FINAL

BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR WOOD PRESERVING WASTES F032, F034, AND F035

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA or the Agency) is promulgating Best Demonstrated Available Technology (BDAT) treatment standards for the regulation of listed hazardous wastes identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as F032, F034, and F035. These BDAT treatment standards are being promulgated in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976 enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. Compliance with these treatment standards is a prerequisite for land disposal, as defined in 40 CFR Part 268. In 40 CFR 268.44, EPA supplies provisions that, if met, may justify granting a variance from the applicable treatment standards. In 40 CFR 268.6, EPA supplies provisions that, if met, may justify granting waste- and site-specific waivers from the applicable treatment standards in 40 CFR 268.40.

Hazardous Waste Numbers F032, F034, and F035 are generated during the application of a preservative to wood to prevent damage from weather, insects, and fungi. They are:

- F032 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes at facilities that currently use or have previously used chlorophenolic formulations (except waste from processes that have complied with the cleaning or replacement procedures set forth in §261.35 and do not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

- F034 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes that currently use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

- F035 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes that currently use inorganic preservatives containing arsenic and chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

This background document provides the Agency's rationale and technical support for developing BDAT treatment standards for F032, F034, and F035 under the Land Disposal Restrictions (LDR) program. This document also provides waste characterization data that may serve as a basis for determining whether a variance from the applicable treatment standards is warranted for a particular type of wood preserving waste that may be more difficult to treat than the wastes on which the promulgated treatment standards are based.

The treatment standards promulgated for these wood preserving wastes are the same universal treatment standards (UTS) that apply to the same regulated constituents in other hazardous wastes listed in the 40 CFR 268.40. See Table ES-1 for a list of each regulated constituent in F032, F034, and F035 and the Chemical Abstract Service classification number (CAS No.) of each hazardous constituent of concern, if available. Tables ES-2 and ES-3 summarize universal treatment standards (UTS) limits promulgated for all the specific hazardous constituents regulated in F032, F034, and F035. The treatment performance data base and methodology employed for identifying the nonwastewater universal treatment standards are found in Appendix A. The treatment performance data base and methodology employed for identifying the wastewater universal treatment standards are found in Appendix B.

It should be noted that the proposed rule and the BDAT Background Document for Wood Preserving Wastes did have several typographical errors with regard to the numerical limits or the constituents proposed in F032, F034, and F035. EPA issued a correction notice to the proposed Phase IV rule (see 60 FR 546451) to clarify the typographical errors discovered in the proposed treatment standards for wood preserving wastes. For instance, EPA clarified that the treatment standards for wastewater forms of 2,4-dimethylphenol and 2,3,4,5-tetrachloro-phenol should have appeared as 0.036 mg/l and 0.030 mg/l, respectively. These are the levels being promulgated in this final rule. The correction notice also acknowledged that in the proposed Phase IV rule the constituents and treatment standards that appeared in the regulatory tables were inconsistent with the preamble language. In the correction notice, EPA directed commenters to the summary table in the preamble language rather than the regulatory tables. The correct standards are promulgated today which can be found in the regulatory Table 268.40 revisions published in today’s rule.

EPA is also noting today that the Proposed BDAT Background Document for Wood Preserving Wastes was in error with regard to the proposed treatment standards for wastewater forms of 2,4-dimethylphenol, 2,3,4,6- tetrachlorophenol, and pentachloro-di-benzofurans. The background document had typographical errors in the proposed limits for 2,4-dimethyl phenol, 2,3,4,6-tetrachloro- phenol, pentachlorophenol, pentachlordibenzofuran, and arsenic. These limits were inconsistent with the UTS limits published in the Final Best Demonstrated Available Technology (BDAT) Background Document for Universal Treatment Standards Volume B: Universal Treatment Standards for Wastewater Forms of Listed Hazardous Wastes (July 1994). EPA is thus promulgating the applicable UTS limits for these specific four constituents of concern in this BDAT Background Document in accordance with those limits published in the UTS BDAT Development Document (Volume B).

EPA is also promulgating a compliance treatment standard alternative of combustion -- “CMBST” -- in response to several commenters who asked EPA to consider adopting such an alternative treatment standard for the regulation of Dioxin and Furan (D/F) constituents in F032. Under this alternative compliance treatment standard, EPA is setting combustion as the treatment standard for specific dioxin and furan (D/F) constituents in F032 that are treated via combustion and thus, the monitoring of each regulated D/F constituent is not required as a prerequisite to land disposal. Under this compliance treatment alternative, the specific UTS numerical limits of other regulated organic and metal hazardous constituents in F032 must be met as a prerequisite to land disposal. (See May 10, 1996 (61 F.R. 21418).) In addition, EPA is limiting the promulgated compliance treatment alternative standard to F032 wastes that are combusted in interim status combustion units regulated under 40 CFR Part 266 or in a Part B permitted combustion devices operated under 40 CFR Part 264, Subpart O. Therefore, residues arising from the combustion of F032 and F024 in interim status combustion units operated under 40 CFR Part 265 will have to meet applicable numerical limits for D/F prior to disposal unless the facility combusting F032 obtains from EPA a treatability variance of equivalent treatment pursuant to the 40 CFR 268.42 (b). The treatability variance application should emphasize to what extend the Part 265 incinerator has combustion controls that are equivalent to those prescribed by EPA to combustion

Part 264 incinerators or Part 266 Boilers and Industrial Furnaces. See Section 5.0 for additional discussion on this topic.

There is some level of uncertainty regarding to what extent a given set of operating combustion conditions or technological controls can provide F032 and F024, or any other waste, with effective treatment as well as to what extent such technology, as practiced, is protective of the human health and the environment. EPA currently relies on Omnibus permit authority provisions under 40 CFR Parts 264 and 266 to require studies that enable EPA to prescribe *ad hoc* permit conditions that can minimize these uncertainties. One example of such Omnibus permit authority is the conduct of risk analyses to assess the potential for emitting specific products of incomplete combustion into the air. Another example of such Omnibus permit authority is an approved permit requiring additional operating conditions that have been demonstrated to minimize the generation and emission of hazardous air pollutants. EPA currently lacks such permit discretionary authority to readily expedite and address these kind of concerns in units that operate under 40 CFR Part 265 permits. EPA believes, therefore, that the monitoring of D/F in F032 and F024 being combusted in 40 CFR Part 265 interim status combustion units must be required to ensure that F032 and F024 are destroyed prior to disposal unless the facility operating the 265 incinerator obtains from EPA a treatability variance of equivalent treatment for such combsution device.

A universal treatment standard is a single concentration limit established for a specific constituent regardless of the waste matrix in which it is present, i.e., the same treatment standard applies to a particular constituent in each waste code in which it is regulated. The Agency has established two different sets of universal treatment standards: one for nonwastewater forms of waste and one for wastewater forms of waste. These two sets differ in the population of regulated constituents and the individual universal treatment standards. A more detailed discussion concerning the determination of these treatment standards is provided in EPA's <u>Final Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume A: Universal Standards for Nonwastewater Forms of Listed Hazardous Wastes</u> and EPA's <u>Best Demonstrated Available Technology (BDAT) Background Document for</u>

Universal Standards, Volume B: Universal Standards for Wastewater Forms of Listed Hazardous Wastes.

The universal treatment standards promulgated for each regulated organic constituent in nonwastewater forms of F032 and F034 are based on incineration treatment performance data that were used to promulgate previous BDAT treatment standards. The universal treatment standards for wastewater forms of F032, F034, and F035 are based on treatment performance data from several sources, including the BDAT data base, the National Pollutant Discharge Elimination System (NPDES) data base, the Water Engineering Research Laboratory (WERL) data base, EPA-collected Wet Air Oxidation/ Powdered Activated Carbon (WAO/PACT®) data, the EPA Office of Water's Engineering and Analysis Division (EAD) data base, industry-submitted leachate treatment performance data, data in literature that were not already part of the WERL data base, and data in literature submitted by industry (Advanced Notice of Proposed Rulemaking (ANPR)) on the WAO and PACT® treatment processes.

The Agency has treatment data on these wood preserving wastes, including data submitted during the comment period for the Advanced Notice of Proposed Rulemaking of October 24, 1991. These data are presented in Appendix C. A summary of the comments received from the ANPR is presented in Appendix D. Appendix E contains examples of alternative or emerging technologies potentially applicable to the treatment of wood preserving or related waste streams. Appendix F contains information on the thermal desorption of a petroleum refining waste successfully removed from Subtitle C controls. Appendix G is the most recent memorandum from Office of Solid Waste and Emergency Response (OSWER), "Assuring Protective Operation of Incinerators Burning Dioxin-Listed Wastes." Appendix H contains the most recent OSWER guidance on obtaining a variance from land disposal restrictions for soil and debris. Appendix I contains a summary of the final CAMU rule. Appendix J contains a list of additional references that provide treatment information for hazardous waste. Appendix K is a summary of data submitted to EPA pursuant to the Phase 4 proposal for wood preserving wastes. Appendix L is a summary of data submitted to EPA pursuant to Phase 4' s Notice of Data Availability with regard to the feasibility of setting a CMBST treatment standard alternative for the regulation of D/F constituents in F032. Appendix M is an expanded list of references evaluated for Wood Preserving Wastes.

The Agency is prohibiting the land disposal of both nonwastewater and wastewater forms of wood preserving hazardous wastes F032, F034, and F035. If these prohibited wood preserving wastes meet the treatment standards promulgated today, the wastes can be land disposed. These wood preserving wastes are currently managed in hazardous waste treatment, storage, and disposal facilities subject to RCRA Subtitle C requirements. It is believed that these wood preserving wastes are likely to be commingled with other wastes prior to treatment and disposal. As a result, the Agency believes it would be appropriate to apply the universal treatment standards to the hazardous constituents proposed for regulation in these wastes. EPA also is promulgating a compliance treatment standard alternative of combustion -- “CMBST” -- in response to several commenters who asked EPA to consider adopting such an alternative standards for the regulation of Dioxin and Furan (D/F) constituents in F032.

Finally, the majority of the commenters raised concerns about the potential impact the promulgated treatment standards may have on ongoing remediation activities at RCRA and Superfund sites. Section 6.0 summarizes EPA responses to the major comments raised regarding the management of contaminated media and debris under the land disposal restrictions.

TABLE ES-1
REGULATED CONSTITUENTS FOR HAZARDOUS WASTE NUMBERS F032, F034, and F035

Constituent	CAS No.	F032	F034	F035
Phenol	108-95-2	X		
2,4-Dimethylphenol	105-67-9	X		
2,4,6-Trichlorophenol	88-06-2	X		
2,3,4,6-Tetrachlorophenol	58-90-2	X		
Pentachlorophenol	87-86-5	X		
Acenaphthene	83-32-9	X	X	
Anthracene	120-12-7	X	X	
Benz(a)anthracene	56-55-3	X	X	
Benzo(a)pyrene	50-32-8	X	X	
Benzo(k)fluoranthene	[a]	X	X	
Chrysene	218-01-9	X	X	
Dibenz(a,h)anthracene	53-70-3	X	X	
Fluorene	86-73-7	X	X	
Indeno(1,2,3-cd)pyrene	193-39-5	X	X	
Naphthalene	91-20-3	X	X	
Phenanthrene	85-01-8	X	X	
Pyrene	129-00-0	X	X	
Arsenic	7440-38-2	X	X	X
Chromium	7440-47-3	X	X	X
Tetrachlorodibenzo-p-dioxins	---	X		
Pentachlorodibenzo-p-dioxins	---	X		
Hexachlorodibenozo-p-dioxins	---	X		
Tetrachlorodibenozofurans	---	X		
Pentachlorodibenzofurans	---	X		
Hexachlorodibenzofurans	---	X		

Source: U.S. EPA, June 1995.

[a] this constituent is regulated as the sum of benzo(b)fluoranthene (CAS No. 205-99-2) and benzo(k) fluoranthene (CAS No. 207-08-9), since both of them coelute on gas chromatography.

TABLE ES-2
BDAT TREATMENT STANDARDS FOR NONWASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	F032 (mg/kg)	F034 (mg/kg)	F035 (mg/L)
Phenol	6.2		
2,4-Dimethylphenol	14.0		
2,4,6-Trichlorophenol	7.4		
2,3,4,6-Tetrachlorophenol	7.4		
Pentachlorophenol	7.4		
Acenaphthene	3.4	3.4	
Anthracene	3.4	3.4	
Benz(a)anthracene	3.4	3.4	
Benzo(a)pyrene	3.4	3.4	
Benzo(k)fluoranthene*	6.8 (sum)	6.8 (sum)	
Chrysene	3.4	3.4	
Dibenz (a,h)anthracene	8.2	8.2	
Fluorene	3.4	3.4	
Indeno(1,2,3-cd)pyrene	3.4	3.4	
Naphthalene	5.6	5.6	
Phenanthrene	5.6	5.6	
Pyrene	8.2	8.2	
Arsenic	5.0 (mg/L TCLP)	5.0 (mg/L TCLP)	5.0 (TCLP)
Chromium	0.86 (mg/L TCLP)	0.86 (mg/L TCLP)	0.86 (TCLP)
Tetrachlorodibenzo-p-dioxins	0.001		
Pentachlorodibenzo-p-dioxins	0.001		
Hexachlorodibenzo-p-dioxins	0.001		
Tetrachlorodibenzozfurans	0.001		
Pentachlorodibenzofurans	0.001		
Hexachlorodibenzofurans	0.001		

Source: U.S. EPA, June 1995. * Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, this constituent is regulated as a sum of the two compounds.

TABLE ES-3
BDAT TREATMENT STANDARDS FOR WASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	F032 (mg/L)	F034 (mg/L)	F035 (mg/L)
Phenol	0.039		
2,4-Dimethylphenol	0.036		
2,4,6-Trichlorophenol	0.035		
2,3,4,6-Tetrachlorophenol	0.030		
Pentachlorophenol	0.089		
Acenaphthene	0.059	0.059	
Anthracene	0.059	0.059	
Benz(a)anthracene	0.059	0.059	
Benzo(a)pyrene	0.061	0.061	
Benzo(k)fluoranthene*	0.11 (sum)	0.11 (sum)	
Chrysene	0.059	0.059	
Dibenz (a,h)anthracene	0.055	0.055	
Fluorene	0.059	0.059	
Indeno(1,2,3-cd)pyrene	0.0055	0.0055	
Naphthalene	0.059	0.059	
Phenanthrene	0.059	0.059	
Pyrene	0.067	0.067	
Arsenic	1.4	1.4	1.4
Chromium	2.77	2.77	2.77
Tetrachlorodibenzo-p-dioxins	0.000063		
Pentachlorodibenzo-p-dioxins	0.000063		
Hexachlorodibenozo-p-dioxins	0.000063		
Tetrachlorodibenozofurans	0.000035		
Pentachlorodibenzofurans	0.000063		
Hexachlorodibenzofurans	0.000063		

Source: U.S. EPA, June 1995.

*Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, these constituents are regulated as the sum these two compounds.

TABLE ES-4
COMPLIANCE TREATMENT ALTERNATIVE FOR DIOXIN AND FURAN CONSTITUENTS IN F032 WASTES

Constituent	CAS Number	Treatment Method*
Tetrachlorodibenzo-p-dioxins	---	CMBST
Pentachlorodibenzo-p-dioxins	---	CMBST
Hexachlorodibenzo-p-dioxins	---	CMBST
Tetracholorodibenzo-p-furans	---	CMBST
Pentachlorodibenzo-p-furans	---	CMBST
Hexachlorodibenzo-p-furans	---	CMBST

Compliance with this treatment method is limited only to combustion devices regulated under 40 CFR Parts 264, Subpart O, and 266. Also, any Part 265 incinerator who have obtained from EPA a treatment equivalency pursuant to 40 CFR 268.42 (b).

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA or the Agency) is promulgating Best Demonstrated Available Technology (BDAT) treatment standards for the regulation of listed hazardous wastes identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as F032, F034, and F035. These BDAT treatment standards are being promulgated in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976 enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. Compliance with the proposed treatment standards is a prerequisite for land disposal, as defined in 40 CFR Part 268. In 40 CFR 268.44, EPA supplies provisions, that, if met, may justify granting a variance from the applicable treatment standards. In 40 CFR 268.6, EPA supplies provisions, that, if met, may justify granting waste- and site-specific waivers from the applicable treatment standards in 268.40. The BDAT treatment standards for these wastes are presented in Tables 1-1 and 1-2 of this document.

Hazardous Wastes Numbers F032, F034, and F035 are generated during the application of a preservative to wood to prevent damage from weather, insects, and fungi. These hazardous wastes are defined as follows:

- F032 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes at facilities that currently use or have previously used chlorophenolic formulations (except waste from processes that have complied with the cleaning or replacement procedures set forth in §261.35 and do not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

- F034 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes that currently use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

- F035 - Wastewaters, process residuals, preservative drippage, and discarded spent formulations from wood preserving processes that currently use inorganic preservatives containing arsenic and chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

This background document provides the Agency's rationale and technical support for developing BDAT treatment standards for F032, F034, and F035 under the Land Disposal Restrictions (LDR) program. This document also provides waste characterization data that may serve as a basis for determining whether a variance from the applicable treatment standards is warranted for a particular type of wood preserving waste that may be more difficult to treat than the wastes on which the promulgated treatment standards are based.

The Agency's legal authority and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards, 1991.

1.1 Regulatory Background

Section 3001(e)(1) of RCRA requires EPA to determine whether to list as hazardous, wastes containing chlorinated dioxins and chlorinated dibenzofurans. As part of this mandate, the Agency initiated a listing investigation of dioxin-containing wastes from pentachlorophenol wood preserving processes and pentachlorophenate surface protection processes. Two other similar wood preserving processes that use creosote and aqueous inorganic formulations containing chromium or arsenic were also included in this investigation.

On December 30, 1988, EPA proposed four listings pertaining to wastes from wood preserving and surface protection processes, as well as a set of standards for the management of these wastes (53 FR 53282). The Agency finalized three generic hazardous waste listings for wastes from wood preserving processes and promulgated standards for the management of these wastes on drip pads (40 CFR parts 264 and 265, Subpart W) on December 6, 1990 (55 FR 50450).

HSWA amended RCRA to require EPA to promulgate treatment standards for a waste within 6 months after determining it is hazardous [3004(g)(4)]. The Agency did not meet this statutory deadline for the wood preserving wastes, as well as other wastes identified or listed after adoption of the HSWA amendments to RCRA in 1984. As a result, the Environmental Defense Fund (EDF) filed a lawsuit against the Agency to force the Agency to comply with RCRA. This suit resulted in EPA and EDF signing a consent degree for adopting prohibitions and treatment standards for newly identified and listed wastes. This final rule meets requirements of the consent degree to promulgate treatment standards for wood preserving wastes.

In the December 5, 1992, Federal Register, EPA proposed to revise several elements of the wood preserving hazardous waste regulations and requested comment on those issues. The Agency proposed the following actions: (1) eliminate the F032 classification for certain wastes generated by past users of chlorophenolic formulations such that any wastewaters, drippage, process residuals, or spent preservatives are regulated as F034 wastes, F035 wastes, or wastes exhibiting the Toxicity Characteristic (TC); (2) narrow the scope of the wastewater listings contained in the F032, F034, and F035 listings to include only those wastewaters that come in contact with process contaminants; (3) require contingency plans and cleanup of storage yard drippage in response to incidental drippage in storage yards; (4) remove the requirement that new drip pad coatings, sealers, or covers be impermeable; (5) add a requirement that new drip pads have leak collection devices; (6) revise the requirement that all existing drip pad coatings, sealers, or covers be impermeable to reflect data on the permeabilities of available coatings, sealers, or covers; (7) require that drip pad surface materials be chemically resistant to the preservation being used and that these surface materials be maintained free of cracks, gaps, corrosion, or other deterioration that would increase their hydraulic conductivity above the 1 x 10^7 cms level and lead to a potential for releases to the environment; (8) revise the requirement that drip pads be cleaned weekly to a requirement that drip pads be cleaned in a manner and frequency such that the entire surface of drip pads can be inspected weekly; (9) revise the schedule for upgrading existing drip pads to allow 15 years for the incorporation of liners and leak detection systems; and (10) revise the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) designation of hazardous substances to reflect the modifications in the listings.

The Agency also requested comment as to whether the standards for new drip pads should allow the choice of either a highly impermeable surface (e.g., sealers, coatings, or covers for concrete drip pads) or a liner with a leak detection and collection system.

These changes were finalized on Thursday, December 24, 1992.

1.2 Summary

The Agency is prohibiting the land disposal of both nonwastewater and wastewater forms of Hazardous Waste F032, F034, and F035 by applying the universal treatment standards to each hazardous constituent proposed for regulation in these wastes. These wood preserving wastes are currently managed in hazardous waste treatment, storage, and disposal facilities subject to RCRA Subtitle C requirements. It is believed that these wood preserving wastes are likely to be commingled prior to treatment and disposal. As a result, the Agency believes that it would be appropriate to apply the universal treatment standards to the hazardous constituents proposed for regulation in these wastes. EPA is also promulgating a compliance treatment standard alternative of combustion -- “CMBST”--in response to several commenters who asked EPA to consider adopting such an alternative standard for the regulation of Dioxins and Furans (D/F) constituents in F032. (See Section 5.0 for a general discussion of EPA’s rationale and implementation guidance.)

A universal standard is a single concentration limit established for a specific constituent regardless of the waste matrix in which it is present (i.e., the same treatment standard applies to a particular constituent in each waste code in which it is regulated). The Agency has established two different sets of universal treatment standards: one for nonwastewater forms of waste and one for wastewater forms of waste. These two sets differ in the population of regulated constituents and the individual universal treatment standards. A more detailed discussion concerning the determination of these treatment standards is provided in EPA's Proposed Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume A: Universal Standards for Nonwastewater Forms of Listed Hazardous Wastes and

EPA's Proposed Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume B: Universal Standards for Wastewater Forms of Listed Hazardous Wastes.

The universal treatment standards promulgated for each regulated organic constituent in nonwastewater forms of F032 and F034 are based on incineration treatment performance data that were used to promulgate previous BDAT treatment standards. The universal treatment standards for wastewater forms of F032, F034, and F035 are based on treatment performance data from several sources, including the BDAT data base, the National Pollutant Discharge Elimination System (NPDES) data base, the Water Engineering Research Laboratory (WERL) data base, EPA-collected Wet Air Oxidation/Powdered Activated Carbon (WAO/PACT®) data, the EPA Office of Water's Engineering and Analysis Division (EAD) data base, industry-submitted leachate treatment performance data, data in literature that were not already part of the WERL data base, and data in literature submitted by industry on the WAO and PACT® treatment processes.

The Agency has treatment data on these wood preserving wastes, including data submitted during the comment period following the Advance Notice of Proposed Rulemaking of October 24, 1991. These data are presented in Appendix C.

Table 1-1 presents the promulgated BDAT treatment standards for nonwastewater forms of F032, F034, and F035. Table 1-2 presents the promulgated BDAT treatment standards for wastewater forms of these wastes. The standards shown on Tables 1-1 and 1-2 are numerically equivalent to the universal treatment standards for those constituents. This action is taken in accordance with the schedule established in the consent degree signed between the EPA and the EDF.

Table 1-3 presents the promulgated compliance treatment alternative of combustion (CMBST) for the regulation of specific dioxin and furan constituents in F032. Under this alternative compliance treatment standard, EPA is setting combustion as the treatment standard for specific dioxin and furan (D/F) constituents in F032 that are treated via combustion and thus, the monitoring of each regulated D/F constituent is not required as a prerequisite to land disposal. Under this compliance treatment alternative, the specific UTS numerical limits of other regulated organic and metal hazardous constituents in F032 must be met as a prerequisite to land disposal. (See May 10, 1996 (61 FR 21418) .) In addition, EPA is limiting the promulgated compliance treatment alternative standard to F032 wastes that are combusted in permitted interim status combustion units regulated under 40 CFR Part 266 or in RCRA Part B permitted combustion devices operated under 40 CFR Part 264, Subpart O unless the facility combusting F032 obtains from EPA a treatability variance of equivalent treatment pursuant to the 40 CFR 268.42 (b). The treatability variance application should emphasize to what extend the Part 265 incinerator has combustion controls that are equivalent to those prescribed by EPA to combustion Part 264 incinerators or Part 266 Boilers and Industrial Furnaces. See Section 6.0 for additional discussion on this topic.

There is some level of uncertainty regarding to what extent a given set of operating combustion conditions or technological controls can provide F032, or any other waste, with effective treatment as well as to what extent such technology, as practiced, is protective of the human health and the environment. EPA currently relies on Omnibus permit authority provisions under 40 CFR Parts 264 and 266 to require studies that enable EPA to prescribe *ad hoc* permit conditions that can minimize these uncertainties. One example of such Omnibus permit authority is the conduct of risk analyses to assess the potential for emitting specific products of incomplete combustion into the air. Another example of such Omnibus permit authority is an approved permit requiring additional operating conditions that have been demonstrated to minimize the generation and emission of hazardous air pollutants. EPA currently lacks such permit discretionary authority to readily expedite and address these kind of concerns in units that operate under 40 CFR Part 265 permits. EPA believes, therefore, that the monitoring of D/F in F032 being combusted in 40 CFR Part 265 interim status combustion units must be required to ensure that F032 are destroyed prior to disposal unless the facility operating the 265 incinerator obtains from EPA a treatability variance of equivalent treatment for such combsution device.

1.3 Contents of This Document

Section 2.0 of this document summarizes the promulgated BDAT standards, the basis for listing wood preserving wastes as hazardous, and how the promulgated standards reflect the goals of the Land Disposal Restrictions program. Section 3.0 describes the industry and processes generating Hazardous Waste Nos. F032, F034, and F035, and presents data characterizing these wastes. Existing waste management practices for these wastes also are described in Section 3.0. Section 4.0 explains the methodology and rationale for selection of the proposed regulated constituents, discusses the treatment technologies the Agency has designated as "applicable" and "demonstrated" for these wastes, identifies BDAT for wastewater and nonwastewater forms of these wastes, and presents the determination of the promulgated treatment standards for these wastes. In addition, potential reuse and recycling, source reduction, pollution prevention, and waste minimization alternatives for these wastes are discussed in Section 4.0. EPA’s rationale for setting the alternative complaince treatment standard of combustion and how such standard will be implemented can be found in Section 5.0. A summary of pertinent comments received with regard to the potential impact today’s treatment standards may have on remedial activities at wood preserving sites can be found Section 6.0. References are liste, generally, in Section 7.0. Acknowledgements are provided in Section 8.0. Tables and figures are located at the end of each section.

The treatment performance data base and methodology employed for identifying the nonwastewater universal treatment standards are found in Appendix A. The treatment performance data base and methodology employed for identifying the wastewater universal treatment standards are found in Appendix B.

The Agency has treatment data on these wood preserving wastes, including data submitted during the comment period for the Advanced Notice of Proposed Rulemaking of October 24, 1991. These data are presented in Appendix C. A summary of the comments received from this ANPR is presented in Appendix D. Appendix E contains examples of alternative or emerging technologies potentially applicable to the treatment of wood preserving or related waste streams.

Appendix F contains information on the thermal desorption of a petroleum refining waste successfully removed from Subtitle C controls. Appendix G is the most recent memorandum from Office of Solid Waste and Emergency Response (OSWER), "Assuring Protective Operation of Incinerators Burning Dioxin-Listed Wastes." Appendix H contains the most recent OSWER guidance on obtaining a variance from land disposal restrictions for soil and debris. Appendix I contains a summary of the final CAMU rule. Appendix J contains a list of additional references that provide treatment information for hazardous waste. Appendix K is a summary of data submitted to EPA pursuant to the Phase 4 proposal for wood preserving wastes. Appendix L is a summary of data submitted to EPA pursuant to Phase 4' s Notice of Data Availability with regard to the feasibility of setting a CMBST treatment standard alternative for the regulation of D/F constituents in F032. Appendix M is an expanded list of references evaluated for Wood Preserving Wastes.

TABLE 1-1
TREATMENT STANDARDS FOR NONWASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	F032 (mg/kg)	F034 (mg/kg)	F035 (mg/L)
Phenol	6.2		
2,4-Dimethylphenol	14.0		
2,4,6-Trichlorophenol	7.4		
2,3,4,6-Tetrachlorophenol	7.4		
Pentachlorophenol	7.4		
Acenaphthene	3.4	3.4	
Anthracene	3.4	3.4	
Benz(a)anthracene	3.4	3.4	
Benzo(a)pyrene	3.4	3.4	
Benzo(k)fluoranthene*	6.8 (sum)	6.8 (sum)	
Chrysene	3.4	3.4	
Dibenzo(a,h)anthracene	8.2	8.2	
Fluorene	3.4	3.4	
Indeno(1,2,3-cd)pyrene	3.4	3.4	
Naphthalene	5.6	5.6	
Phenanthrene	5.6	5.6	
Pyrene	8.2	8.2	
Arsenic	5.0 (mg/L TCLP)	5.0 (mg/L TCLP)	5.0 (TCLP)
Chromium	0.86 (mg/L TCLP)	0.86 (mg/L TCLP)	0.86 (TCLP)
Tetrachlorodibenzo-p-dioxins	0.001		
Pentachlorodibenzo-p-dioxins	0.001		
Hexachlorodibenzo-p-dioxins	0.001		
Tetrachlorodibenozfurans	0.001		
Pentachlorodibenzofurans	0.001		
Hexachlorodibenzofurans	0.001		

Source: U.S. EPA, June 1995.

*Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, this constituent is regulated as a sum of the two compounds.

TABLE 1-2
PROPOSED BDAT TREATMENT STANDARDS FOR WASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	F032 (mg/L)	F034 (mg/L)	F035 (mg/L)
Phenol	0.039		
2,4-Dimethylphenol	0.036		
2,4,6-Trichlorophenol	0.035		
2,3,4,6-Tetrachlorophenol	0.035		
Pentachlorophenol	0.089		
Acenaphthene	0.059	0.059	
Anthracene	0.059	0.059	
Benz(a)anthracene	0.059	0.059	
Benzo(a)pyrene	0.061	0.061	
Benzo(k)fluoranthene*	0.11 (sum)	0.11 (sum)	
Chrysene	0.059	0.059	
Dibenzo(a,h)anthracene	0.055	0.055	
Fluorene	0.059	0.059	
Indeno(1,2,3-cd)pyrene	0.0055	0.0055	
Naphthalene	0.059	0.059	
Phenanthrene	0.059	0.059	
Pyrene	0.067	0.067	
Arsenic	1.4	1.4	1.4
Chromium	2.77	2.77	2.77
Tetrachlorodibenzo-p-dioxins	0.000063		
Pentachlorodibenzo-p-dioxins	0.000063		
Hexachlorodibenozo-p-dioxins	0.000063		
Tetrachlorodibenozofurans	0.000063		
Pentachlorodibenzofurans	0.000063		
Hexachlorodibenzofurans	0.000063		

Source: U.S. EPA, June 1995.

*Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, this constituent is regulated as a sum of the two compounds.

TABLE 1-3
COMPLIANCE TREATMENT ALTERNATIVE FOR DIOXIN AND FURAN CONSTITUENTS IN F032 WASTES

Constituent	CAS Number	Treatment Method*
Tetrachlorodibenzo-p-dioxins	---	CMBST
Pentachlorodibenzo-p-dioxins	---	CMBST
Hexachlorodibenzo-p-dioxins	---	CMBST
Tetracholorodibenzo-p-furans	---	CMBST
Pentachlorodibenzo-p-furans	---	CMBST
Hexachlorodibenzo-p-furans	---	CMBST

Compliance with this treatment method is limited only to combustion devices regulated under 40 CFR Parts 264, Subpart O, and 266. Also, any Part 265 incinerator who have obtained from EPA a treatment equivalency pursuant to 40 CFR 268.42 (b).

2.0 LAND DISPOSAL RESTRICTIONS FOR F032, F034, AND F035

Section 3001(e)(2) of HSWA requires that EPA evaluate whether wastes from the wood preserving industry should be listed as hazardous. HSWA directed EPA to study the production and use of wood preservatives and determine whether these processes result in the generation of hazardous waste according to the criteria in 40 CFR 261.11. The Agency performed an extensive study of the wood preserving industry and made the determination to list as hazardous the following three wastes associated with the production and use of wood preservatives: F032, F034, and F035 (see the Background Document Supporting the Final Listing of Wastes from Wood Preservation Processes, November, 1990, (EPA refers to this document as the Listing Background Document)).

2.1 Summary of Basis for Listing of Wood Preserving Wastes

As presented in the Listing Background Document, the Agency determined that certain residuals from the preservation of wood, listed as Hazardous Waste Numbers F032, F034, and F035 wastes, typically contain constituents that, when mismanaged, pose a substantial present or potential threat to human health and the environment due to their carcinogenic or toxic properties. In addition, the Agency compiled evidence that these wastes contain toxic constituents that are mobile and/or persistent in the environment and, therefore, are capable of reaching receptors in harmful concentrations. The information that supports these findings is presented in this proposed Background Document and the Listing Background Document; it is also available in the RCRA Docket supporting the listing of wood preserving wastes. The Agency identified the following as constituents of concern in these wastes: pentachlorophenol, benz(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, tetrachlorodibenzo-p-dioxins, pentachlorodibenzo-p-dioxins, hexachlorodibenzo-p-dioxins, tetrachlorodibenzofurans, pentachlorodibenzofurans, hexachlorodibenzofurans, arsenic, and chromium. In addition to these constituents, the Agency has proposed the following additional constituents for regulation in these wood preserving wastes: phenol, 2,4-dimethylphenol, 2,4,6-trichlorophenol, 2,3,4,6-tetrachlorophenol, acenaphthene, anthracene, chrysene, fluorene, phenanthrene, and pyrene. The reason for the addition of these compounds is provided in Section 4.1. Table 2-1 summarizes these constituents.

2.2 Key Points of Wood Preserving Waste Standards and How They Reflect LDR Goals

The LDR program is designed to protect human health and the environment by prohibiting the land disposal of RCRA hazardous wastes unless specific treatment standards are met.

In RCRA Section 3004(m), Congress directed the Agency to:

> ". . . promulgate . . . levels or methods of treatment . . . which substantially diminish the toxicity of the waste or . . . the likelihood of migration of hazardous constituents . . . so that short-term and long-term threats to human health and the environment are minimized."

Key provisions of the LDR program require that: (1) treatment standards are met prior to land disposal, (2) treatment is not evaded by long-term storage, (3) actual treatment occurs rather than dilution, (4) record keeping and tracking follow a waste from "cradle to grave" (i.e., generation to disposal), and (5) certification verifies that the specified treatment standards have been met.

The Agency is promulgating treatment standards for specific hazardous constituents in both nonwastewater and wastewater forms of F032, F034, and F035 wastes as these treatment standards are expressed as the same universal treatment standard concentrations applicable to each constituent of concern in 268.48 (see Phase IV proposal (60 FR 43654, August 22, 1995)). The Agency's treatment standards promulgated for each constituent of concern in both nonwastewater and wastewater forms of wood preserving wastes are presented in Table 2-1.

The Agency has determined that it is technically feasible to apply UTS to wood preserving wastes, and thus, EPA is promulgating the corresponding universal treatment standards that were promulgated in the Phase II LDR. EPA believes that the promulgated treatment limits meet

LDR's goal of minimizing threats to human health and the environment from land disposal. These treatment limits are based on the treatment performance data representing treatment technologies identified as "best" for wood preserving wastes. Since EPA is promulgating treatment limits for each regulated hazardous constituent in F032, F034, and F035, other treatment technologies capable of meeting treatment limits are not precluded except for those that may constitute impermissible dilution.

For Dioxin and Furan constituents in nonwastewaters and wastewater forms of F032, EPA is also promulgating an alternative compliance treatment standard of combustion (CMBST). Facilities treating F032 via the alternative CMBST standard do not have to monitor the concentrations of D/F constituents in CMBST residues, e.g. scrubber waters, as a prerequisite for land disposal. However, other organic and metal constituents regulated in F032 must meet applicable treatment limits prior to disposal. EPA is also limiting the availability of these compliance alternative treatment standards to those CMBST devices operated in compliance with regulatory requirements under 40 CFR Part 264, Subpart O, and Part 266. Thus, with residues resulting from combustion in units regulated under 40 CFR Part 265 must meet applicable D/F numerical limits prior to disposal.

TABLE 2-1
CONSTITUENTS OF CONCERN FOR HAZARDOUS WASTE NUMBERS F032, F034, and F035

Constituent	CAS No.	F032	F034	F035
Phenol	108-95-2	X		
2,4-Dimethylphenol	105-67-9	X		
2,4,6-Trichlorophenol	88-06-2	X		
2,3,4,6-Tetrachlorophenol	58-90-2	X		
Pentachlorophenol	87-86-5	X		
Acenaphthene	83-32-9	X	X	
Anthracene	120-12-7	X	X	
Benz(a)anthracene	56-55-3	X	X	
Benzo(a)pyrene	50-32-8	X	X	
Benzo(k)fluoranthene	[a]	X	X	
Chrysene	218-01-9	X	X	
Dibenz(a,h)anthracene	53-70-3	X	X	
Fluorene	86-73-7	X	X	
Indeno(1,2,3-cd)pyrene	193-39-5	X	X	
Naphthalene	91-20-3	X	X	
Phenanthrene	85-01-8	X	X	
Pyrene	129-00-0	X	X	
Arsenic	7440-38-2	X	X	X
Chromium	7440-47-3	X	X	X
Tetrachlorodibenzo-p-dioxins	---	X		
Pentachlorodibenzo-p-dioxins	---	X		
Hexachlorodibenozo-p-dioxins	---	X		
Tetrachlorodibenozofurans	---	X		
Pentachlorodibenzofurans	---	X		
Hexachlorodibenzofurans	---	X		

Source: U.S. EPA, June 1995.

[a] this constituent is regulated as the sum of benzo(b)fluoranthene (CAS No. 205-99-2) and benzo(k) fluoranthene (CAS No. 207-08-9), since both of them coelute on gas chromatography.

Note: X indicates that the constituent is promulgated for regulation in the individual wastestream.

3.0 DETAILED DESCRIPTION OF WOOD PRESERVING WASTESTREAMS

The following sections present a profile of the wood preserving industry and a description of the raw materials used during wood preservation. Unless otherwise noted, the material cited in this section is taken from the Background Document Supporting the Final Listing of Wastes from Wood Preservation Processes, November, 1990 (1).

3.1 Description of Wood Preserving Industry

The American Wood Preservers Institute (AWPI) identified 588 plants that treated wood products in 1987 (including 6 plants that were inactive in 1987). As of 1990, this number had been reduced to 543 wood treating plants, consisting of 534 pressure treating plants and 9 nonpressure treating plants. Based on production reports for 431 plants and estimates of production for 112 non-reporting plants, the industry treated approximately 590 million cubic feet of wood products in 1990 (10). In 1993, the number of active plants in the wood preservation industry dropped to 471, of which only 2 are nonpressure treaters (11). The distribution of wood preservers by region is depicted in Table 3-1.

A wide variety of chemicals are used to preserve wood. The most commonly used chemicals are pentachlorophenol, creosote, and inorganic arsenical and/or chromate salts. In 1973, AWPI reported that creosote and creosote solutions were used to treat approximately 51 percent of the total industry production, while pentachlorophenol and inorganic arsenicals accounted for 32 percent and 17 percent of the total production that year, respectively. However, since the mid-1980s, there has been an upward trend in the overall percentage of wood treated with inorganic arsenical and/or chromate salts. As of 1990, 88 percent of pressure-treating plants used only one type of preservative: 76.4 percent treated with inorganic preservative only, almost all contained arsenic; 7.7 percent treated with creosote alone; and 3.6 percent used pentachlorophenol. The remaining 12 percent used more than one type of preservative. In 1993, the distribution throughout the industry was 76 percent using inorganic preservatives, 9 percent using creosote preservatives, 4 percent using pentachlorophenol preservatives, and 11 percent using a combination of preservatives.

3.2 Raw Materials

Wood preservatives are used to delay wood deterioration and decay caused by wood-destroying organisms such as insects, fungi, and marine borers. For example, surface discoloration (sapstaining) that occurs during short-term wood storage can be adequately controlled by applying a superficial application of the preservative, but for long-lasting effectiveness, deep and uniform penetration of preservative into wood is required. The deep penetration is usually accomplished by forcing preservative into the wood under pressure. As such, the term "pressure-treated" is often used as a synonym for "preserved."

Many different types of preservatives are used in the wood preserving industry. The American Wood Preservers Association (AWPA) has been a primary force in the standardization of specifications for wood preservatives and their application to wood. According to AWPA, the desirable characteristics of a wood preservative are:

- It must be toxic to wood-destroying organisms.
- Its value as a preservative must be supported by field and/or service data.
- It must possess satisfactory physical and chemical properties which govern its permanence under the conditions for which it is recommended for use.
- It must be relatively free from objectionable qualities in handling and use.
- It must be subject to satisfactory laboratory and plant control.
- It must be available under provisions of current patents.
- It must be in actual commercial use.
- For certain special uses, it may also need to be clean, colorless, odorless, paintable, nonswelling, moisture-repelling, or possess a specific combination of these properties.

As stated earlier, the most commonly used chemicals to preserve wood are pentachlorophenol, creosote, and inorganic arsenical and/or chromate salts (inorganics). In 1987, the estimated consumption of pentachlorophenol, creosote, and inorganics used during wood preservation was 9-million kilograms, 308-million liters, and 65-million kilograms, respectively. Pentachlorophenol is usually used in an oil carrier for wood preservation and in a water soluble form for surface treatment. Inorganics are always used in a water solution. Each of the three major preservative types is discussed below.

3.2.1 Pentachlorophenol (PCP) Preservatives

Pentachlorophenol is one of a group of synthetic organic compounds, called chlorophenols, which are commercially manufactured by reacting chlorine with phenol. Pentachlorophenol formulations are used primarily to treat poles, crossarms, lumber, timbers, and fence posts. Pentachlorophenol is used in a wide variety of solvents, including heavy petroleum (fuel oils) and creosote oils, light petroleum solvents such as butane, and volatile solvents such as liquefied petroleum gas (LPG), alcohols, and methylene chloride. Standard petroleum oils (AWPA P-9) are most frequently used in preparing the treating formulations. Pentachlorophenol (using salts, such as sodium or potassium pentachlorophenate) may also be dispersed in water. Data from a 1985 RCRA 3007 Survey of the wood preserving industry indicated that approximately 89 percent of the plants treating with pentachlorophenol used organic solvents, while 11 percent used pentachlorophenol in the salt form diluted in water. In 1987, industry representatives claimed that water-based pentachlorophenol was no longer used for pressure treating wood. The practice had been attempted in the late 1970s and early 1980s due to the high cost of oil; however, because oil prices fell in the mid-1980s, water-based pentachlorophenol is now rarely used for wood preservation.

Pentachlorophenol formulations using petroleum solvents typically contain 5 percent total pentachlorophenol; however, concentrations may range from 2 to 9 percent pentachlorophenol. Because pentachlorophenol has lower solubility in lighter petroleum solvents (such as kerosene, mineral spirits, butane, and similar oils), auxiliary solvents (such as ether or alcohols) may be added to achieve a 5 percent concentration. Proprietary auxiliary solvents of undisclosed compositions may also be used in some formulations. Waxes and resins may also be added to pentachlorophenol formulations to prevent crystallization or "blooming" of the pentachlorophenol on the wood surface as the solvent evaporates.

Water solutions of the sodium salts of pentachlorophenol (pentachlorophenates) are used extensively in the control of sapstain in lumber. Chlorophenate formulations are produced by dissolving chlorophenates in slightly alkaline (above pH 7) sodium hydroxide solution. Buffers such as sodium tetraborate may be added to the formulations to maintain the alkaline condition. Generally, these commercial concentrates are diluted 0.5 to 1 percent total pentachlorophenate concentration and are applied directly to the wood by dipping or spraying.

Commercial pentachlorophenol used in wood preserving contains approximately 83 percent pentachlorophenol, 6 percent tetrachlorophenol, 6 percent other chlorinated phenols, and 5 percent impurities (chlorine compounds and inert materials). Pentachlorophenol and chlorophenate impurities have been found to include the tetra- to octa-chlorinated dioxins and furans. Compositions for pentachlorophenol and tetrachlorophenol are given in Table 3-2. A more recent study, conducted for the current sole producer of pentachlorophenol, showed lower dioxin contents in the current pentachlorophenol product. The product was found to contain <0.050 ppm (<50 ppb) TCDDs, <0.050 ppm (<50 ppb) PeCCDs, 1.55 ppm (1,550 ppb) HxCDDs, and 94 ppm (94,000 ppb) HpCDDs. Covington and Burling (for the Penta Task Force) and the American Wood Preservers Institute submitted additional data on PCP formulations in their comments on the Phase 4 proposed rule. These data are summarized in Appendix K, Table K-1.

3.2.2 Creosote Preservatives

Creosote generically refers to mixtures of relatively heavy residual oils obtained from the distillation of tar or crude petroleum. Creosote formulations are used primarily in treating railroad ties, fence posts, lumber and timbers, crossarms, poles, and marine and fresh-water piling.

Although creosotes can be derived from a variety of tars, including wood-, petroleum-, and coal-based tar derivatives, creosote formulations also include creosote solutions, in which creosote is blended with petroleum oils or crude coal tar, and creosotes fortified with insecticide additives such as pentachlorophenol, arsenic trioxide, copper compounds, or malathion. The use of insecticide-fortified creosote has been limited.

The majority of creosote-based formulations consist of the pure coal tar creosotes. Pure creosote is composed mainly of liquid and solid aromatic hydrocarbons, with 2 to 10 percent tar acids and tar bases. A typical creosote composition is given in Table 3-3. For comparison, the polynuclear aromatic hydrocarbon concentrates of coal tar and petroleum oil are also presented in this table. Creosote usually contains 1 to 3 percent water by volume, has a higher density than water (the specific gravity of creosote is typically 1.1), and has a continuous boiling range beginning at about 200°C. Creosote blends consist of pure creosote blended with crude coal tar or petroleum oil. The noncreosote components typically consist of 40 to 70 percent of the treating solution. The creosote formulation used depends on the particular application involved and on the local availability of additives.

3.2.3 Inorganic Preservatives

Inorganic preservatives consist of arsenical and chromate salts and fluorides dissolved in water. Inorganic arsenical and/or chromate formulations are used primarily for the treatment of lumber and timber for the building industry. According to a RCRA 3007 Survey conducted in 1985, the most commonly used inorganic preservatives include:

- Chromated Copper Arsenate (CCA);
- Ammoniacal Copper Arsenate (ACA);
- Acid Copper Chromate (ACC);
- Chromated Zinc Chloride (CZC); and
- Fluor-Chrome-Arsenate-Phenol (FCAP).

Three formulations of CCA (Types A, B, and C) are currently used at wood preserving plants. The composition of the most frequently used formulation, CCA-C, is given along with the compositions of other inorganic preservatives in Table 3-4. CCA accounts for the vast majority of inorganic preservative use (83 percent). Other inorganic preservatives used were ACA (9 percent), ACC (3 percent), CZC (3 percent), and FCAP and other inorganics (2 percent). For treatment purposes, CCA is typically diluted in water to 1 to 2 percent total CCA concentration, but treatment concentrations range from 0.9 to 8 percent total CCA in various treating solution. Due to the nature of these preservative mixtures, they are likely to undergo chemical changes when heated to high temperatures during treatment. Maximum acceptable temperatures range from 120 to 150°F.

3.3 Processes Generating Hazardous Waste Numbers F032, F034, and F035

Wood preserving consists of several processes. However, there are essentially only two processes from which contaminated wastestreams are potentially created. These two processes, conditioning (basically drying the wood) and preservative application, are discussed in detail below. Other sources of contamination, such as drippage during removal and storage after preservative application, are discussed in Sections 3.3 and 3.4.

3.3.1 Conditioning Processes

Wood preserving consists of the application of preservative chemicals to wood to protect against decay and deterioration. Surface discoloration (sapstaining) can be adequately controlled by applying a superficial coat of preservative, but for long-lasting effectiveness, deep and uniform penetration of preservative into the wood is required. This type of penetration can only be achieved if the wood has been properly conditioned before the preservative is applied. However, even with proper conditioning, only a limited number of wood species are amenable to wood preservation (e.g., spruce and fir do not treat well).

Seasoning and mechanical conditioning are the two most commonly used conditioning methods. Seasoning reduces the moisture content of freshly-cut wood to a point where the preservative can penetrate and be retained by the cells of the wood. Mechanical conditioning consists of physically preparing the wood to improve the penetrability of the preservative, usually by making holes or incisions along the wood surface. Untreated wood may undergo either one or both of these conditioning methods before to preservative application.

Seasoning conditioning methods include: (1) steaming wood at elevated pressure in a retort followed by application of a vacuum; (2) kiln drying; (3) heating wood in a preservative bath under reduced pressure in a retort (Boulton process); (4) heating unseasoned wood in a solvent (vapor drying); and (5) drying wood in yards, at ambient temperatures (air seasoning). Steam, Boulton, and vapor conditioning produce more process wastes (especially wastewater) than either air or kiln drying. All of these seasoning methods are described below.

(1) Steam Conditioning. Conventional steam conditioning (open steaming) is a process in which unseasoned or partially seasoned wood is subjected to direct steam impingement at an elevated pressure in a closed vessel or retort, thus vaporizing the water content of the wood. AWPA standards set the maximum permissible temperature at 118°C (244°F) and the duration of the steaming cycle at no more than 20 hours. Immediately following steaming, a minimum vacuum of 0.74 atm is applied for 1 to 3 hours to pull the steam and vaporized wood water from the retort. Steam condensate that forms in the retort is removed through traps and is generally conducted to oil/water separators for removal of free oils. The steam condensate may be further treated before reuse or discharge off site.

In closed steaming, a widely used variation of conventional steam conditioning, steam is generated in situ by covering coils in the retort with water from a reservoir and heating the water by passing process steam through the coils. The water is returned to the reservoir after oil separation and is reused during the next steaming cycle. The volume of water in the storage tank increases slightly after each cycle because of the water removed from the wood. A small blowdown from the storage tank is necessary to remove this excess water and to control the level of wood sugars in the water. Because the steaming water may be reused, closed steaming conditioning generates less wastewater than open steaming conditioning.

Modified closed steaming is another variation of the steam conditioning process in which steam condensate is allowed to accumulate in the retort during the steaming operation until it covers the heating coils. Direct steaming is then discontinued, and the remaining steam required for the cycle is generated within the retort by using the heating coils. At the end of the steaming cycle, the water in the cylinder is discarded after oil contaminants are removed.

(2) Kiln Drying. Kiln drying is a batch-type process. Lumber or poles are placed in dry kilns in which air is either cross-circulated or circulated from one end to the other. Drying temperatures and times vary with wood species and type of product. Drying temperatures ranging from 150-220°F have been used to dry poles. Pine lumber, which is commonly kiln-dried, is dried at approximately 165°F.

Kiln drying may produce wastewater in the form of condensate, which drains from the kiln during the drying cycle. Kiln drying is also used, in some cases, to dry lumber after it is treated with inorganic preservatives. Kiln drainage is also generated during the drying of treated lumber.

(3) Boulton Conditioning. Boulton conditioning consists of heating wood in a preservative formulation in a pressure treating cylinder under vacuum conditions. The preservative, which has a boiling point higher than the boiling point of water, serves as a heat transfer medium. After the temperature in the treating cylinder is raised to operating temperature, a vacuum is drawn and water vaporizes from the wood, passes through the preservative bath, and collects in a condenser. The condensate then may go to an oil/water separator and to any further treatment or recycling steps.

The Boulton conditioning cycle may have a duration of 48 hours or longer for large poles and pilings accounting for the lower daily production per retort compared to plants than steam-condition. Boulton conditioning is usually limited to the application of creosote or nonwater-based pentachlorophenol formulations.

(4) Vapor Conditioning. Vapor conditioning (vapor drying) consists of exposing wood in a closed vessel to vapors from one of many organic chemicals that are immiscible with water and have initial boiling points ranging from 212°F to 400°F (100°C to 204°C). Selected derivatives of petroleum and coal tar, such as high-flash naphtha, or Stoddard solvent, are preferred; but numerous chemicals, including blends, are also employed as drying agents in this process.

Vapors for drying are generated by boiling the chemical in an evaporator. The vapors are conducted to the retort containing the wood, where they condense on the wood, give up their latent heat of vaporization, and cause the water in the wood to vaporize. The water vapor thus produced, along with the excess organic vapor, is conducted from the vessel to a condenser and then to a gravity-type separator. The water layer is discharged from the separator and the organic chemical is returned to the evaporator for reuse.

At the end of the heating period, the flow of organic vapors to the vessel is stopped, and a vacuum is applied for 30 minutes to 2 hours to remove the excess vapor along with any additional water. Because the drying cylinder frequently serves as the pressure treatment cylinder, the wood can be treated immediately after conditioning.

(5) Air Drying. Air drying consists of simply allowing wood to dry at ambient temperatures in storage yards.

3.3.2 Typical Conditioning Processes Used Before Wood Preserving

Usually, the selection of a particular conditioning method depends on the species of wood to be treated and on the preservative to be used. According to the 3007 Survey, the majority of plants treating with creosote and pentachlorophenol condition wood by air drying, kiln drying, or steaming. (See Table 3-5.) Predictably, air drying, the simplest and least expensive method, has the highest overall percentage of uses for both groups combined (approximately 38 percent). Kiln drying and steaming are also used by pentachlorophenol and creosote treaters, with overall percentages of 25 percent and 23 percent, respectively. A smaller overall percentage (14 percent) of pentachlorophenol and creosote treaters use the Boulton conditioning method.

Plants treating with inorganics, however, almost exclusively use kiln drying (52 percent) or air drying (47 percent), because AWPA standards require wood treated with CCA or ACC to be cooled to 120°F or below before treatment to prevent fixation of the salts on the wood surface. Thus, any of the pressure conditioning methods would require an intermediate cooling step, leading to inefficient use of pressure equipment. Further, most wood treated with inorganic preservatives consists of lumber and timbers, and steaming would distort the size and shape of these products.

After both pressure and nonpressure treatment, some unabsorbed preservative formulation (drippage) will adhere to the treated wood surface. Over time, this liquid will drip from the wood or be washed off by precipitation. If the wood has been pressure-treated, excess preservatives will also exude (bleed) slowly from the wood as it gradually returns to atmospheric pressure, a phenomenon commonly called "kickback." Pressure- and nonpressure-treated wood may continue to bleed for long periods, even after the wood is shipped off site and installed for its intended end use.

3.4 <u>Preservative Application Processes</u>

After conditioning, preservatives may be applied by either pressure or nonpressure processes. Pressure processes for applying wood preservatives employ a combination of air and hydrostatic pressure and vacuum. Pressure treatment, carried out in batch processes known as treatment cycles, is accomplished by submerging wood in a preservative solution within a sealed cylinder, or retort. Nonpressure processes are usually carried out in open tanks, at ambient pressure. Wood is immersed in the treating chemicals, which may be at ambient temperature or above.

Many possible combinations of wood preserving processes, conditioning methods, and preservative types are currently used in the wood preserving industry. AWPA sets standards ("Required Results of Treatment") for the industry, which depends on factors such as the commodity (lumber, ties, poles, etc.); and the type of wood (Southern Pine, Douglas Fir, oak, etc.). The "Required Results of Treatment" are stated in pounds of preservative per cubic foot of wood. The selection of a particular wood preserving process depends on its ability to meet the AWPA Standards. Each major preserving process is discussed below.

3.4.1 Pressure Treatment Processes

There are two basic types of pressure treatment processes, distinguished by the particular sequence of application of vacuum and pressure. The first pressure method is referred to in the industry as the "empty cell" process. It is used to obtain relatively deep penetration with limited absorption of preservative, typically desired for products such as railway ties, poles, fence posts, and construction lumber. The second pressure method, known as the "full cell" process, results in higher retention of preservative but in limited penetration compared to the empty cell process. This type of penetration is particularly desirable for wood used in the marine environment. The difference between the two processes can be viewed simply as whether the objective is to fill the wood cells (full cell) or just to coat them (empty cell) with preservative. The distinguishing process steps is an initial vacuum that is applied in full cell processes but not in empty cell processes. There is no difference in the types of wastes generated by full cell and empty call processes, although wood treated by the full cell process may drip more and has a greater tendency to bleed than wood treated by the empty cell process. A flow diagram of typical pressure treatment processes is presented in Figure 3-1.

A vacuum-only preservative process is also used in the wood preserving industry. This process is simpler to control than the two pressure-vacuum process described above, but requires more complex equipment than is generally used for other processes. The vacuum-only process is performed by enclosing wood in an airtight container, pulling an initial vacuum, and adding preservative solution to atmospheric pressure. The preservative is driven into the wood by the pressure difference between the initial vacuum and the atmospheric pressure. A final vacuum may be applied to control preservative retention and recover excess solution. The vacuum-only method is commonly used to treat window sashes with pentachlorophenol.

3.4.2 Nonpressure Treatment Processes

A limited quantity of wood is treated each year by nonpressure processes. Nonpressure processes including brushing or spraying, dipping, soaking (steeping), and thermal applications. The length of treatment and the concentration of the preservative are important factors in nonpressure processes because the preservative is driven into the wood by diffusion. The effectiveness of nonpressure processes depends heavily on the properties of the wood to be treated and the moisture content. Figure 3-2 presents a flow diagram of typical nonpressure treatment processes.

Brushing and Spraying. Brushing and spraying are the simplest of the nonpressure wood treatment processes. These techniques can achieve good penetration through cut end-grain surfaces, but result in only surface treatment along the grain of the wood. Creosote-based and oil-based pentachlorophenol preservatives are generally applied by these methods, although water-borne salts are applied in this manner to some degree. In the brushing and spraying methods of preserving wood, the preservative is applied to the surface of the wood in a thick layer and is allowed to soak in. Generally, two applications of preservatives are required. Brushing and spraying are most effective when applied to end-grain surfaces because preservatives penetrate much more readily in the direction of the grain. The preservative is usually mixed and stored in tanks or drums, from which it is applied to the brush or sprayer. Brushing or spraying is used for small volume applications, requires very little equipment, and results in quick, inexpensive, and easy application of the preservative of to the wood.

Dipping. Dipping is generally used to treat structural forms of timber and consists of immersing wood in a batch of preservative for a few seconds or a few minutes. Dipping is essentially the same as spraying or brushing in terms of the types of preservatives used and conditioning requirements except that it generally uses more preservative and requires more equipment, namely, a dip tank of sufficient size. Dipping has the advantage of more adequately treating the wood through further penetration due to the longer contact between the wood and the preservative.

Soaking (Steeping). Soaking at ambient temperature involves immersing wood in an unheated oil solution (commonly a pentachlorophenol formulation) for periods ranging from 2 days to 1 week. The wood must be well-conditioned (dried) to achieve maximum absorption of the preservative. The effectiveness of treating wood by soaking depends on the types of wood and on the product being treated.

It is also possible to soak wood in water-based solutions for several days or even weeks at ambient temperature (steeping). Occasionally, the preservative is heated somewhat to attain more rapid penetration. Both conditioned and unconditioned wood can be steeped; however, conditioned wood attains the desired penetration of preservative much faster. Solution concentrations generally range from 5 percent for conditioned timbers to 10 percent for unseasoned timber. Kyanizing, a patented soaking process, uses preservatives of mercuric chloride and was formerly used to preserve lumber, building timber, and poles.

Thermal Process. The thermal process, or hot and cold bath process, involves immersing seasoned wood in successive baths of hot and cool preservatives. Each stage typically takes 8 to 48 hours, depending on the ambient temperature and on the water content of the wood. The hot baths expand the outer layers of the timbers and evaporate moisture through the surface of the wood. The cold bath causes the air and vapor in the outer shell of the wood to contract, thereby forming a partial vacuum. Atmospheric pressure then forces the surrounding preservative into the wood.

Creosote and pentachlorophenol formulations are generally used in the thermal process; however, inorganic formulations have been used. Hot baths generally range from 210° to 220°F, and cold baths are generally around 100°F. Treating times, actual temperatures, and preservative mixtures depend on the type of wood being treated. The thermal process is used primarily to treat fence posts, lumber, and other forms of timber. It can be performed by using two separate tanks or by changing the temperature of the preservative solution in one treating tank.

3.5 Wastestream Status Under Other Regulations

Under the Clean Water Act (CWA), the discharge of pollutants into surface waters and publicly-owned treatment works (POTWs) from wood preserving facilities is regulated under the Timber Products Point Source Category, specifically 40 CFR 429, Subparts F and G. Subpart F does not list specific constituents, but Subpart G includes effluent limitations and standards for phenols, arsenic, and chromium (as well as COD, oil and grease, and pH). Phenols would include the following constituents regulated in F032 Wood Preserving Category: phenol, 2,4-Dimethylphenol, 2,4,6-Trichlorophenol, 2,3,4,6-tetrachlorophenol, and pentachlorophenol. Arsenic and chromium are also regulated in F032, F034, and F035.

Of the 25 constituents promulgated for Wood Preserving Wastes regulation under the LDR program, 15 (phenol; 2,4-dimethylphenol; 2,4,6-trichlorophenol; pentachlorophenol; anthracene; benz(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; naphthalene; phenanthrene; arsenic; and chromium) are also regulated under the Emergency Planning and Community Right-to-Know Act (EPCRA) Section 313 of the CERCLA. Under Section 313 (and also under the implementing regulations, 40 CFR Part 372, Subpart D), facilities that manufacture, process, or otherwise use these chemicals, and that meet certain other criteria, must report the releases and transfers of these chemicals annually, on the Toxic Release Inventory (TRI) form R.

Under the Clean Air Act (CAA), Section 112, National Emission Standards for Hazardous Air Pollutants (NESHAPs) program (and the implementing regulations - 40 CFR Part 61), no Wood Preserving industry atmospheric emissions are currently regulated or scheduled for regulation. There are also no specific regulations for Wood Preserving Industry atmospheric emissions sources under CAA New Source Performance Standards (40 CFR Part 60). However, certain constituents found in Wood Preserving Wastes do have NESHAPs emissions limits from other sources. For instance, coke oven emissions are regulated under NESHAPs. Coke oven emissions contain numerous polynuclear aromatic hydrocarbons (PAHs) that are also found in Wood Preserving Wastes, such as naphthalene.

3.6 Wastestream Residuals

This section describes the sources of wastes generated during wood preservation processes. Source information is presented for each type of residual; first for residuals generated during wood preservation and then for residuals resulting from cross-contamination. As shown in Figures 3-1 and 3-2, the preservation of wood can result in the generation of the following residuals: wastewaters, process residuals, and treated wood drippage and wash-off residuals (including unused preservative formulations). These residuals are discussed below.

3.6.1 Wastewaters

Wastewaters are generated at various points in both the pressure/vacuum and nonpressure treatment processes. The sources of wood preserving wastewaters are described in detail below.

Conditioning Wastewater. Conditioning is the process in which the natural moisture content of wood is removed to enable preservatives to adequately penetrate the wood. This may be accomplished by air drying the untreated wood in storage yards for a period of months (seasoning) or by kiln drying the untreated wood in controlled temperature and humidity kilns. These conditioning methods may be used by pressure, vacuum, or nonpressure treaters. Air drying does not produce contaminated wastewater unless surface protection (sapstain control) with chlorophenolics is used before air drying.

Boultonizing, steam conditioning, and vapor drying are conditioning methods used by pressure treaters. The wastewater produced by these conditioning methods consists of the water that is driven out of the wood. Steam conditioning also produces a considerable volume of steam condensate. The volume of wood conditioning water will vary according to wood type, preservative formulation, conditioning method, etc. In general, 64 to 1,200 liters of water per cubic meter (0.5 to 9 gallons per cubic foot) of wood may be generated.

Although the preservative types do not specifically dictate the conditioning method used, wood treated with inorganic arsenical and/or chromate salts is almost exclusively conditioned by air or kiln drying. The use of conditioning methods that do not produce wastewater (and the possibility of using condensate from vacuum systems and precipitation which falls in the treatment area as makeup water for the inorganic salt preservative formulations) means that inorganic processes can be operated with no net generation of wastewater. However, arsenic and chromium may accumulate in wastewater and wastewater treatment residuals generated at plants that treat with inorganic salts along with pentachlorophenol or creosote.

Wastewater from Preservative Formulation Recovery and Regeneration. In addition to the wastewater generated during conditioning, some water will accumulate in the pentachlorophenol and creosote formulations used by both pressure and nonpressure treaters. Periodic heat treatment or mechanical oil/water separation may be used to remove any accumulated moisture content.

Door Drippage and Spills. Not all wastewater from pressure wood conditioning can be effectively condensed and collected as an overhead from the pressure/vacuum retort or collected by bottom drains from the retort. Steam or condensate may leak from door gaskets or drip from the door as it is opened. Wastewater (and also preservative solution) may also spill out as the door is opened.

Pole-Washer Wastewater. Excess surface preservative may be washed off with water sprays either as the wood is removed from the treating retort or in another section of the plant separate from the treating area. The use of pole-washers is more common in areas of the country with little rainfall and for the small amount of wood treated by the Cellon® process (pentachlorophenol in butane).

Precipitation That Accumulates in the Process Area. Wastewaters managed by wood preserving plants include precipitation falling in process areas contaminated with wood preserving formulations. Runoff from the immediate process area (1/4- to ½-acre adjacent to the process equipment) is currently included as a process wastewater stream required to be collected and treated by the effluent guidelines and standards promulgated in 1981 under the CWA (46 FR 8260-8295).

Drying Kiln Condensate. Occasionally, wood treated with water solutions of inorganic salts is kiln-dried after treatment. Kiln drying may produce some wastewater in the form of condensate. If the kiln is used to dry wood treated with water solutions of inorganic salts, the condensate may be contaminated with heavy metals. Condensate from this process constitutes contaminated wastewater.

Other Sources of Wastewater. Other sources of wastewater that may be present at some plants are blowdown from wet air pollution control devices, drum rinsates, vehicle and equipment washdown wastewater, and process area washdown.

3.6.2 Process Sludges or Residuals

Typical pressure treatment of wood is characterized by recycling preservatives from work, storage, and mixing tanks to the pressure treating vessels. Nonpressure treatments involve the repeated use of preservative in the treatment tank or the recycling of hot and cold formulations to the mixing and work tanks. In both cases, fresh preservative solution is added to replace consumptive loss. Preservative formulation lost with wastewater or through drippage into the door sumps is frequently collected and fed back into the process. The continual reuse of preservative formulation leads to accumulations of sawdust, wood chips, sand, dirt, stones, tar, and polymerized oils. This material comprises the bulk of wood preserving process sludges or residuals and is collected in treating cylinders and tanks; in holding, work, storage, and mixing tanks; in door sumps; and in filters and separators used to prepare preservative solutions for reuse. Other process residuals are fugitive emissions (e.g., leaks and spills) and maintenance wastes that are typically managed by land disposal at the site of generation. These residuals are described in detail below.

Treating Cylinder and Treating Tank Sediments. Sediments containing sawdust, wood chips, sand, dirt, stones, tar, and emulsified and polymerized oils will accumulate in the bottom of pressure treating cylinders and nonpressure tanks at wood preserving plants. Some treating cylinders and tanks have bottom drains to recycle unused preservatives to work and storage tanks. When this type of drain is used, sediments do not accumulate in the treating cylinders and tanks, but are carried back to the mixing tanks.

The frequency with which sediments are removed from treating vessels depends on the preservative used, the production schedule, and how the wood is handled before treatment. A pressure cylinder used to treat a high volume of wood with creosote may be cleaned out four or more times per year, while a cylinder used to treat a low volume of wood with organic salts may go 5 years without cleaning.

The sediment layer that accumulates in the bottoms of the nonpressure treating tanks may also need periodic dredging and removal, particularly for pentachlorophenol or creosote processes, which do not use heat because of potential oil/water emulsion problems.

Treating cylinder sediments may be reduced in volume by cleaning the wood before treatment and by storing wood during air seasoning on pallets or concrete pads instead of on open ground. Also, kiln drying results in some surface dirt being retained in the kiln rather than in the treating cylinder.

Residuals from Holdings, Work, Storage, Mixing, or Other Tanks. Sediments similar in composition to those generated in treating cylinders may be generated in holding, work, storage, or mixing tanks at wood preserving plants.

Pentachlorophenol tank sediments may be pumped out from the bottoms of tanks every year or so, depending on plant conditions. These sediments often have a high water content from emulsified oils. Usable preservative may be recovered form the sediments by mechanical oil/water separation and/or thermal evaporation. Pentachlorophenol tank outlet lines may be several feet higher than the bottoms of the tanks to allow water emulsions and solid residuals to accumulate without being returned to the process.

Creosote tank sediments also require periodic removal. Some heavy creosote tank bottoms not suitable for a particular wood treatment application at one plant may be of the proper grade for use at another plant. These sediments have a high thermal recovery value and can be used as boiler fuel. Manufacturers of creosote may also regenerate these tank bottoms off site.

Inorganic arsenical/chromate processes generally do not generate tank sediments because build-up of tarry residues or emulsions is not a problem, except in cases where wastewater from a pentachlorophenol process is used as makeup water for the inorganic processes. Any entrained insoluble matter may be filtered from the treating solution before its return to work tanks. Adjustment of pH is a means of resolubilizing precipitated preservative salts and will reduce the quantity of process wastes requiring disposal. Inadequate control of the temperature of the preservative solution may contribute to sediment formation; temperatures in excess of 140-150°F or temperatures below freezing are avoided for this reason.

Residuals from Secondary Containment of Holding, Work, Storage, Mixing, or Other Tanks. The tank area of many wood preserving plants may be equipped with secondary containment in the form of concrete or earthen berms around the concrete pads upon which the tanks are installed. Drippage and spills (as well as windblown dirt and other debris) collect in these units.

In addition, plants may have secondary collection systems for any stormwater runoff from the "tank farm" secondary containment areas. Some plants require the manual operation of hoses and pumps in the event of a major spill. In almost all cases, solid materials, such as dried formulation residues and contaminated dirt and debris, are periodically shoveled from the containment area and disposed.

Door or Treating Cylinder Sump Residuals. Most wood preserving plants have secondary containment for their treating cylinders in the form of concrete sumps either at the door opening of the retort or around the entire length of the retort. Sediments, windblown dirt, debris, as well as spills of preservative formulation, are collected in these sumps. Some treating cylinders may be designed so that all sediments collect in these sumps, rather than on the floor of the treating cylinder itself.

Some plants use sections of the containment sump area as conduits for wastewater or preservative formulation collection and recycling. At some plants, recycling from the retort containment sumps is automatic. At other plants, manual operation of hoses is necessary to collect wastewater or formulation from the top of the sump contents, to avoid recycling dirt, debris, and other residuals. Often residuals, sediments, dirt, and debris must be shoveled from the sumps by hand.

Preservative Recycling/Regeneration Residuals. The recycling and regeneration of preservative solutions used at wood preserving plants may require removal of entrained water and solid material. Filters or screens may be used in-line before returning solutions to the work tanks, thus generating filtration residuals. Heat may be applied to creosote or pentachlorophenol solutions to break emulsions and evaporate entrained water, generating some portion of solid or tarry material which cannot be returned.

Drips and Spills from Leaking Process Equipment. Wood preserving plants are often old, the processes are frequently run at elevated pressures, and the technology does not require great precision and control. These factors may increase the probability of drips and spills from leaking pipes, valves, and process equipment.

Maintenance Area and Shop Residuals. Processing equipment, trams and baskets for holding wood during treatment, tanks, and vehicles contaminated with preservative formulation at wood preserving plants are usually repaired on site in a maintenance shop area. Vehicles and equipment may be hosed down over open ground or on pads before repair.

In the maintenance shop, degreasing solvents may be used on equipment before any repair, thus becoming contaminated. Surface residues from equipment may also drip or be brushed onto the shop floor, resulting in contaminated floor sweepings.

Other Sources of Process Sludges or Residuals. Maintenance and cleaning activities in the process areas at wood preserving plants may generate process residuals. These residuals include floor sweepings, empty drums and drum liners, and used gloves and other protective clothing.

3.6.3 Treated Wood Drippage, Wash-Off Residuals, and Unused Preservative Formulations

Treated wood drippage and wash-off residuals are generated at various points in both the pressure/vacuum and nonpressure treatment processes. The sources of treated wood drippage and wash-off residuals from wood preserving are described below.

Information about discarded unused preservative formulations is limited, but it is believed to be similar to drippage in composition. Available data are presented in Section 3.4 for each type of waste. No generation rates are available for discarded formulations, but they are believed to be generated when plants discontinue wood preserving operations.

Free Drippage from Treated Wood. After both pressure and nonpressure treatment, some unabsorbed preservative formulation will adhere to the treated wood surface. Over time, this liquid will drip from the wood or be washed off by precipitation. If the wood has been pressure-treated, excess preservative will also exude slowly from the wood as it gradually returns to atmospheric pressure, a phenomenon commonly called "kickback." Preservative formulations (especially pentachlorophenol and creosote formulations) may continue to exude ("bleed") from pressure and nonpressure treated wood for long periods, even after the wood is shipped off site and installed for its intended end use.

Free drippage from pressure-treated wood may be minimized by steaming the wood after treatment to wash off adhering preservative or by applying a final vacuum on the wood before it is removed from the retort; however, applying a final vacuum or steam cleaning to the treated wood while it is in the treatment cylinder may not always be possible. Certain types of preservative formulation applications and certain types of wood preclude the use of vacuum, especially if a maximum amount of formulation on the wood surface is desirable for water repellency during storage or use (e.g., creosote applications to railroad ties or marine pilings). A final steam cleaning may not be permitted by AWPA standards for certain woods in specified applications (e.g., steaming of oak piles, poles treated with water-borne preservatives, and lumber and timber requiring protection from marine borers is not permitted). Final steaming may also render certain treatment applications, (e.g., Cellon® process pentachlorophenol treatment) less effective. Because a final steam cleaning and/or vacuum delay the next treatment cycle, and because final steam cleaning and/or vacuums are energy-intensive, a plant may choose not to employ these techniques. Finally, steam cleaning in the treating cylinder or tan is not possible for nonpressure and vacuum treatment processes, nor is a final vacuum cycle position for nonpressure processes.

In general, wood that has been treated by the empty cell process will have less free drippage than the same wood treated with the same preservative formulation by the full cell process. The empty and full cell processes are distinguished by an initial vacuum which is part of the full cell process, but not part of the empty cell process. The empty cell process is based on the principle that part of the preservative forced into the wood is expelled by entrapped air upon release of pressure at the conclusion of the treating cycle. In contrast, in the full cell process, air is withdrawn from the wood by a vacuum drawn at the beginning of the treating cycle. Preservative is then forced into the wood under pressure, as in the empty cell process. However, most of the preservative remains in the wood when the pressure is released, because there is no entrapped air forcing the preservative out of the wood. A final vacuum may be applied at the end of either the empty or full cell process. Wood treated by the full cell will have a higher preservative retention and, thus, may drip more than wood treated by the empty cell process.

The amount of free drippage from treated wood also depends on the type of formulation used (viscosity), the degree of penetration into the wood (amount available for drippage), the type of wood used (porosity and swelling capacity), the imperfections in the wood (splits and knotholes), and the size of the wood treated (relative surface area and relative proportion of end-cuts).

Climatic conditions will also affect the amount of free drippage and the period of time over which this drippage will occur. Warm climates, summer, and direct sunlight will favor greater amounts of free drippage from creosote- or pentachlorophenol-treated wood. Cold climates (especially freezing temperatures) and high humidity will prevent drying and fixation of inorganic arsenical/chromate-treated wood, resulting in greater amounts of free drippage from both inorganic arsenical/chromate-treated wood and creosote and pentachlorophenol-treated wood until spring or the first warm day. As a result, large volumes of free drippage may be generated over a short period of time.)

Management of free drippage varies from plant to plant and often depends on the production schedule a plant must meet. A plant producing near its capacity will remove wood from the treating cylinder and transfer it to storage quickly. Thus, most free drippage and kickback will occur in the treated wood storage yard. At a plant that does not need to maximize its retort use, a charge may be allowed to drip in the retort for a extended period of time. Other plants have "drip pads" over which trams of freshly-treated wood are allowed to sit for 1 to 3 days. Collected drippage may be routed to a sump and then reused in the treatment process, or may be disposed.

Several plants have "drip pad sludge" volumes. These volumes represent only sludge accumulation at plants that collect a portion of their drippage; they do not represent the total volume of excess preservative which drips from pressure-treated wood. Generally, collected drippage is reused in preservative processes, while sludges may be left in place indefinitely, or may be periodically dredged and hauled to offsite disposal in general or secure landfills. Eighty-six percent of the plants that responded to a 1985 RCRA 3007 questionnaire did not report managing treated wood drippage, although most generated this waste. Plants typically allowed treated wood to drip on drip pads, along tram tracks, and in the wood storage yards.

Wash-Off of Excess Preservative Formulations from Treated Wood. Excess preservative adhering to the surface of treated wood is undesirable because it prevents the clean use of the treated wood for construction purposes. AWPA standards specify that all treated wood should be free of visible surface residue before sale to the customer. However, there is no known practice by which wood preserving plants eliminate surface residues from wood treated with creosote or pentachlorophenol in petroleum carriers before sale, other than to allow the wood to rest in the open where precipitation washes off excess preservative. At most plants, washed-off preservative is disposed of on open ground. At a few plants, both initial free drippage and treated wood storage takes place over areas covered with asphalt or concrete, where drippage, kickback, and washed-off preservatives are collected and treated. A few plants are currently roofing their concrete-covered treated wood storage yards to minimize the amount of washed-off preservative that requires collection and treatment.

Residues of excess formulation from treatments with nonpetroleum pentachlorophenol formulations, known as "bloom," may appear on the surface of treated wood. Wood preserving plants may wash off this surface residue with specially-installed sprays (often over open ground), or may be able to take advantage of natural precipitation to perform this function in some climates or seasons.

Surface residues may also form on wood treated with arsenical and/or chromate formulations because complete fixation of all arsenical/chromate salts as insoluble complexes in the wood fiber is not possible. Some fraction of the water-borne arsenical/chromate salts remains as free, powdery residues on the surface of the wood, in the grain (especially along cuts), or in the pores of the wood. Incomplete fixation is due in part to hydrostatic tension that keeps some of the formulation as pockets or layers of free liquid, thus preventing the intimate contact of the formulation with the wood fiber during drying. Further, wood may be overtreated with more inorganic salts than can be fixed in the wood fiber. Finally, impurities or imbalances in the treating salts themselves may lead to the formation of residues of unfixed arsenic and chromium in the pores and surfaces of the wood.

These surface residues of unfixed (i.e., soluble) arsenic and chromium may be washed from treated wood with polewashers or other washing devices. A final steam cleaning may also be used to minimize surface residue. Alternatively, the residues may be washed off by precipitation.

3.6.4 Cross-Contamination Residuals

Because wastes generated at plants that previously used chlorophenolic preservatives and wastes generated from creosote and inorganic wood preserving processes located within the same plant as a chlorophenol process can be contaminated with pentachlorophenol and PCDDs and PCDFs, these wastes are included in under Hazardous Waste No. F032. However, wastes from wood preserving processes at plants that do not resume the use of chlorophenolic preservatives will be excluded from the definition of F032, provided the generator meets the requirements of 40 CFR §261.35.

Process sludges and wastewater residuals accumulate gradually in wood preserving and wastewater treatment equipment. Periodically (annually, semiannually, monthly, or perhaps less frequently depending on the size and operating practices or a particular plant), the accumulated residuals are removed from the equipment and disposed. The Agency has determined that wood preserving plants regularly change the preservatives used in a particular piece of process equipment without removing accumulated materials or cleaning the equipment.

EPA also believes that waste from inorganic and creosote processes, generated either from equipment that has been previously used in pentachlorophenol process or at plants that have used pentachlorophenol processes on the same site, is contaminated by the constituents of concern from the pentachlorophenol processes. This potential for cross-contamination is documented by the waste characterization data provided in the November 1990 Background Listing Document for Wood Preserving Wastes (Final), Appendix D. These data show that constituents unique to pentachlorophenol waste were identified in some creosote and inorganic wastes. This cross-contamination is further documented by information collected by EPA through site visits and surveys. Based on this information, EPA has concluded that the potential for cross-contamination is significant and has, therefore, included in the F032 listing wastes from inorganic and creosote processes that may be cross-contaminated with chlorophenolic preservatives.

3.7 Quantities and Composition of the Wastestreams

The following section describes the quantities and concentration of contaminants in the wastestreams produced from the wood preserving industry. Because the data are more readily available by the type of waste, rather than by waste code, this section is divided into the following three subsections: wastewaters, process sludges and residuals, and drippage/wash-off streams. However, the generation of wood preserving wastes is reported as wastewater and nonwastewater forms for each wood preserving hazardous waste code of concern.

Based on the 1985 RCRA Section 3007 Survey, which was used as the primary source for determining the quantities of waste generated, volume estimates have been calculated on a waste code basis. To determine current volumes for each waste code, wood preserving waste generation rates from the survey were multiplied by the total volume of wood treated with each preservative type scaled up from the 1994 Micklewright Report (1). Table 3-6 presents EPA's estimates of the quantities of wood preserving wastes generated by waste code.

3.7.1 Quantity of Process Wastewater Generated by the Wood Preserving Industry

The average process wastewater generation rate was 174 1/m^3 of treated wood for the 14 plants supplying both production and wastewater generation information in response to the

RCRA 3007 Survey. In contrast, data collected by EPA's Office of Water indicated that for 47 surveyed plants in 1976, the average wastewater generation rate was 157 $1/m^3$. Data collected in the 1985 RCRA 3007 Survey were assumed to better represent current industry practices and were used to estimate the rate at which process wastewater is produced during wood preserving activities.

All 28 plants that reported process wastewater management in the RCRA 3007 Survey treated wood with pentachlorophenol, creosote, or both. Although plants treating with inorganic preservatives generate process wastewater (condensate from vacuum systems and process area runoff), these plants recycled these wastewaters back to the treating process. Therefore, based on data from the questionnaires, attributing any net process wastewater generation to processes using inorganic preservatives would not be accurate.

The total quantity of process wastewater managed by the wood preserving industry in 1985 was estimated to include: process wastewater generation was associated with only 80 percent of the production of wood treated with creosote or pentachlorophenol because not all plants treating wood with creosote or pentachlorophenol reported generating and managing process wastewater. The remaining 20 percent of production may be conditioned by kiln or air drying processes that generate little wastewater. (However, plants that evaporate or reuse all of their process wastewater may also have failed to report managing any wastewater.) The total 1985 production of wood treated with pentachlorophenol or creosote was reported by AWPI to be 3,394,000 m^3. Eighty percent of the treated wood (2,715,200 m^3) are associated with wastewater generation. The total quantity of process wastewater managed by the wood preserving industry in 1984 has been estimated to be 4.72×10^8 liters.

Of the 14 plants in the 1985 RCRA 3007 Survey that supplied information on their wastewater generation rates, 6 treated with creosote only, 2 with pentachlorophenol only, and 6 with both creosote and pentachlorophenol. Insufficient information was provided to calculate separate wastewater generation rates for processes using pentachlorophenol and processes using creosote formulations, particularly because plants treating with both preservatives typically combine the wastewaters for treatment and cannot attribute an individual flow to a specific preservative. Further, the majority of available wastewater constituent data came from sources in which the wastewaters from creosote and pentachlorophenol treating processes were commingled. Therefore, calculation of separate wastewater flow rates for pentachlorophenol processes and for creosote processes was not considered to be meaningful, and the rates were assumed to be the same.

3.7.2 Concentration of Constituents in Wood Preserving Process Wastewaters

The constituents in wood preserving wastes, including process wastewaters, can be divided into five groups: pentachlorophenol (PCP), polychlorinated dioxin and furan (PCDD and PCDF), polynuclear aromatic hydrocarbon (PAH) constituents, phenolic constituents, and metal constituents (specifically arsenic and chromium). Table 3-7 presents minimum, maximum, and average detected concentrations for the listing constituents and other significant compounds for F032 and F034 wastewaters. The complete data set for all constituents found in the sampled wood preserving wastes is provided in Appendix D of the Listing Background Document.

Process wastewater constituent concentrations have probably been underestimated because many wastewater samples collected represent partially treated wastewater. These include samples collected for the development of effluent guidelines, which were taken after preliminary oil/water separation, as well as samples collected for the Georgia study (Case Number 110), which were taken from potentially stratified surface impoundments.

<u>Pentachlorophenol</u>. Concentrations of pentachlorophenol in wood preserving wastewasters were available from the Development Document supporting the effluent guidelines for wood preserving; from sampling performed by EPA's Office of Solid Waste (OSW); from a study of wood preserving surface impoundment wastes by the State of Georgia; and from data obtained during RCRA site inspections. In all, data were available for samples of 25 different wastewaters. Pentachlorophenol concentrations in wastewaters ranged from 0.01 ppm to 300 ppm and averaged 10 ppm.

Polychlorinated Dioxins and Furans (PCDDs and PCDFs). Concentrations of PCDDs and PCDFs in untreated wood preserving wastewaters were available from published studies describing four sites in Canada and from a study undertaken as part of a CERCLA cleanup (Case Number 93). Ranges and average concentrations for specific PCDD and PCDF homologs are given in Table 3-7.

Other data quantifying wastewater concentrations of PCDDs and PCDFs were not used to estimate typical dioxin concentrations because they are not considered to be representative. One plant from which unused data were obtained is attempting to use an aeration process to biologically degrade the constituents of sludge and water contained in a large surface impoundment. This process includes adding "dispersants" to the sludge/water mixture in an attempt to force the constituents in the sludge into the wastewater and thus increase their availability to micro-organisms. However, while increasing availability of sludge constituents, PCDD and PCDF concentrations in water may also be increased. Further, the wastewater samples are filtered before analysis. Thus, the data may not be representative of typical wastewater concentrations of PCDDs and PCDFs in wood preserving wastewaters.

The PCDD and PCDF concentrations in the wastewater from the Cellon® process at one plant were also not used. The concentrations of PCDDs and PCDFs in wastewaters at this plant are several orders of magnitude greater than the concentrations measured in other wastewater sources. A possible explanation for these higher concentrations is that butane, the carrier used in the Cellon® process, is much more soluble in water than in petroleum oil, which is more frequently used as the carrier for pentachlorophenol. Because a relatively small proportion of the plants treating wood with pentachlorophenol use the Cellon® process, the PCDD and PCDF concentrations in wastewater from the Cellon® process are not considered typical of concentrations of these constituents in the wood preserving industry.

Polynuclear Aromatic Hydrocarbons and Phenolics. Wastewater concentrations of PAHs and phenolics in wood preserving wastewaters were available from the Development Document supporting the effluent guidelines for wood preserving; from sampling performed by EPA's OSW;

and from a study of wood preserving surface impoundment wastes by the State of Georgia. EPA believes these data can represent F032/F034 untreated wastewater and wastewater treated in preliminary oil/water separation. Ranges and average concentrations for specific PAHs and phenolics are provided in Table 3-7.

Metals. Wastewater concentrations or arsenic and chromium in wood preserving wastewaters were available from the Development Document supporting the effluent guidelines for wood preserving; from sampling performed by EPA OSW; and from data obtained during RCRA site inspections (Appendix D of Background Listing Document). As shown in Table 3-7, arsenic concentrations ranges from 0.003 mg/L to 30 mg/L and averaged 5 mg/L. Chromium concentrations ranged from 0.004 to 10 mg/L and averaged 2 mg/L.

As described, process wastewater generated while using inorganic preservatives is reused as preservative makeup water, resulting in no net generation of wastewater. However, wastewater generated while using creosote and/or pentachlorophenol preservatives may be contaminated with arsenic and chromium due to cross-contamination at plants which use both organic and inorganic preservatives. The extent of this cross-contamination, and the associated concentration of arsenic and chromium in cross-contaminated wastewater, are quite variable. Nevertheless, EPA concluded that concentrations of chromium and arsenic in these wastewater forms supported the listing of F032, F034, and F035 as hazardous waste under RCRA. EPA is not reopening this determination to review in today’s final rule.

Three of the 11 wastewater samples analyzed for arsenic had concentrations greater than 5.0 mg/L and, thus, would be considered characteristically hazardous due to EP toxicity (40 CFR 261.24). These three samples represented wastewaters from treatment area surface runoff, oil/water separator wastewater, and impoundment wastewater.

One of the 10 samples analyzed for chromium had a concentration greater than 5.0 mg/L, and, thus, would be considered characteristically hazardous due to EP toxicity (40 CFR 261.24). This sample consisted of conditioning condensate from Boulton conditioning with creosote and pentachlorophenol. However, the plant at which this sample was collected also treats with chromated zinc chloride (CZC), which is assumed to be the source of the chromium in the wastewater.

3.7.3 Quantity of Process Sludges or Residuals Generated by the Wood Preserving Industry

Data collected in the RCRA 3007 Survey were used to estimate the rates at which process sludges or residuals are produced during wood preserving activities. In contrast to the data supplied to describe wastewaters, data describing process residuals were detailed enough for calculation of separate statistics for residuals from each type of preservative. The average process sludge or residual generation rates in liters per cubic meter (L/m^3) were as follows:

Preservative	Average Generation Rate
Creosote	0.542 L/m^3
Pentachlorophenol	0.845 L/m^3
Inorganics	0.051 L/m^3

Fifteen percent of the plants responding to the RCRA 3007 questionnaires claimed to produce no residuals from their wood preserving operations. These plants accounted for approximately 3 percent of the pentachlorophenol production, 4 percent of the creosote production, and 5 percent of the inorganic production reported in the survey. However, many survey respondents stated that, while there was residual buildup in the treating equipment, the residuals had never been removed. Thus, for the purpose of this estimate, all wood preserving operations were assumed to generate process residuals. The total 1985 production rates, by preservative (as reported by AWPI), were used to estimate the total quantity of process residuals generated:

Preservative	L/m^3	x	m^3/yr	=	L/yr
Pentachlorophenol	0.845		1,389,000		1,174,000
Creosote	0.542		3,641,000		1,973,000
Inorganics	0.051		9,549,000		487,000

Because the listing definition of F032 includes all wood preserving wastes generated at plants that use chlorophenate preservative formulation, any process residuals from creosote processes or inorganic processes at plants that also use pentachlorophenol would be classified as F032. Similarly, process residuals from inorganic processes at plants that also use creosote would be classified as F034. The quantity of process residuals generated in each listing category was estimated as follows:

Waste Code	Preservative	L/m^3 x	m^3/yr =	L/yr
F032	Pentachlorophenol	0.845	1,389,000	1,174,000
	Creosote	0.542	1,136,000	616,000
	Inorganics	0.051	660,000	34,000
	TOTAL			**1,824,000**
F034	Creosote	0.542	2,504,000	1,357,000
	Inorganics	0.051	319,000	16,000
	TOTAL			**1,373,000**
F035	Inorganics	0.051	8,576,000	437,000

3.7.4 Concentrations of Constituents in Wood Preserving Process Sludge or Residuals

EPA has reviewed available characterization data on untreated and treated F032, F034, and F034 from documents supporting the listing of these wastes as hazardous and additional data gathered by EPA on F034/F035 during 1991 (EPA refers to these additional data as the EPA's 1991 F035 studies). EPA's 1991 F035 studies consist of four studies that characterize untreated and treated wastewater and nonwastewater forms of wastes believed to be as difficult to treat as F035. The first study consists of characterization studies of untreated F035 sludges, wastewater collection sumps, wastewaters, and other filter residuals at three wood preserving facilities. The second study involved collecting data on untreated and treated F035 wastes that were commingled at a hazardous waste treatment facility prior to their stabilization with lime and cementitious agents. The third study describes an EPA in house stabilization treatability study of

F035 using lime, fly ash, and cementitious agents. The fourth study is an EPA in house feasibility study to selectively remove arsenic and chromium from a synthetic wastewater formulated to simulate F035 wastewaters.

Other literature and documents reviewed included the EPA's Preliminary Data Summary for the Wood Preserving Segment of the Timber Products Processing Point Source Category, September 1991 (EPA 440/1-91/023), the 1986-1990 summary abstracts on the treatment of F032, F034, and F035 contaminated soils at Superfund sites, other literature published on the treatment of wood preserving and petroleum refining contaminated soils, and data included in comments submitted in response to the Advanced Notice of Proposed Rulemaking of October 21, 1990 (ANPRM) and Phase 2. Additional data regarding the makeup of F032 wastes were reviewed by EPA after the comment period for the Phase 4 proposed rule. These supplemental data can be found in Appendix K (The Penta Task Force, comment PH4P-00032, 2/23/96; American Wood Preservers Institute, comment PH4P-00039, 11/20/95.) In addition, EPA analyzed all available data on the treatment of other RCRA wastes that are believed to be as difficult to treat as F032, F034, and F035. Based on the analyses of these data, EPA believes that it is not necessary to subcategorize F032, F034, and F035 wastes beyond wastewaters and nonwastewaters.

The constituents of concern in wood preserving wastes, including process sludges or residuals, can be divided into five groups: pentachlorophenol (PCP) constituents, polychlorinated dioxin and furan (PCDD and PCDF) constituents, polynuclear aromatic hydrocarbon (PAH) constituents, phenolic constituents, and metal constituents (specifically arsenic and chromium). Minimum, maximum, and average detected concentrations for the listing constituents and other significant compounds for process sludges or residuals from pentachlorophenol, creosote, and inorganic wood preserving processes are presented in Tables 3-8, 3-9, and 3-10, respectively. The complete data set for all of the constituents found in the sampled wood preserving wastes is provided in Appendix D of the Background Listing Document.

Pentachlorophenol. Concentrations of pentachlorophenol in wood preserving process sludges or residuals were available from sampling performed by EPA's OSW and from data obtained during RCRA site inspections. The sampled residuals, all derived from processes in which pentachlorophenol was used, included pressure retort sediments and door sump sediments. The concentrations of pentachlorophenol in process sludges or residuals ranged from 40 ppm (0.004 percent) to 30,000 ppm (3 percent), and averaged 20,000 ppm (2 percent).

Two samples had concentrations much lower than the average concentration. One was a sample of soil from the pit around a treating cylinder (40 ppm), and one was from a cylinder in which creosote, not pentachlorophenol, had been used for 2 to 4 months prior to samplings. Excluding these samples, the concentration of pentachlorophenol in treating cylinder sludges ranged from 1.1 to 3.4 percent, and averaged 2.2 percent.

Two samples of residuals from nonpressure processes had pentachlorophenol concentrations of 2.0 percent and 1.1 percent - not significantly different from the overall average. Therefore, concentrations of pentachlorophenol in residuals from pressure and nonpressure processes are assumed to be the same.

Polychlorinated Dioxins and Furans (PCDDs and PCDFs). Concentrations of PCDDs and PCDFs in wood preserving process sludges or residuals were available from sampling performed by EPA/OSW and from data obtained during RCRA site inspections. The sampled residuals, all derived from processes in which pentachlorophenol was used, included pressure retort sediments, nonpressure treating tank sediments, work and storage tank sediments, and floor scrapings from a treating cylinder shed. Not all samples were analyzed for all PCDD and PCDF homologs. Ranges and average concentrations for specific PCDD and PCDF homologs are given in Table 3-8. In addition, data on PCDD and PCDF concentrations were submitted by Covington and Burling for the Penta Task Force. These data include samples of work tank solution, retort sludge, drip pad waste, oil-water separator sludge, and filter press cake. They are summarized in Appendix K, Tables K-2 and K-6.

Polynuclear Aromatic Hydrocarbons (PAHs) and Phenolics. Concentrations of PAHs and phenolics in wood preserving process sludges or residuals were available from sampling performed by EPA/OSW and from data obtained during RCRA site inspections. The sampled residuals were divided into two groups: those derived from processes in which pentachlorophenol was used (Table 3-8), and those derived from processes in which creosote was used (Table 3-9). The pentachlorophenol process residuals included pressure retort sediments, nonpressure treating tank sediments, storage tank sediments, and door sump sediments. The creosote process residuals included pressure retort sediments and door sump sediments. Not all samples were measured for all compounds. Compound by compound, the relative makeup of creosote waste sediments did not differ greatly from the makeup of pentachlorophenol waste sediments at about 10 times the concentrations present in the pentachlorophenol waste sediments. Ranges and average concentrations for specific PAHs and phenolics are provided in Tables 3-8 and 3-9.

Metals. Concentrations of arsenic and chromium in wood preserving process sludges or residuals were available from sampling performed by EPA/OSW. The sampled residuals, all derived from processes in which inorganic arsenical and/or chromate salts were used, included treating cylinder residuals (ACA and CCA processes) and one residual from the recycle of preservative solution (a CCA process). The absolute and relative concentrations of arsenic, chromium, and copper depended on the type of preservative used. Ammoniacal copper arsenate (ACA) residuals had very low chromium concentrations (the formulation does not contain chromium), but had higher copper concentrations than copper chromated arsenate (CCA) residuals. All four CCA process residuals were EP toxic for chromium, and both ACA process residuals were EP toxic for arsenic. Ranges and average concentrations for specific metals are given in Table 3-10.

3.7.5 Quantity of Drippage, Wash-Off, and Associated Residuals Generated by the Wood Preserving Industry

The volume of treated wood drippage and wash-off residuals generated by the wood preserving industry has not been characterized well. It is uncertain how much drippage is collected and reused and how much is simply allowed to drip along tram tracks and into wood storage yards. However, the extensive soil contamination documented at wood preserving sites sampled as part of the listing effort and during RCRA and CERCLA site investigations demonstrates that substantial quantities of treated wood drippage and wash-off are generated.

Using information collected by EPA/OSW site inspections, three estimates of the amount of drippage generated by creosote wood preserving processes were made. The first estimate was based on information supplied by a plant that reported the kickback drippage of 0.1-0.2 kg/tram car, based on the amount of material that dripped in the first few hours after treatment. The kickback rate is 0.018-0.035 kg/m^3 of treated wood (0.02-0.03 1/m^3). This rate is probably a low estimate, because the sampled plant uses an empty cell preservation process and pulls a final vacuum on the treated wood - both are procedures that reduce drippage. Further, the experiment lasted only a few hours, while it is expected that initial free drippage from kickback occurs over a period of 2 to 3 days.

The second estimate was based on information supplied by another plant. This plant reported that they collected 0.13 to 0.17 liters of kickback on its concrete drip pad for every cubic meter of railroad ties treated. These estimates may be biased low depending on the production schedule under which the plant was operating. A plant producing near its capacity generally removes a charge from the treating cylinder and transfers it to storage quickly, therefore, generating a larger volume of kickback in their concrete drip pad area. At plants operating on slower schedules, a charge may be allowed to drip in the retort for an extended period, and an extra period of vacuum may be performed, thereby, generating a smaller volume of kickback.

A third estimate involved the assumption that treated wood has a surface-to-volume ratio of 4:1, that a kickback layer 5-mm (0.2 inches) thick accumulates on the surface, and that 95 percent of the kickback are collected in the treating cylinder. Thus, the "free drippage" generated is:

$$4\ \text{m}^2/\text{m}^3 \text{ x } 0.005\ \text{m x } 1{,}000\ \text{L/m}^3 \text{ x } 5\% = 1\ \text{L/m}^3.$$

Fourteen percent of the plants that returned RCRA 3007 questionnaires reported managing drip pad sludges. The average rate for the eight plants supplying both production and waste generation information was 0.0462 L/m^3 of treated wood. Six of these eight plants were licensees of one supplier of inorganic preservative chemicals. Each plant reported managing the same volume of sludge. Thus, this waste generation rate may not be representative of the entire wood preserving industry.

Very little data on the volume of drippage generated by wood preserving plants were available. The limited data provided by commentors were not accompanied by sufficient documentation of the conditions (e.g., temperature) under which the measurements were taken. The drippage rates supplied by the commentors were multiplied by a factor of 10 to account for the uncertainty in the available data, concern that there could be many situations in which drippage rates would be higher than indicated in the commentors' data, and theoretical estimates of drippage that were considerably higher than those provided by commentors.

All wood preserving plants are assumed to produce treated wood drippage. The total 1987 productions estimated by AWPI, by preservative, were used to estimate the total quantity of drippage generated:

Preservative	Drippage Rate (L/m^3)x	Annual Production (m^3/yr)=	Annual Industry-Wide Drippage Generation (L/yr)
Creosote	1.12	2,314,000	2,592,000
Pentachlorophenol	1.56	1,080,000	1,685,000
Inorganics	0.061	10,530,000	642,000

If drip pad sludges are assumed to be generated at the rate reported in the RCRA 3007 questionnaire, the quantity of drip pad sludge produced by plants treating with pentachlorophenol, creosote, and inorganic preservative formulations amounts to 50,000; 107,000; and 486,000 L/yr, respectively.

3.7.6 Concentration of Constituents in Treated Wood Drippage, Wash-off Residuals, and Associated Residuals

The constituents of concern in wood preserving wastes, including treated wood drippage, wash-off residuals, and associated residuals, can be divided into five groups: pentachlorophenol (PCP) constituents, chlorinated dioxin and furan (PCDD and PCDF) constituents, polynuclear aromatic hydrocarbon (PAH) constituents, phenolic constituents, and metal constituents (specifically arsenic and chromium). No analysis of preservative formulation was available as it drips from treated wood. However, in-use pentachlorophenol wood preserving formulations, believed to be similar in composition to drippage, were sampled and analyzed. Table 3-11 presents minimum, maximum, and average concentrations for the listing constituents and other significant compounds detected in the samples of in-use formulations. Initial drippage and unused preservative formulations from creosote-treated wood were assumed to have the same compositions as raw creosote. (See Table 3-12.) Initial drippage and unused preservative formulations from wood treated with inorganic preservatives were assumed to have the same compositions as unused preservative solutions, as specified by the AWPA (Table 3-13).

Pentachlorophenol. Concentrations of pentachlorophenol in treated wood drippage were assumed to be the same as pentachlorophenol concentrations in used (usable) treating solutions. The concentrations of pentachlorophenol in treated wood drippage ranged from 10,000 ppm to EPA's 50,000 ppm, and averaged 30,000 ppm.

Data were available from sampling performed by OSW and from RCRA site inspections (Appendix D of the Background Listing Document). Preservative solutions from both pressure and nonpressure processes were sampled.

Polychlorinated Dioxins and Furans (PCDDs and PCDFs). Concentrations of PCDDs and PCDFs in pentachlorophenol-treated wood drippage were assumed to be the same as concentrations in used (but usable) pentachlorophenol treating solution and surface residue (bloom) on wood treated by the Cellon® process. Data were available from sampling performed by OSW, from RCRA site inspections, and from a study performed by the State of California. Ranges and average concentrations for specific PCDD and PCDF homologs are given in Table 3-11.

Polynuclear Aromatic Hydrocarbons and Phenolics. Concentrations of PAHs and phenolics in pentachlorophenol-treated wood drippage were assumed to be the same as concentrations in used (usable) pentachlorophenol treating solutions. Data were available from sampling performed by EPA/OSW.

Initial free drippage from creosote-treated wood was assumed to have the same composition as unused creosote (Table 3-12) because analytical data describing drippage from creosote-treated wood or in-use creosote solutions were limited. Literature sources provided concentrations for 11 of the 15 PAH constituents of concern. Concentrations for the remaining four compounds were estimated based on their proportions in creosote process residuals. (See Table 3-9.)

Data quantifying the concentrations of PAH constituents for drippage from creosote-treated wood were available from one plant and are presented in Table 3-14. However, these data are not considered to be characteristic of drippage as it is released to the environment. The data were obtained from samples of "kickback" deposits located in collection pipes and on the ground adjacent to the plant's treatment cylinder. For most constituents, the measured PAH concentrations were lower in these samples than the PAH concentrations in unused creosote (Table 3-12). Because these samples were not collected when drippage occurred, the more volatile constituents may have vaporized during the residence time on the ground and in the collection pipes. Vaporization is enhanced at elevated temperatures, under the sun, and with high wind. In addition, treatment area runoff at the plant is routed to the treatment ponds via the same piping system that is used to collect the kickback; therefore, some constituents might have been carried away in the runoff stream.

Metals. Concentrations of metals in initial free drippage were assumed to be the same as unused preservative solution, as specified in AWPA standards and specifications (Table 3-13), because analytical data describing drippage from arsenical-treated wood or in-use organic solution were not available. The specifications for the weight percent of metal oxides in CCA-C, ACA, and ACC were used to estimate arsenic, chromium, and copper concentrations. Further, it was assumed that CCA and ACC were used as 2.5 percent solutions, and that ACA was used as a 3 percent solution. The concentrations of arsenic, chromium, and copper were weighted according to the productions using each salt-type reported in the RCRA 3007 questionnaires.

3.8 Amenability of Wastes to Chemical Analysis

This section presents the recommended analytical methods for monitoring the regulated constituents in these hazardous wastes. Several commenters expressed concerns that the concentrations of PCDD and PCDF in F032 wood preserving wastes may not be amenable to chemical analysis recommended in the Agency's Test Methods for Evaluating Solid Waste (SW-846) (6). The commenters felt, therefore, that EPA should withdraw the proposal for regulating specific PCDD and PCDF constituents in F032. EPA has addressed specific comments raised by these commenters in the document titled Phase 4 Response to Comments for Wood Preserving Wastes. Given the limited information submitted by the Penta Task Force (Comment PH4P-00032), EPA has concluded that the PCDD and PCDF constituents that EPA is promulgating as regulated constituents in F032 can be routinely analyzed by the recommended analytical test methods in SW-846. Also, EPA has revised Section 3.8 in today's background document to enhance the discussion regarding the applicability of SW-846 test methods and preparation and clean up procedures for the analysis of PCDD and PCDF in F032 wastes and, thus, how potential analytical difficulties can be overcome.

3.8.1 Applicability of SW-846 Methods

EPA methods for the analysis of BDAT List constituents in nonwastewater and wastewater forms of wastes are presented in the Agency's *Test Methods for Evaluating Solid Waste (SW-846)* (6). Each BDAT List constituent to be regulated in wood preserving wastes is listed as a target analyte in at least one SW-846 method. Table 3-15 contains a list of the SW-846 methods applicable to each BDAT List constituent in wood preserving wastes. Table 3-16 contains a brief description of the instrumentation used in the determinative method.

The SW-846 manual is provided as a guidance document. With the exception of specific applications where the use of SW-846 methods is mandated by federal regulations, the Office of Solid Waste provides SW-846 as guidance in performing analyses under RCRA regulations, but will accept *"any appropriate method"* that can provide data for *"the analytes of concern, in the* *matrix of concern, and the regulatory levels of concern"* (17). Except for the *preparation* of TCLP leachates, the analysis of BDAT List constituents in wood preserving wastes is *not* one of the applications where the use of SW-846 methods has been mandated by EPA. In order to comply with the treatment standards for leachates, facilities *must use* the TCLP procedure in SW-846 Method 1311 to prepare the leachate [see 40 CFR §268.7(a)]. Once the leachate has been prepared, any appropriate determinative method may be used to analyze the leachate that results from the application of Method 1311.

It should be noted that EPA may choose to enforce the treatment standards based on those test methods recommended in the BDAT Background Document. If needed, EPA may issue subsequent policy memoranda to authorized States, EPA Regions, and/or members of the regulated community that describe equivalent test methods and may choose to use such equivalent methods in enforcing these treatment standards.

Because SW-846 serves primarily as a guidance document and because the wastes regulated under RCRA vary so widely, the Agency has provided a discussion in Chapter Two of SW-846 entitled "Choosing the Correct Procedure." Among other topics, Chapter Two discusses adjustments that may be made to the SW-846 methods to address the problems of "trace analyses" versus "minor" and "major" analyses of different wastes and matrices. Chapter Two also provides guidance on sample preparation and extraction techniques and describes several approaches to the preparation and analysis of multiphase samples. For wastes such as F032, this guidance may be critical to the successful application of the methods. The following sections of this document provide additional information on the analyses of wood preserving wastes.

The Agency is regulating benzo(k)fluoranthene in F032, F034, and F035 wastes as the sum of both benzo(k)fluoranthene and benzo(b)fluoranthene, as these two stereoisomers cannot be chromatographically separated using methods such as Method 8100 or Method 8270 or other gas chromatographic procedures. The regulation of these two constituents as a sum is being finalized for both nonwastewater and wastewater forms of these wood preserving wastes.

3.8.2 Sample Preparation Issues

Samples of wood preserving wastes will require various preparation, extraction or digestion, clean-up, and determinative procedures. The sample preparation procedures are described in the SW-846 extraction methods for organic constituents and the SW-846 digestion methods for inorganic constituents. The SW-846 3500 Series methods (3510, 3520, 3535, 3540, 3541, 3542, 3545, 3550, 3551, 3560, 3561, and 3580) describe solvents that may be employed for extraction of organic constituents. The choice of solvent will depend on the constituent, the sample matrix, and the extraction technique to be employed. Common solvents described in these methods include methylene chloride, hexane, acetone, acetonitrile, and 2-propanol.

Method 3500 and the individual 3500 Series extraction methods describe common interferences that may arise from solvents, reagents, glassware, and other sample processing hardware. Method 3500 provides guidance on appropriate steps to eliminate or minimize interferences from such sources. Additional interferences may be extracted from the sample matrix itself.

An additional potential problem relevant to the analysis of wood preserving wastes is that of cross-contamination among samples. Because some constituents may be found in these wastes at relatively high levels, there is an increased risk that the sample processing glassware and equipment and even the analytical instrumentation may provide a means of transferring constituents from one sample to another during the analysis. Such cross-contamination may be minimized by a variety of laboratory housekeeping techniques designed to segregate samples known or suspected to be highly contaminated from those that are less contaminated. None of the techniques is extraordinary, but most require reasonable diligence and awareness of the potential problems. Method 8280A provides guidance on laboratory glassware cleaning procedures that are designed to minimize cross-contamination, solvent rinsing or pre-extraction procedures for glassware, and segregation of glassware used for extraction of different matrices.

The standardized EPA quality control procedures described in SW-846 include the preparation and analysis of method blanks. The results of such blank analyses should be used as an indication of the potential for cross-contamination and the presence of interferences derived from the sample processing steps. Analysts should consult Chapter Two, Method 3500, the specific extraction method to be employed, Method 8000, and the specific determinative method for additional information. The corresponding sample preparation, digestion, and determinative procedures for the inorganic BDAT List constituents also contain information relevant to interferences with these analyses.

3.8.3 Addressing Potential Analytical Difficulties Determining PCDDs and PCDFs in F032 Wood Preserving Wastes

The analysis of PCDDs and PCDFs is inherently more complicated than the analyses for most other compounds and more complicated than the analysis of any of the other BDAT List constituents for wood preserving wastes. In many instances, the complications arise from the very low levels at which these constituents may be regulated. However, for the F032 wood preserving wastes, the proposed regulatory limit of 1 µg/kg (ppb) of total PCDDs and PCDFs does not pose a challenge on the basis of sensitivity. Rather, the analysis of these constituents is more complicated than that for other organics because of the number of preparation and clean-up procedures that are routinely applied during the sample processing. As a result, many of the laboratories that perform PCDD/PCDF analyses tend to specialize in this area.

Although the treatment standards for wood preserving wastes are based on analyses that employed SW-846 Method 8280 (September 1986), EPA is recommending that either Method 8280A or Method 8290 be used to comply with the treatment limits promulgated today. These two analytical methods for PCDDs and PCDFs are provided in *Test Methods for Evaluating Solid Waste* (SW-846). Method 8280A is a low resolution mass spectrometric procedure designed to achieve quantitative results for the PCDDs and PCDFs at levels of 1 ppb (µg/kg) in solid samples. Method 8290 is a high resolution mass spectrometric procedure designed to achieve quantitative results at levels of 10 ppt (parts per trillion, or ng/kg) in solid samples. Method 8290 was promulgated in Update II to the Third Edition of SW-846 in December 1994. Method 8280A was proposed as part of Update III in July 1995, and will supersede Method 8280 upon promulgation. Both methods can produce data that meet the data quality objectives for compliance monitoring, however, the working ranges of the two methods do not overlap.

Method 8280A differs greatly from its predecessor, Method 8280, and many of the differences are specifically designed to address the difficulties posed by matrices such as those associated with wood preserving wastes. Thus, analyses comparable to those that were performed using Method 8280 will be able to be performed using Method 8280A, and many of the analytical difficulties may be eliminated through the use of the more recent version. While Method 8280A is presently a proposed, not promulgated, method, it is closely based on an existing Superfund CLP method for these analytes and has been in wide use in commercial laboratories since 1989. Therefore, it represents a well-established approach to these analyses. EPA expects final promulgation of Method 8280A by early 1997.

Methods 8280A and 8290 differ from the SW-846 methods for other organic constituents in that these two methods are stand-alone procedures that address all the sample processing, extraction, clean-up, and determinative steps in a single procedure. Thus, Methods 8280A and 8290 contain extraction procedures that address a wide variety of matrices, from aqueous samples to waste oils. Both methods contain a series of clean-up procedures, including acid-base washing, silica gel, alumina, and carbon column chromatographic procedures, that are designed to remove interferences that may also be extracted from the sample. Both methods employ high resolution gas chromatography to separate the PCDDs and PCDFs from one another and both methods employ mass spectrometers in the selected ion monitoring (SIM) mode to increase the ability of the detector to differentiate the target analytes from possible interferences. Method 8280A employs a quadrapole mass spectrometer to achieve unit mass (1 atomic mass unit [amu]) resolution. Method 8290 requires the use of a magnetic sector mass spectrometer to achieve resolution of 1/10,000th of an amu, and exploits the fact that the masses of different atoms are not whole numbers, but differ in the third or fourth decimal place. For example, although the mass of hydrogen (H) is generally considered to be 1 amu, it is more precisely defined as 1.007825 amu.

While a low resolution mass spectrometer can distinguish between two compounds that differ in mass by 1 amu, it would require a high resolution instrument to determine if the difference was due to the loss of a hydrogen atom from one ion or if the difference was due to the presence of one atom of ^{13}C instead of an atom of ^{12}C. With regard to the analysis of PCDDs/PCDFs in wood preserving wastes, the use of a high resolution mass spectrometer allows the analyst to better distinguish the target analytes from possible interferences, which may differ in mass from the PCDDs/PCDFs by 1/1,000th of an amu or less.

As with the remainder of the SW-846 methods, Methods 8280A and 8290 are not prescriptive procedures, but are provided as guidance. Thus, for some samples and matrices, it may not be necessary to employ all the clean-up procedures described in the method in order to achieve acceptable results. However, in the case of F032 wastes, it is highly likely that all the clean-up procedures will need to be employed. In addition, the analyst must employ professional judgement and knowledge of the objectives of the analysis in choosing a specific course of action for each sample. The analyst may need to consider the following aspects of the overall analytical process.

- Collecting a representative sample
- Low resolution mass spectrometry vs. high resolution mass spectrometry
- Sample size vs. method sensitivity

EPA believes that thoughtful consideration of these aspects of the analytical process, combined with careful application of the procedures described in the methods, will permit the analysis of F032 wastes subject to regulation.

Collecting a Representative Sample

As with any environmental analysis, the sample results are only as good as the sample that was collected. Sample collection procedures for F032 wastes should focus on the collection of a representative sample. Chapter Nine of the SW-846 manual describes various approaches to designing and conducting sampling. In addition, EPA has issued guidance on sample collection procedures in documents such as "Guidance for the Sampling and Analysis of Municipal Waste Combustion Ash for the Toxicity Characteristic" (EPA530-R-95-036, June 1995) that have relevance to the sampling of incinerator ash. As noted in Chapter Two of SW-846, multiphase samples may require additional efforts. If samples of all phases can be collected, it may be advisable to analyze each phase separately.

Mass Spectrometer Resolution

As noted above, the principal difference between Methods 8280A and 8290 is the mass resolving power of the mass spectrometer. The use of the high resolution instrument in Method 8290 allows the analyst to better distinguish between the target PCDDs/PCDFs and potential interferences that are also extracted from the sample matrix. Therefore, Method 8290 would appear at first to be the preferred approach to the analysis of F032 wastes. However, as written, Method 8290 is designed to achieve much lower quantitation limits than Method 8280A, on the order of 10 ppt in solids versus 1 ppb for Method 8280A. In addition, analyses for PCDDs/PCDFs at sub-ppb levels require that the laboratory carefully control sources of background contamination. A sample of F032 waste containing PCDDs/PCDFs near the proposed 1 ppb limit could be viewed by some laboratories employing Method 8290 as unacceptably "dirty" for a facility attempting to perform analyses in the ppt range.

In addition, samples near the 1 ppb regulatory limit would be well above the calibration range of Method 8290. Since Methods 8280A and 8290 employ forms of isotope dilution quantitation, where the standards used for quantitation are added to the samples at the time of extraction, extracts of samples above the calibration range *cannot* simply be diluted and reanalyzed. A new sample aliquot must be extracted and analyzed in these instances.

The use of Method 8280A lessens the potential problems of highly contaminated samples for the laboratory, however, it may not be capable of separating the target PCDDs/PCDFs from all interferences. One approach to the analysis of F032 wastes would be to employ Method

8280A at first, and determine the approximate range of concentrations of the target PCDDs/PCDFs in the specific waste samples. If the target PCDDs/PCDFs cannot be detected by Method 8280A, then the more sensitive method, 8290, would be employed to analyze the samples and ensure that the waste does not contain PCDDs/PCDFs above the regulatory limit of 1 ppb.

Sample Size versus Method Sensitivity

Another alternative would be to employ Method 8290, but adjust the size of the sample that is extracted such that the method is *less* sensitive, so that samples near the regulatory limit will fall within the calibration range of the method. Such adjustments to sample sizes are allowed within the flexibility inherent in SW-846 methods.

If the use of a smaller size sample is likely to raise issues of the representativeness of the sample, a third alternative would be to extract a larger sample, but spike it with a larger aliquot of the "internal standard solution" used for quantitation and increase the volume of the final extract by the same proportion. In other words, if 10 times as much internal standard solution is added to the sample prior to extraction, the final extract is concentrated to a 10 times larger volume, e.g., 200 µL versus the 20 µL volume specified in the method.

Extraction and Clean-up Procedures

Both Methods 8280A and 8290 contain a wide range of possible extraction and extract clean-up procedures. Of particular relevance to the analysis of F032 waste are the procedures described in these methods for the extraction of:

- chemical waste samples, including:
    - chemical sludges,
    - wet fuel oil,
    - still bottoms, and
    - oils
- fly ash

These methods contain clean-up procedures that are applied to sample extracts to remove potential interferences that may be extracted from the sample matrix. These clean-ups include:

- Acid/base washing, using concentrated sulfuric acid and potassium hydroxide solutions
- Silica gel column chromatography combined with alumina column chromatography
- Carbon column chromatography

These clean-up procedures are well-established aspects of PCDD/PCDF analysis, and all three should be applied to samples such as those from F032 wastes.

Summary Recommendations Regarding Analytical Difficulties

The choice of an analytical method will depend on generator knowledge of the waste itself. This information should be conveyed to the laboratory prior to shipment of samples, so that the laboratory can take appropriate steps to segregate more highly contaminated samples and choose the analytical technique that provides the appropriate data. Given this information and the understanding that the goal of the analysis is to establish compliance with a regulatory limit of 1 ppb of PCDDs/PCDFs, EPA believes that either Method 8280A or Method 8290, with modifications similar to those described above, should be adequate to monitor the analytes of interest in F032 wastes subject to regulation.

3.9 Current Wood Preserving Waste Management Practices

This section presents currently reported waste management practices in use in the United States for wood preservation wastes (1).

3.9.1 Reported Wastewater Management Practices

Thirty-three percent of the plants that responded to a 1985 RCRA 3007 Survey reported the generation and management of some process wastewater. Many plants did not describe the process that generated the wastewater, but instead labeled it with the name of the treatment process from which it was discharged (oil/water separator wastewater, filtration wastewater, cooling tower blowdown, spray field wastewater, and the general "treated wastewater discharge").

The most frequently named process wastewater source was treating cylinder condensate. Drip pad and process area wastewater, sludge/work tank water, drum washings, scrubber liquor from wet air pollution control devices, and pole wash waster were also named as sources of wastewater.

Wastewater management practices in use in 1984 at the surveyed plants are summarized in Table 3-17. Sixty-three percent of the surveyed plants that reported managing wastewater discharged their process wastewater to POTWs. Usually, this wastewater was pretreated by oil/water separation in tanks. Ten percent of the plants also used some type of aeration process, and 3 percent used activated carbon filtration as well. Thirteen percent of the plants reported storage or disposal of process wastewater in land-based units (e.g., land application, evaporation ponds, and surface impoundments).

Few inorganic-process wood preserving plants discharge wastewater. At these plants zero discharge is achieved by reusing process wastewater and some contaminated precipitation. Contaminated precipitation is also managed at these plants through soil percolation and evaporation.

Additional information on wastewater management practices is contained in the Preliminary Data Summary for the Wood Preserving Segment on the Timber Products Point Source Category (14).

3.9.2 Reported Process Residuals Management Practices

Ninety percent of the plants that returned their RCRA 3007 questionnaires reported managing process residuals. Many plants use more than one preservative. Fifty-one percent of the plants generated residuals from processes using inorganic arsenical and/or chromate salts, 35 percent from processes using pentachlorophenol, and 35 percent from processing using creosote. The types of residuals managed at these plants, by preservative, are listed in Table 3-18. Plants using inorganic preservatives reported generating more of their process residuals as door sump sediments and preservative recycling residues than did plants treating with pentachlorophenol or creosote. In contrast, plants treated with the organic preservatives reported generating more of their process residuals as treating cylinder sediments.

The number of plants generating process drips and spills is probably underestimated. The exact source or quantity of drips and spills are rarely determined because they are potentially land-disposed at the point at which they are released. In the 3007 Survey responses, reporting plants probably included drips and spills generated from maintenance operations with reports of other types of wastes.

Reported process residual management practices are for the surveyed plants summarized in Table 3-19. Most of the plants contract with waste removal services to transport and dispose of their process residuals. Many plants reported that their wastes were treated as hazardous and were disposed in secure landfills. Six plants that are licensees of a supplier of inorganic preservatives reported that their wastes were removed and disposed of by the chemical supplier.

3.9.3 Reported Treated Wood Drippage Management Practices

In 1987, AWPI surveyed the wood preserving industry. An extensive questionnaire was sent to 570 wood preserving plants, and approximately 160 usable responses were returned to AWPI. Selected results from this survey were provided to EPA in December 1987. In this survey, AWPI collected information on the percentage of plants with surfaced or covered drip pads and storage pads. The survey results provided by AWPI that pertain to the management of treated wood drippage at wood preserving plants are summarized in Table 3-20.

Drip pads are used to collect excess preservative that drips from the treated wood when it is first removed from the treating cylinder. Plants that do not have surfaced drips pads generally allow excess preservatives to drip directly onto the ground. Most plants with surfaced drip pads report reusing the collected drippage. AWPI did not report the management practices used by plants that do not reuse collected drippage. Forty to 50 percent of the plants that use pentachlorophenol and/or creosote have a surfaced drip pad, while 91 percent of the plants that use inorganic preservatives have a surfaced drip pad. A larger percentage of the inorganic plants have surfaced drip pads because they are generally newer than other wood preserving plants and are specifically designed for the recovery and reuse of preservative drippage.

Only 12 to 13 percent of the plants treated with pentachlorophenol and/or creosote have surfaced storage pads (i.e., long-term storage yards). Thirty-eight percent of plants treated with inorganic preservatives have some surfaced storage area. The Agency concluded that approximately 88 percent of pentachlorophenol and creosote plants, and approximately 62 percent of inorganic plants, treated wood preservative drippings, and treated wood preservative drippage, and treated wood precipitation wash-off.

A few plants currently store surface-protected wood on concrete or asphalt pads with a system to collect excess surface preservative, which either drips from the wood or is washed from the surface by rain. The collected runoff may be used as makeup water (after filtration) for the preservative formulations or may be discharged to surface waters with other plant washwater.

TABLE 3-1
REGIONAL DISTRIBUTION OF WOOD PRESERVATION FACILITIES

Region	1993 Number of Plants
Northeast	54
North Central	87
Southeast	143
South Central	125
Rocky Mountain	22
Pacific Coast	40
All Regions	471

Source: Draft Capacity Background Document, March 8, 1995.

TABLE 3-2
HISTORICAL CONSTITUENTS OF CHLORINATED PHENOLS

Constituent	Technical Grade Pentachlorophenol	Tetrachlorophenol
Pentachlorophenol (%)	85-93	3.1-17
Tetrachlorophenol (%)	1.5-10.1	7.7-14
2,3,7,8-TCDD (ppb)	<0.03-<0.1	0.21-0.56
TCDDs (ppm)	<0.03-18	<0.005-0.25
PeCDDs (ppm)	<0.03-100	<0.03-1.4
HxCDDs (ppm)	<0.03-1,000	<0.03-20
HpCDDs (ppm)	<0.03-1,000	0.3-88
OCDD (ppm)	0.6-3,600	0.7-216
TCDFs (ppm)	<0.01-10	<0.02-11.1
PeCDFs (ppm)	<0.03-40	<0.03-22.1
HxCDF (ppm)	<0.03-90	0.1-60
HpCDFs (ppm)	<0.1-400	1-50
OCDF (ppm)	<0.1-300	0.062-2.9

Source: (1)

TABLE 3-3
TYPICAL COMPOSITIONS OF CREOSOTE, COAL TAR, AND PETROLEUM OIL

	Raw Creosote			
Major Components	Range (Percent)	Average (Percent)	High Temperature Coal Tars	Petroleum Oil (#2 Fuel Oil)
Acenaphthene	9-14.7	10.9	NDA	0.002-0.005
Anthracene	2-7	4.5	1.5	0.006
Benz(a)anthracene	0.16-0.26	0.26	0.65	NDA
Benzo(a)pyrene	0.04-0.06	0.06	0.55	NDA
Benzofluorenes	1.0-2.0	1.5	NDA	NDA
Biphenyl	0.8-1.6	1.1	NDA	NDA
Carbazole	1.2-2.0	1.6	0.6	NDA
Chrysene	2.6-3.0	2.8	1.1	0.0004
Dibenz(a,h)anthracene	0.01-0.04	0.04	0.10	NDA
Dibenzofuran	4.0-7.5	5.5	NDA	0.008
Dimethylnaphthalenes	2.0-2.3	2.15	NDA	NDA
Fluoranthene	0.5-10	6.9	3.3	0.0003-0.0007
Fluorene	7.3-10	8.8	NDA	0.004-0.02
Methylanthracenes	3.9-4.0	3.9	NDA	0.009-0.028
Methylfluorenes	2.3-3.0	2.7	NDA	0.006-0.035
1-Methylnaphthalene	0.9-12	4.9	NDA	0.082
2-Methylnaphthalene	1.2-12	5.3	NDA	0.12
Methylphenanthrenes	3.0	3.0	NDA	NDA
Naphthalene	1.3-18	7.4	10	0.01-0.03
Phenanthrene	16-21	18.1	5	0.03
Pyrene	1.0-8.5	5.5	2.1	0.0005-0.002

Source: (1)

TABLE 3-4
COMPOSITIONS OF THE MOST COMMONLY USED ARSENATE AND CHROMATE PRESERVATIVES

		Dry-Weight Formulation Basis				Concentration in Typical Treating Solution			
Preservative	pH Limit	Arsenic (AS_2O_5) (%)	Copper (CuO) (%)	Chromium (CrO_3) (%)	Zinc (ZnO) (%)	Arsenic (%)	Copper (%)	Chromium (%)	Zinc (%)
Chromated Copper-Arsenate Type C (CCA-C)	1.6-3.0	3.40	18.5	47.5	NDA	0.55	0.37	0.62	NDA
Ammoniacal Copper Arsenate (ACA)	NDA	50.2	49.8	NDA	NDA	1.14	1.19	NDA	NDA
Acid Copper Chromate (AZC)	2.0-3.9	NDA	31.8	68.2	NDA	NDA	0.63	0.89	NDA
Chromated Zinc Chloride (CZC)	2.8-4.0	NDA	NDA	20	80	NDA	NDA	0.21	1.29
Fluoro-Chrome-Arsenate-Phenol (FCAP)	5.5-7.8	25	NDA	37	NDA	0.33	NDA	0.38	NDA

Source: (1)

TABLE 3-5
BREAKDOWN OF CONDITIONING METHODS BY PRESERVATIVE TYPE
(RCRA 3007 SURVEY DATA, 1984)

	Percent of Plants With		
Conditioning Method	Creosote	PCP	Inorganics
Air Drying (Seasoning)	36	39	47
Kiln Drying	20	29	52
Steam Conditioning	26	20	1
Boulton Conditioning	16	12	0
Vapor Drying	2	0	0
TOTAL	100	100	100

Source: (1)

TABLE 3-6
GENERATION OF WOOD PRESERVING WASTES

Waste Type	Quantity Generated (Tons)
F032	
Organic Nonwastewater	10,400
Inorganic Nonwastewater	2,200
Organic Wastewater	26,800
Inorganic Wastewater	140,800
Soil	10,500
Debris	20
F034	
Organic Nonwastewater	28,800
Inorganic Nonwastewater	1,600
Organic Wastewater	35,400
Inorganic Wastewater	2,579,900
Soil	9,400
Debris	3
F035	
Organic Nonwastewater	600
Inorganic Nonwastewater	1,900
Organic Wastewater	3,400
Inorganic Wastewater	9,800
Soil	2,700
Debris	0
Total	
Organic Nonwastewater	39,800
Inorganic Nonwastewater	5,700
Organic Wastewater	65,600
Inorganic Wastewater	2,730,500
Soil	22,600
Debris	23

Source: Draft Capacity Background Document, July 18, 1995 (16).

TABLE 3-7
CONCENTRATIONS OF LISTING CONSTITUENTS AND OTHER SIGNIFICANT COMPOUNDS IN WOOD PRESERVING WASTEWATERS FROM PENTACHLOROPHENOL AND/OR CREOSOTE PROCESSES

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
Pentachlorophenol (1)	0.01	300	10	25
Benz(a)anthracene (1,2)	0.03	10	3	12
Benzo(a)pyrene (1,2)	0.007	10	3	8
Benzo(k)fluoranthene (2)	0.02	4	1	6
Dibenz(a,h)anthracene (1,2)	0.1	1	0.5	4
Indeno(1,2,3-c,d)pyrene (1,2)	0.006	10	5	6
Naphthalene (2)	0.1	400	50	18
Arsenic (1,2)	0.003	30	5	11
Chromium (1,2)	0.004	10	2	10
	(ppb)	(ppb)	(ppb)	
TCDDs (1)	0.001	8	4	5
PeCDFs (1)	0.008	20	9	5
HxCDDs (1)	0.03	200	30	8
HpCDDs (1)	0.009	80	20	9
TCDFs (1)	0.0006	2	0.9	5
PeCDFs (1)	0.001	300	60	5
HxCDFs (1)	0.001	10	3	8
HpCDFs (1)	0.002	50	10	8

Source: (1)
NA - Not analyzed
(1) - Listing Constituent for F032
(2) - Listing Constituent for F034

Note: All concentrations have been rounded to one significant figure.

TABLE 3-7 (continued)

Other Compounds	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	
Acenaphthene	1	300	30	10
Acenapthylene	0.006	7	1	11
Anthracene (1,2)	20	400	200	2
Benzo(b)fluoranthene	0.03	2	0.7	6
Benzo(g,h,i)perylene	0.006	0.3	0.1	4
Biphenyl	50	50	50	1
Chrysene	0.02	6	0.9	12
Fluoranthene	0.3	400	30	14
Fluorene	0.3	200	20	11
Lead	0.001	0.3	0.1	6
Phenanthrene + Anthracene	0.9	600	50	14
Phenol (2)	0.2	300	50	6
Pyrene (2)	0.2	300	30	12
	(ppb)	(ppb)	(ppb)	
2,3,7,8-TCDD	NA	NA	--	0
OCDD	0.02	300	50	11
OCDF	0.03	40	10	6

Source: (1)
NA - Not analyzed.
(1) - Listing Constituent for F032.
(2) - Listing Constituent for F034.

Note: All concentrations have been rounded to one significant figure.

TABLE 3-8
CONCENTRATIONS OF LISTING CONSTITUENTS AND OTHER SIGNIFICANT COMPOUNDS IN WOOD PRESERVING PROCESS SLUDGES OR RESIDUALS FROM PENTACHLOROPHENOL PROCESSES

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
Pentachlorophenol	40	30,000	20,000	8
Benz(a)anthracene	5	3,000	900	4
Benzo(a)pyrene	50	1,000	500	3
Dibenz(a,h)anthracene	50	300	200	2
Indeno(1,2,3-c,d)pyrene	20	100	70	2
Arsenic (1)	NA	NA	--	0
Chromium (1)	NA	NA	--	0
	(ppb)	(ppb)	(ppb)	
TCDDs	0.001	5	3	2
PeCDDs	0.2	2	1	2
HxCDDs	0.06	5,000	2,000	9
HpCDDs	0.5	100,000	30,000	10
TCDFs	0.01	30	20	4
PeCDFs	0.08	1,000	500	5
HxCDFs	0.01	10,000	3,000	7
HpCDFs	0.3	20,000	4,000	7

Source: (1)

NA - Not analyzed.

U - Compound was analyzed for but not detected; value listed is the lowest detection limit reported.

(1) - This compound was not analyzed for but is included as a listing constituent because of the potential for cross-contamination.

(2) - GC peak resolution was not sufficient to provide individual quantitation of benzo(b)fluoranthene and benzo(k)fluoranthene.

(3) - 2,3,7,8-TCDD was not detected in any of the three samples analyzed. The value listed is the lowest detection limit value reported.

Note: All concentrations have been rounded to one significant figure.

TABLE 3-8 (cont.)

Other Compounds	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
2,4-Dimethylphenol	10	200	80	3
2,4,6-Trichlorophenol	30	30	30	1
Acenaphthene	40	8,000	2,000	6
Acenapthylene	30	400	200	3
Benzo(b)fluoranthene (2)	100	2,000	800	3
Benzo(g,h,i)perylene	40	300	100	2
Chrysene	10	3,000	700	5
Fluoranthene	20	10,000	3,000	6
Fluorene	60	8,000	2,000	6
Phenanthrene	300	30,000	9,000	5
Phenol	70	500	300	2
Anthracene	30	7,000	2,000	5
Anthracene/Phenanthrene	100	100	100	1
Benzene	0.03	0.03	0.03	1
Toluene	0.8	0.8	0.8	1
Naphthalene	50	20,000	5,000	6
Pyrene	30	10,000	2,000	6
	(ppb)	(ppb)	(ppb)	
2,3,7,8-TCDD	< 5 (3)	--	--	3
OCDD	1	90,000	30,000	10
OCDF	0.2	20,000	4,000	7

Source: (1)

NA - Not analyzed.

U - Compound was analyzed for but not detected; value listed is the lowest detection limit reported.

(1) - This compound was not analyzed for but is included as a listing constituent because of the potential for cross-contamination.

(2) - GC peak resolution was not sufficient to provide individual quantitation of benzo(b)fluoranthene and benzo(k)fluoranthene.

(3) - 2,3,7,8-TCDD was not detected in any of the three samples analyzed. The value listed is the lowest detection limit value reported.

Note: All concentrations have been rounded to one significant figure.

TABLE 3-9
CONCENTRATION OF LISTING CONSTITUENTS AND OTHER SIGNIFICANT COMPOUNDS IN WOOD PRESERVING PROCESS RESIDUALS FROM CREOSOTE WOOD PRESERVING PROCESSES

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
Benz(a)anthracene	300	8,000	4,000	4
Benzo(a)pyrene	2,000	3,000	2,000	3
Benzo(k)fluoranthene (1)	2,000	2,000	2,000	1
Dibenz(a,h)anthracene	100	700	400	3
Indeno(1,2,3-c,d)pyrene	100	300	200	3
Naphthalene	700	60,000	40,000	4
Arsenic (2)	NA	NA	--	0
Chromium (2)	NA	NA	--	0
Other Compounds	(ppm)	(ppm)	(ppm)	
2,4-Dimethylphenol	300	1,000	600	2
2,4,6-Trichlorophenol	50	50	50	1
Acenapthene	500	30,000	20,000	5
Acenapthylene	800	2,000	1,000	2
Benzo(b)fluoranthene	2,000	3,000	2,000	3
Benzo(g,h,i)perylene	200	500	300	3
Chrysene	3,000	7,000	5,000	3
Fluoranthene	4,000	40,000	20,000	5
Fluorene	800	30,000	10,000	4
Phenanthrene	40,000	70,000	50,000	3
Phenol	800	3,000	2,000	2
Anthracene	20,000	20,000	20,000	3
Anthracene/Phenanthrene	5,000	6,000	5,000	2

TABLE 3-9 (continued)

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
Benzene	0.007	0.007	0.007	1
Pyrene	2,000	30,000	10,000	5

Source: (1)
NA - Not analyzed.
U - Compound was analyzed for but not detected; value listed is the lowest detection limit reported.
(1) - GC peak resolution was not sufficient to provide individual quantitation of benzo(b)fluoranthene and benzo(k)fluoranthene.
(2) - This compound was not analyzed for but is included as a listing constituent because of the potential for cross-contamination.
All concentrations have been rounded to one significant figure.

TABLE 3-10
CONCENTRATIONS OF LISTING CONSTITUENTS IN WOOD PRESERVING PROCESS RESIDUALS FROM INORGANIC WOOD PRESERVING PROCESSES

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
Arsenic	5,000	800,000	100,000	7
Chromium	70	30,000	10,000	7
Lead	5	300	80	6

Source: (1)
All concentrations have been founded to one significant figure.

TABLE 3-11
CONCENTRATIONS OF LISTING CONSTITUENTS AND OTHER SIGNIFICANT COMPOUNDS IN PENTACHLOROPHENOL PRESERVATIVE SOLUTIONS (DRIPPAGE)

Compounds Selected As The Basis For Listing	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
Pentachlorophenol	10,000	50,000	30,000	5
Benz(a)anthracene	80	80	80	1
Benzo(a)pyrene	50	50	50	1
Dibenz(a,h)anthracene	7	7	7	1
Indeno(1,2,3-c,d)pyrene	50 U	50 U	--	2
Arsenic (1)	NA	NA	--	0
Chromium (1)	NA	NA	--	0
	(ppb)	(ppb)	(ppb)	
TCDDs	1	1	1	1
PeCDDs	30	70	50	2
HxCDDs	100	5,000	2,000	8
HpCDDs	9,000	100,000	4,000	8
TCDFs	1	30	20	3
PeCDFs	100	1,000	400	5
HxCDFs	200	10,000	3,000	8
HpCDFs	100	10,000	5,000	8

Source: (1)
NA - Not analyzed.
U - Compound was analyzed for but not detected; value listed is the lowest detection limit reported.
(1) - This compound was not analyzed for but is included as a listing constituent because of the potential for cross-contamination.
All concentrations have been rounded to one significant figure.

TABLE 3-11 (continued)

Other Compounds	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Number of Data Points
	(ppm)	(ppm)	(ppm)	
2,4-Dimethylphenol	40	40	40	1
Acenaphthene	300	500	400	3
Acenapthylene	10	10	10	1
Benzo(b)fluoranthene	90	90	90	1
Benzo(g,h,i)perylene	4	4	4	1
Chrysene	70	70	70	1
Fluoranthene	40	400	200	3
Fluorene	300	1,000	700	3
Naphthalene	1,000	7,000	4,000	3
Pyrene	70	300	200	3
Phenanthrene	1,000	4,000	2,000	3
Anthracene	300	300	300	1
	(ppb)	(ppb)	(ppb)	
2,3,7,8-TCDD	2 U	--	--	5
OCDD	5,000	200,000	90,000	10
OCDF	400	100,000	3,000	8

Source: (1)

NA - Not analyzed.

U - Compound was analyzed for but not detected; value listed is the lowest detection limit reported.

(1) - This compound was not analyzed for but is included as a listing constituent because of the potential for cross-contamination.

Note: All concentrations have been rounded to one significant figure.

TABLE 3-12
CREOSOTE COMPOSITION, PERCENT

	Raw Creosote				
Constituent	A	B	C	D	Overall Average A-D[a] (Percent)
Acenaphthene	9.0	14.7	9.0	--	10.9
Acenapthylene	--	--	--	--	0.54[b]
Anthracene	2.0	--	7.0	--	4.5
Benz(a)anthracene	--	--	--	0.16-0.26	0.26
Benzo(g,h,i)perylene	--	--	--	--	0.12[b]
Benzo(a)pyrene	--	--	--	0.04-0.06	0.06
Benzo(b+k)fluoranthene	--	--	--	--	2.14[b]
Chrysene	3.0	2.6	--	--	2.8
Dibenz(a,h)anthracene	--	--	--	0.01-0.04	0.04
Fluoranthene	10.0	7.6	3.0	0.49-0.93	6.7
Fluorene	10.0	7.3	9.0	--	8.8
Indeno(1,2,3-c,d)pyrene	--	--	--	--	0.10[b]
Naphthalene	3.0	1.3	18.0	--	7.4
Phenanthrene	21.0	17.4	16.0	--	18.1
Pyrene	8.5	7.0	1.0	--	5.5

Source: (1)

[a] Average is presented for calculation purposes.

[b] Estimated from creosote characterization references supporting the proposed rule.

TABLE 3-13
ESTIMATE OF CONSTITUENT CONCENTRATIONS OF TOTAL METALS, INORGANIC-TREATED WOOD DRIPPAGE AND UNUSED PRESERVATIVE FORMULATIONS

Constituent	Average Concentration (ppm)
Arsenic	5,500
Chromium	6,172
Copper	3,787

Source: (1)

TABLE 3-14
CONCENTRATIONS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) IN DRIPPAGE FROM WOOD TREATED WITH CREOSOTE

Constituent	Measured Concentration (ppm)	Estimated Concentration (ppm)
Acenaphthene	5,265	109,000
Acenapthylene	NA	5,400
Anthracene	175,000	45,000
Benzo(g,h,i)perylene	NA	1,200
Benzo(a)pyrene	733	600
Chrysene	2,590	28,000
Fluoranthene	14,750	67,000
Fluorene	7,225	88,000
Naphthalene	1,280	74,000
Phenanthrene	28,750	181,000
Pyrene	12,100	55,000

Source: (1)
NA - Not analyzed.

TABLE 3-15
SW-846 ANALYTICAL METHODS APPLICABLE TO CONSTITUENTS PROPOSED FOR REGULATION IN F032, F034, AND F035

Constituent	SW-846 Method[1]
Phenol	8270
2,4-Dimethylphenol	8270
2,4,6-Trichlorophenol	8270
2,3,4,6-Tetrachlorophenol	8270
Pentachlorophenol	8270
Acenaphthene	8270, 8100
Anthracene	8270, 8100
Benz(a)anthracene	8270, 8100
Benzo(a)pyrene	8270, 8100
Benzo(k)fluoranthene[1]	8270, 8100
Chrysene	8270, 8100
Dibenz(a,h)anthracene	8270, 8100
Fluorene	8270, 8100
Indeno(1,2,3-c,d)pyrene	8270, 8100
Naphthalene	8270, 8100
Phenanthrene	8270, 8100
Pyrene	8270, 8100
Arsenic	7060, 6010
Chromium	7190, 6010
Tetrachlorodibenzo-p-dioxins	8280, 8290
Pentachlorodibenzo-p-dioxins	8280, 8290
Hexachlorodibenzo-p-dioxins	8280, 8290

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[1] Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, this constituent is regulated as a sum of these two compounds.

TABLE 3-15 (continued)

Constituent	SW-846 Method[1]
Tetrachlorodibenozfurans	8280, 8290
Pentachlorodibenzofurans	8280, 8290
Hexachlorodibenzofurans	8280, 8290

TABLE 3-16
ANALYTICAL METHODS INSTRUMENTATION

Method Number	Method Instrumentation
6010A	Inductively Coupled Plasma
7060	Graphite Furnace Atomic Absorption Spectroscopy
7190	Flame Atomic Absorption Spectroscopy
8100	Gas Chromatography/Flame Ionization Detector
8270	Gas Chromatography/Mass Spectrometry
8280	Gas Chromatography/Mass Spectrometry
8290	High Resolution Gas Chromatography/Mass Spectrometry

Source: Test Methods for Evaluating Solid Waste, SW-846.

TABLE 3-17
REPORTED WASTEWATER MANAGEMENT PRACTICES IN USE IN 1984 AT SURVEYED WOOD PRESERVING PLANTS (RCRA 3007 SURVEY DATA)

Management Practice	Percent of Plants
Discharge to POTW	63
Discharge to Surface Water	3
Reuse of all Process Wastewater	10
Removal by Waste Contractor	3
Storage/Disposal in Land-Based Units	13
Thermal Evaporation in a Tank	3
Management not Specified	3
	98[a]

Source: (1)

[a] Does not add up to 100 percent due to rounding.

TABLE 3-18
TYPES OF WOOD PRESERVING PROCESS RESIDUALS MANAGED IN 1984 AT SURVEYED WOOD PRESERVING PLANTS, BY PRESERVATIVE (RCRA 3007 SURVEY DATA)

Type of Residual	F032 Pentachlorophenol Percent	F034 Creosote Percent	F035 Inorganics Percent
Treating Cylinder and Treating Tank Sediments	80	73	57
Holding, Work, Storage, Mixing or Other Tank Sediments	47	63	45
Door or Treating Cylinder Sump Sediments	27	37	50
Preservative Recycling/ Regeneration Residues	10	10	43
Drips and Spills	NR	NR	2
Maintenance Residuals	3	NR	2

Source: (1)
NR - Not reported.

Note: Numbers shown are the percentages of plants using each preservative that generate each process residual. For example, 57 percent of plants that use inorganic preservatives reported managing treating cylinder and treating tank sediments.

Totals may exceed 100 percent because most plants generate more than one type of process residual.

TABLE 3-19
REPORTED MANAGEMENT PRACTICES FOR WOOD PRESERVING PROCESS RESIDUALS, BY PRESERVATIVE

	Percent of Plants		
Management Practice	F032 Pentachlorophenol	F034 Creosote	F035 Inorganics
Removal by Waste Contractor	70	63	84[a]
Burning in Boiler/Wood Burner	3	13	0
Disposal in Landfill	13	7	7
Storage in Tank or Container	3	7	5
Storage in Impoundment	7	7	0
Reclaimed for Reuse	0	0	2
Land Treatment	0	3	0
Management Not Specified	10	3	2
Land Disposal in Place	NR[b]	NR[b]	NR[b]

Source: (1)
NR - Not reported.

[a] Includes six plants whose waste is removed by their preservative chemical supplier.

[b] Land disposal at the site of generation of drips, leaks, and spills is assumed to be the typical management practice at most wood preserving plants. Respondents to the 3007 Survey, however, did not report this practice.

Note: Numbers shown are the percentages of plants using each preservative that use each process residual management practice. For example, 70 percent of plants that use pentachlorophenol preservatives reported that their process wastes are removed by a waste contractor.

Totals may exceed 100 percent because some plants may use more than one management practice.

TABLE 3-20
REPORTED TREATED WOOD DRIPPAGE MANAGEMENT PRACTICES FOR WOOD PRESERVING PLANTS, BY PRESERVATIVE

	Pentachlorophenol Only, and Creosote, and Pentachlorophenol	Creosote Only	Inorganics Only	Creosote, Pentachlorophenol, and Inorganics
Number of Plants Surveyed	15	25	82	15
Percent With Surfaced Drip Pad	47	40	91	73
Percent Reusing Drippage from Surfaced Drip Pad	86	100	91	47
Percent With Surfaced Storage Yard	13	12	38	13
Percent Allowing Drippage in Storage Yard Directly to Ground[1]	87	88	62	87

Source: (1)

[1] Calculated by difference (100 percent - percent with surfaced storage yard).

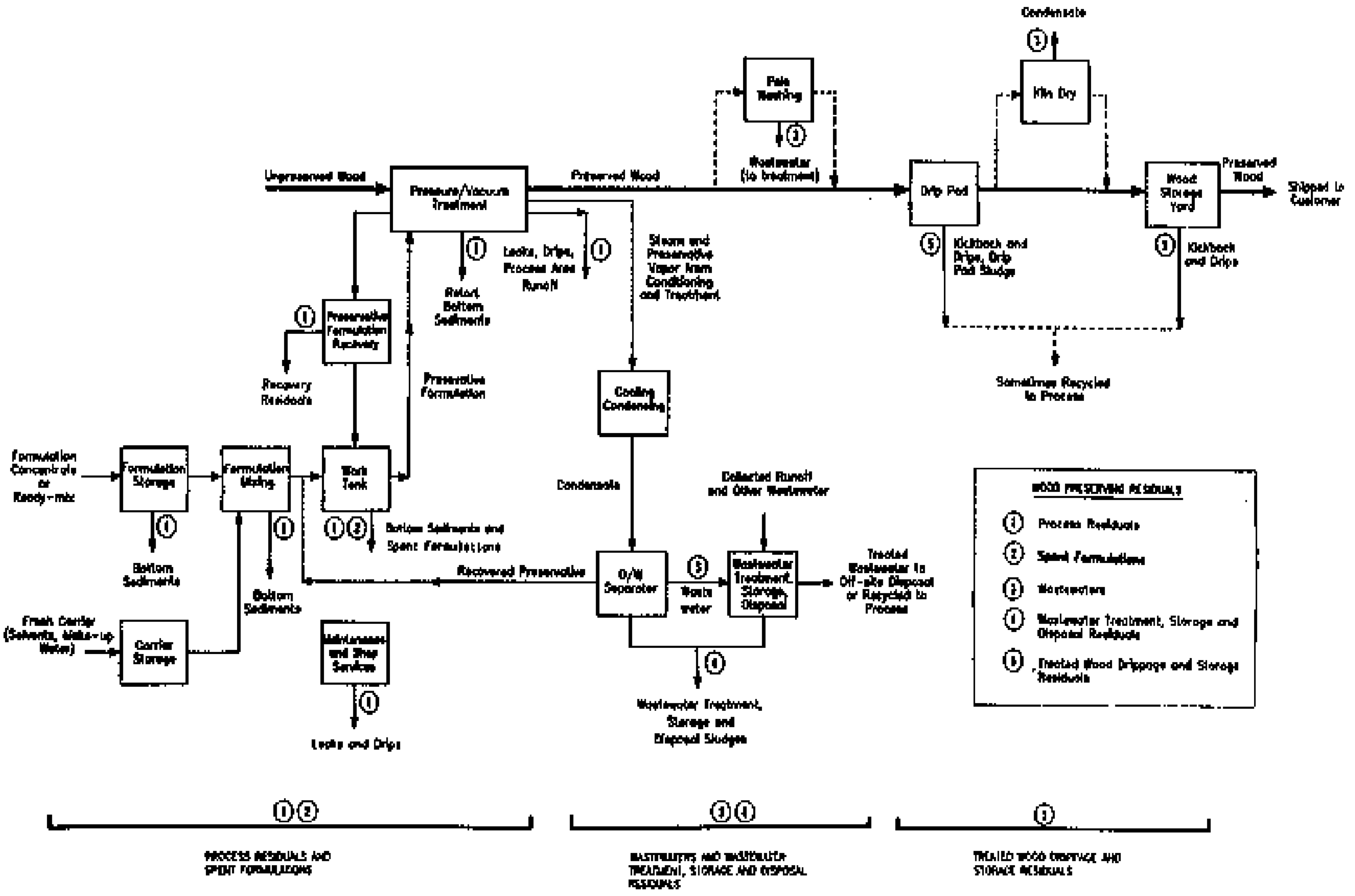

Figure II-1. Flow Diagram of Pressure/Vacuum Treatment Processes

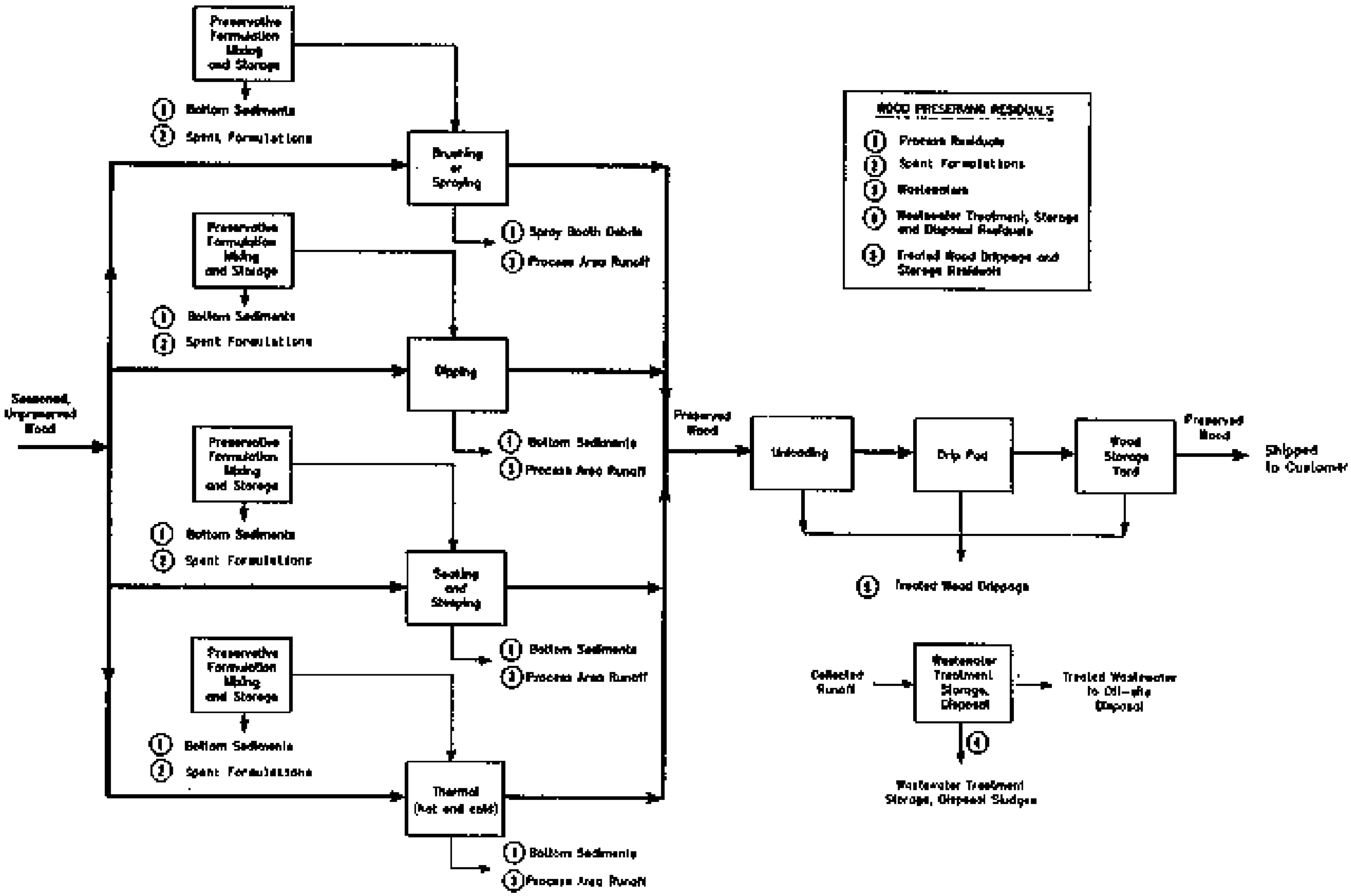

Figure II-2. Flow Diagram of Nonpressure Treatment Processes

4.0 BDAT TREATMENT STANDARDS FOR WOOD PRESERVING WASTES F032, F034, AND F035

4.1 Determination of BDAT Treatment Standards for F032, F034, and F035

This section presents the methodology and rationale for selection of constituents for regulation in nonwastewater and wastewater forms of wood preserving wastes. Constituents selected for regulation must satisfy the following EPA criteria:

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

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

4.1.1 BDAT List Constituents Present in F032, F034, and F035

For BDAT List Constituents present in F032, F034, and F035, see Tables 3-7, 3-8, 3-9, 3-10, 3-11, 3-13, and 3-14.

4.1.2 Regulated Constituents in F032, F034, and F035

Lists of the constituents regulated in each wood preserving waste code are presented in Table 4-1. These constituents were selected based on waste composition data presented in the wood preserving waste Listing Background Document from sampling and analysis of streams at various wood preservers. Though benzo(k)fluoranthene and naphthalene were not constituents of listing concern in F032, based on the characterization data available to the Agency, the Agency believes that these compounds also are present in F032. The Agency has based this decision on the availability of various commercial grades of creosote formulations whose composition with respect to PAH compounds is variable (Table 3-12). The Agency also points out that any F034 or F035 cross-contaminated with F032 must be managed as F032. (See Section 3.6.4.)

Several BDAT List constituents detected in these wastes were not selected for regulation because they were not present in concentrations of regulatory concern or because regulation of another selected BDAT list constituent ensures treatment of the unselected constituent.

Each category of PCDD and PCDF, HxCDD, HxCDF, PeCDD, PeCDF, TCDD, and TCDF must achieve the promulgated treatment standards. The following acronyms and definitions are used: PCDDs--all isomers of all chlorinated dibenzo-p-dioxins; PCDFs--all isomers of all chlorinated dibenzofurans; CDDs- and CDFs-isomers of tetra, penta-, and hexa, -chlorodibenzo-p-dioxins and -dibenzofurans, respectively; and TCDDs and TCDFs--all isomers of the tetrachlorodibenzo-p-dioxins and -dibenzofurans, respectively. The prefixes T, Pe, and Hx denote the tetra-, penta-, and hexa-chlorodioxins and -dibenzofuran congeners, respectively.

The hepta- and octa-congeners and isomers of PCDD or PCDF were identified in F032 sludges, drippage, process residuals, or wastewaters in concentrations up to 400 ppm. However, Vulcan, a manufacturer of pentachlorophenol (PCP) oils, has indicated that current PCP technical grades must meet strict concentrations of dioxins and furans that may not exceed 2 ppm of the hexa isomer and that the PCP technical grades do not contain any of the 2,3,7,8-TCDD.[2] The hepta-PCDD and hepta-PCDF were hazardous constituents for the listing of F032. Additional data on the concentrations of PCDDs and PCDFs present in F032 were submitted to EPA[3] and are presented in Appendix K to this report.

Although the hepta- and octa-PCDD/PCDF constituents are also present in F032, EPA is not regulating them. The hepta- and octa-PCDD and PDDF are not currently included on the list

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[2] See Appendix D of this Background Document.

[3] Comments submitted by the American Wood Preservers Institute (PH4P-00039) and the Penta Task Force (PH4P-00032).

of BDAT regulated constituents. In addition, the octa-isomers and congeners of PCDD and PDDF are not listed in Appendix VIII of the 40 CFR 261. EPA believes, however, that regulation of other PCDD and PCDF hazardous constituents described above will effectively control hepta- and octa-constituents.

As proposed, the Agency is promulgating treatment limits for benzo(k)fluoranthene as the sum of benzo(f)fluoranthene and benzo(f)fluoranthene in both nonwastewater and wastewater forms of F032 and F034. These compounds cannot be separated on a chromatographic column during analysis; therefore, benzo(k)fluoranthene cannot be quantified as a separate compound.

The Agency is promulgating treatment limits for several PAH compounds identified in F032 and F034 that were not part of the original listing for these wastes. The Agency has information that suggests that various grades of commercial creosote vary in their composition of PAH compounds. (See discussion in Section 3.6.4.) Therefore, the Agency believes that is appropriated to regulate a more comprehensive list of PAH constituents for these wastes. The commenters to the Phase 4 proposed rule did not object to the expanded list of hazardous constituents.

4.2 Identification of Best Demonstrated and Available Technologies (BDAT) for Nonwastewaters

Presented in the sections below are the Agency's determination of applicable and demonstrated technologies and the best demonstrated available technology (BDAT) for treatment of nonwastewater and wastewater forms of wood preserving wastes. However, other treatment technologies capable of meeting concentration limits are not precluded except for those that may constitute impermissible dilution.[4]

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[4] EPA’s Office of Solid Waste, Washington DC, or the RCRA Policy Compendium can be consulted for interpretation of those practices that may be prohibited from use pursuant to the provisions in 40 CFR §268.3.

In order to establish BDAT, the Agency first identifies which technologies are "applicable" for treatment of the constituents of interest. An applicable technology is one that, in theory, can treat the waste in question or a waste similar to the waste in question in terms of parameters that affect treatment selection. Detailed descriptions of the technologies identified as applicable for the treatment of listed hazardous wastes are provided in EPA's Final Treatment Technology Background Document. Identifying treatment technologies as applicable for treating BDAT List constituents is based on evaluation of current waste management practices, current literature sources, field testing, data submitted by equipment manufacturers and industrial concerns, plus engineering judgement of EPA technical staff personnel.

The Agency next determines which of the applicable technologies are "demonstrated" for treatment of the wastes. EPA prefers to designate as demonstrated a technology used in a full-scale operation for treatment of the waste of interest or a similar waste. Technologies that are available only at pilot- or bench-scale operations may not be considered demonstrated technologies. EPA may use, in limited circumstances, pilot- and bench-scale data in (1) designating a technology as demonstrated and in (2) developing treatment limits. This would be the case when EPA determines that the performance of pilot- or bench-scale technologies can be optimized to a full-scale operation.

The Agency determines which of the demonstrated technologies is "best" by comparing available treatment performance data from as many systems as possible for the constituents of interest, and determines whether this "best" demonstrated technology is also commercially "available." If the "best" demonstrated technology is "available," then the technology is determined to represent BDAT.

4.2.1 Applicable Treatment Technologies for Nonwastewaters

This section presents the Agency's determination of:

- Applicable technologies;

- Demonstrated technologies; and
- Best Demonstrated Available Technology (BDAT)

for treatment of nonwastewater forms of F032, F034, and F035.

Because nonwastewater forms of these wood preserving wastes contain organic and metal constituents at treatable concentrations, applicable treatment technologies include those that destroy or reduce the total amount of various organic compounds in the waste and reduce the mobility of the metals in the treatment residual. The Agency has identified the following technologies as being applicable for treatment of nonwastewater forms of these wood preserving wastes:

- Critical fluid extraction;
- Alkaline dechlorination;
- High-temperature thermal distillation;
- Combustion (includes incineration and industrial boilers);
- Biological treatment;
- Solvent extraction;
- Thermal desorption;
- Slag vitrification;
- Stabilization/solidification; and
- Total recycle or reuse.

The concentration and type(s) of constituents present in the waste generally determine which technology is most applicable. A brief discussion of each technology identified as applicable for treatment of the constituents in nonwastewater forms of wood preserving wastes is given below.

In addition to these technologies, emerging technologies exist that could provide treatment of wood preserving wastes and contaminated media. They include but are not limited to:

- Base-Catalyzed Dechlorination;
- Lewis Environmental Service's ENVIRO-CLEAN process;
- Texaco Gasification Process; and
- Cashman Process.

Information on these and other potential treatment technologies is provided in Appendices E and F. Other literature sources on the treatment of related wastestreams are referenced in Appendix J.

Critical Fluid Extraction. Critical fluid extraction is a separation and recovery technology in which a solvent is brought to its critical state (a thermodynamically unique equilibrium state between liquid and gas at high pressure and temperature) to extract organic constituents from a waste. The solvents used are usually gaseous when at ambient conditions. In the extraction procedure, the solvent is pressurized, thus converting it from a gas to a liquid. As a liquid, it dissolves the organic constituents and removes them from the waste matrix. After the extraction, the solvent is returned to its gaseous state; a small volume of extract remains that contains a high concentration of organic constituents. This technology generates two residuals: a treated waste residual and an extract.

Alkaline Dechlorination. Alkaline dechlorination is a process that chemically alters halogenated aromatic compounds. It replaces one or more of the halogens (i.e., chlorine) with an aliphatic compound, resulting in a less toxic compound. Its particular applicability is for the treatment of chlorinated dibenzodioxins and furans.

High-Temperature Thermal Distillation. High-temperature thermal distillation is a separation and recovery technology that subjects wastes to indirect, electrically generated heat in an inert atmosphere. The process removes volatile hydrocarbon constituents from a waste; these constituents can subsequently be recovered in a reusable form by cooling the hydrocarbon-bearing inert gases at high pressure. This process generates two residuals: a treated waste residual and an extract.

<ins>Combustion</ins>. Combustion is a high-temperature thermal destruction technology in which heat is transferred to a waste to destabilize chemical bonds and destroy hazardous organic constituents. Combustion includes both incinerator and industrial boilers. Three combustion technologies are applicable for the treatment of organic constituents in nonwastewater forms of these wood preserving wastes: liquid injection, rotary kiln, and fluidized bed.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator where additional heat is supplied to destabilize chemical bonds in the presence of air or oxygen. Once the chemical bonds are broken, these constituents react with oxygen to form carbon dioxide and water vapor. Liquid injection is applicable to wastes with low viscosity values, small particle size, and low suspended solids content.

In a rotary kiln incinerator, solid and/or semi-solid wastes are fed into the higher end of a sloping kiln. The rotation of the kiln mixes the waste with hot gases. Eventually, the waste reaches its ignition temperature and is converted to gas and ash through volatilization and combustion reactions. Ash is removed from the lower slope-end of the kiln. Combustion gases from the kiln, containing volatilized and partially combusted waste constituents, enter an afterburner for further combustion to complete the destruction of the organic waste constituents.

In a fluidized-bed incinerator, solid and/or semi-solid wastes are injected into a fluidized material (generally sand and/or incinerator ash) where they are heated to their ignition temperature. In the incinerator, the waste is converted to gas and ash through volatilization and combustion reactions. Heat energy from the combustion reaction is then transferred back to the fluidized bed. The velocity of the combustion gases is reduced in a wider space above the bed, known as the freeboard, allowing larger ash and waste particles that were not combusted to fall back into the bed. Ash is removed periodically during both operation and bed change-outs.

Offgases from combustion are fed into a scrubber system for cooling and removal of any entrained particles and acid gases. In general, with the exception of liquid injection incineration, two residuals are generated by the combustion process: ash and scrubber water. Because only wastes with low or negligible solids content are amenable to liquid injection incineration, this technology does not normally generate an ash residual, but does generate a scrubber water residual.

<u>Biological Treatment</u>. Biological treatment is a destruction technology that employs micro-organisms to degrade and mineralize biodegradable organic compounds and some inorganic compounds, such as sulfides and cyanides. It can be broadly classified into two classifications: aerobic and anaerobic. Aerobic biological treatment takes place in the presence of free oxygen, and anaerobic biological treatment occurs in the absence of free oxygen. Anaerobic biological treatment is typically done an anaerobic digester.

The most common aerobic biological treatment processes are activated sludge, aerated lagoon, bioslurry reactor, trickling filter, and the rotating biological contactor (RBC). The activated sludge, aerated lagoon, and bioslurry reactor processes work by keeping the microbes in suspension in water. The trickling filter and the RBC work by providing an inert medium, such as rocks or specifically designed ceramic or plastic materials, to which the microbes are attached and grow. Also, wastes containing biodegradable compounds can be mixed with a microbe and nutrient-rich medium, such as manure, and composted.

This technology generates two treatment residuals: a treated effluent and a waste biosludge. Waste biosludge may be land disposed without further treatment if the concentrations of its regulated constituents fall at or below their BDAT treatment standards.

Solvent Extraction. Solvent extraction is a separation and recovery technology in which hazardous organic constituents are removed from the waste due to greater solubility in the solvent phase than in the waste phase. Wastes commonly treated by this technology have a broad range of total organic content. Selection of an appropriate solvent is dependent on the relative solubilities of the constituents to be removed and the other organic compounds in the waste. Solvent extraction generates two residuals: a treated residual and an extract.

Thermal Desorption. Thermal desorption is a separation and recovery technology in which heat is used to volatilize organic constituents from wastes. Thermal desorption has been defined as a thermal treatment that uses direct or indirect heat exchange to elevate the temperature of a waste, thereby volatilizing the organic constituents. Thermal desorption differs from thermal destruction (incineration) in the way in which the organic constituents are treated. The objective of thermal desorption is to sufficiently elevate the temperature of the organic constituents to effect a phase separation to a gaseous state without combustion; the objective of incineration is to combust the organic constituents. Thermal desorption units function by creating steam from the volatilization of the moisture in the waste from heating. The steam tends to strip organic compounds from the waste and aids in the volatilization of organic compounds. Generally, this technology generates two residuals: a treated waste residual and an extract. Additional information is found in Appendix F.

Slag Vitrification. Slag vitrification is a treatment process that reduces the mobility of a metal species, such as arsenic, by dissolving metals into a glass or glass-like matrix. The metals become chemically bonded inside the matrix in many cases. For instance, arsenates are converted to silicoarsenates. Other metals are converted into silicates. In all cases, metals are surrounded by a glass matrix that reduces the mobility of the metals, preventing their reintroduction into the environment.

Stabilization/Solidification. Stabilization/solidification is a treatment technology that immobilizes hazardous constituents, i.e., metals in a waste. The basic principle of operation is that the leachable metals in a waste are immobilized following the addition of stabilizing agents and possibly other chemicals. The stabilization agents form a lattice structure and/or chemical bonds that reduce the leachability of metals in the waste. Treatment is most effective when the metal constituents in the waste are in the least soluble state. For example, hexavalent chromium is much more soluble and, therefore, more difficult to immobilize than trivalent chromium.

Total Recycle or Reuse. Total recycle or reuse of a waste material within the same process or an external process eliminates the generation of a waste for treatment and disposal and subsequently generates no treatment residuals.

4.2.2 Demonstrated Treatment Technologies for Nonwastewaters

Generally, demonstrated treatment technologies are those that have been demonstrated to be effective in full-scale operation for treatment of the waste of interest or a similar waste.

The Agency has determined that combustion provides substantial treatment of organic constituents based on the reduction of all BDAT List organic constituents to nondetectable concentrations. The Agency has also determined that slag vitrification provides substantial treatment of arsenic, based on the arsenic concentration in the toxicity characteristic leachate procedure (TCLP) leachate; and stabilization/solidification provides substantial treatment for chromium, based on the chromium concentration in the TCLP leachate. In addition to achieving substantial treatment, incineration, slag vitrification, and stabilization/solidification are commercially available, meeting the second criterion of "availability." Therefore, combustion, slag vitrification, and stabilization/ solidification represent BDAT for nonwastewater forms of F032, F034, and F035.

The Agency notes, however, that when it establishes concentration-based treatment standards, the regulated community may use any other technologies to treat the waste to meet the treatment standards except for those treatment practices that may constitute disposal or impermissable dilution. Compliance with a concentration-based treatment standard requires only that the effluent concentration be achieved; once achieved, the waste may be land disposed. The waste need not be treated by the technology identified as BDAT; in fact, concentration-based treatment standards provide flexibility in the choice of a treatment technology. Any treatment, including recycling or any combination of treatment technologies, unless prohibited (e.g., impermissible dilution) or unless defined as land disposal (e.g., land treatment), can be used to achieve these standards.

4.3 Identification of Best Demonstration Available Technologies (BDAT) for Wastewaters

This section presents the Agency's determination of:

- Applicable technologies;
- Demonstrated technologies; and
- Best Demonstrated Available Technology (BDAT)

for treatment of wastewater forms of F032, F034, and F035.

Applicable treatment technologies for organics in wastewater forms of wood preserving wastes include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following technologies as being applicable for treatment of wastewater forms of these wood preserving wastes:

- Biological treatment (including aerobic fixed film, aerobic lagoon, activated sludge, filtration, anaerobic fixed film, rotating biological contactor, sequential batch reactor, and trickling filter technologies);
- Carbon adsorption (including activated carbon and granular activated carbon technologies);
- Chemical oxidation;
- Chemical reduction;
- Chemically assisted clarification (including chemical precipitation technology);

- PACT® treatment (including powdered activated carbon addition to activated sludge and biological granular activated carbon technologies);
- Reverse osmosis;
- Solvent extraction;
- Stripping treatment (including steam stripping and air stripping technologies);
- Total recycle or reuse; and
- Wet air oxidation (including supercritical oxidation technology).

The concentration and type(s) of waste constituents present in the wastewaters generally determine which technology is most applicable. In most instances, combinations of two or more of these wastewater treatment practices can be used for the purposes of achieving the treatment limits established today. This is not an unexpected result, since combinations of these wastewater treatment process allow the affected industry to optimize the overall performance of wastewater treatment trains and meet applicable effluent discharge limits under the National Pollutant Discharge Elimination System (NPDES). A brief discussion of each technology identified as applicable for the treatment of constituents in wastewater forms of wood preserving wastes is given below.

Biological Treatment. Biological treatment is a destruction technology that employs micro-organisms to degrade and mineralize biodegradable organic compounds and some inorganic compounds, such as sulfides and cyanides. It can be broadly classified into two classifications: aerobic and anaerobic. Aerobic biological treatment takes place in the presence of free oxygen, and anaerobic biological treatment occurs in the absence of free oxygen. Anaerobic biological treatment is typically done an anaerobic digester.

The most common aerobic biological treatment processes are activated sludge, aerated lagoon, bioslurry reactor, trickling filter, and the RBC. The activated sludge, aerated lagoon, and bioslurry reactor processes work by keeping the microbes in suspension in water. The trickling filter and the RBC work by providing an inert medium, such as rocks or specifically designed ceramic or plastic materials, to which the microbes are attached and grow. Also, wastes containing biodegradable compounds can be mixed with a microbe and nutrient-rich medium, such as manure, and composted.

This technology generates two treatment residuals: a treated effluent and a waste biosludge. Waste biosludge may be land disposed without further treatment if the concentrations of its regulated constituents fall at or below their BDAT treatment standards.

Carbon Adsorption. Carbon adsorption is a separation technology in which hazardous organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology generates two treatment residuals: a treated effluent and spent activated carbon. Spent activated carbon is often reactivated, recycled, or incinerated.

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

Chemical Reduction. Chemical reduction is a technology that converts highly oxidized metal ions, such as hexavalent chromium, to less highly oxidized states. This change in oxidation state renders the metals more amenable to precipitation and stabilization.

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

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

Reverse Osmosis. Reverse osmosis is a separation technology in which dissolved organics (usually salts) are removed from a wastewater by filtering the wastewater through a semipermeable membrane at a pressure greater than the osmotic pressure caused by the dissolved organic constituents. This technology generates two treatment residuals: the treated effluent and the concentrated organic materials that do not pass through the membrane.

Solvent Extraction. Solvent extraction is a separation and recovery technology in which hazardous organic constituents are removed from a waste due to greater solubility in the solvent phase than in the waste phase. Wastes commonly treated by this technology have a broad range of total organic content. Selection of an appropriate solvent is dependent on the relative solubilities of the constituents to be removed and the other organic compounds in the waste. Solvent extraction generates two residuals: a treated residual and an extract.

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

Total Recycle or Reuse. Total recycle or reuse of a waste material within the same process or an external process eliminates the generation of a waste for treatment and disposal and subsequently generates no treatment residuals.

Wet Air Oxidation. Wet air oxidation is a destruction technology in which organic constituents in wastes are oxidized at elevated temperatures and pressures in the presence of dissolved oxygen. This technology is applicable for wastes comprised primarily of water and up to 10 percent total organic constituents. Wet air oxidation generates one treatment residual: treated effluent. The treated effluent may require further treatment for hazardous organic constituents by carbon adsorption or PACT® treatment.

4.3.1 Demonstrated Technologies for Wastewaters

Generally, demonstrated treatment technologies are those that have been demonstrated in full-scale operation for treatment of the wastes of interest or a similar waste. The Agency has identified as applicable technologies that have been demonstrated on a full-scale operational basis for wastewaters containing the constituents of concern or constituents similar to those of concern in these wastes.

4.3.2 Identification of BDAT for Wastewaters

The procedure used to identify BDAT for the wastewater forms of F032, F034, and F035 follows the methodology described in EPA's Methodology for Developing BDAT Treatment Standards. All applicable and demonstrated treatment technologies are identified for the regulated constituents in the wastes of interest, and the treatment performance data are then examined to identify the technologies that perform "best." The treatment performance data are evaluated to determine:

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

The Agency then determines whether the best demonstrated technology is "available." To be "available," a technology (1) must provide substantial treatment and (2) must be commercially available.

The Agency determined the best demonstrated technology for each constituent in F032, F034, and F035 by a thorough review of all of the treatment performance data available for each constituent. The demonstrated technologies determined to be "best" for each constituent are all commercially available. Therefore, the technologies selected as best and demonstrated for each constituent are also considered to be available, and BDAT for that constituent.

The Agency notes, however, that when it establishes concentration-based treatment standards, the regulated community may use any other technologies to treat the waste to meet the treatment standards except for those treatment practices that may constitute disposal or impermissable dilution. Compliance with a concentration-based treatment standard requires only that the effluent concentration be achieved; once achieved, the waste may be land disposed. The waste need not be treated by the technology identified as BDAT; in fact, concentration-based treatment standards provide flexibility in the choice of a treatment technology. In fact, EPA points out that although the promulgated UTS limits are based on the performance of one or the combination of two or three treatment trains, existing wastewater treatment capabilities at wood preserving sites can be optimized to meet the treatment limits promulgated today. This determination is based on the available data on the performance of wastewater treatment practices at wood preserving facilities that show that these facilities treat their wastewater via sequential primary, secondary, and tertiary treatment processes in order to meet their effluent water discharge limits under the National Pollutant Discharge Elimination System. EPA believes that these treatment infrastructures can be optimized to meet the UTS limits promulgated today via the installation of a tertiary treatment process such as carbon adsorption. Specifically, see the document entitled “Treatability of UTS Constituents in F032, F034, and F035 Wastewaters” located in the docket for today’s rulemaking and Appendix K to this report.

4.4 Promulgation of Treatment Standards

As proposed, the Agency is transferring universal treatment standards to the constituents proposed for regulation in nonwastewater and wastewater forms of F032, F034, and F035. A universal standard is a single concentration limit established for a specific constituent regardless of the waste matrix in which it is present. Universal treatment standards are intended to be used to replace treatment standards in previously promulgated waste codes and as the treatment standards for listed hazardous waste codes in the future. Although several commentors objected to the regulation of hexa-, tetra-, and penta-isomers of PCDD and PCDF in F032, as well as chromium and arsenic in F034, EPA has determined that the regulation of these constituents is warranted. These constituents are toxic and they are present in F032 (D/F) and F034 (chromium and arsenic).

In response to public comments concerning the potential refusal of combustion device's owner and operators to manage F032 wastes, some commentors asked EPA to promulgate an alternative compliance treatment standard that allows combustion as the treatment standard for D/F in F032 wastes. After evaluating the submitted data characterization with regard to D/F concentrations in F032, EPA proposed that such treatment compliance alternative is also available for F032.

This section presents the universal treatment standards that were transferred to the constituents proposed for regulation in nonwastewater and wastewater forms of F032, F034, and F035, and the specific data used to determine these treatment standards. EPA is promulgating a modified version of the proposed combustion alternative treatment standard as explained in Section 5.0 of this BDAT Background Document for Wood Preserving Wastes F032, F034, and F035.

4.4.1 Nonwastewaters

The Agency is promulgating universal treatment standards for each constituent proposed for regulation in nonwastewater forms of F032, F034, and F035. Universal treatment standards for the organic constituents proposed for regulation in F032, F034, and F035 were based upon combustion treatment performance data. Universal treatment standards for the inorganic constituents proposed for regulation in F032, F034, and F035 were based upon slag vitrification and stabilization/solidification treatment performance data. These data represent BDAT for wood preserving wastes. This is because incineration, slag vitrification, and stabilization/solidification have also been identified as BDAT for wastes as difficult to treat as wood preserving wastes, the Agency feels it is appropriate to transfer the universal treatment standards for nonwastewaters to the constituents proposed for regulation in nonwastewater forms of F032, F034, and F035. EPA believes that potential difficulties in treating hazardous constituents in F032, F034, and F035 can be effectively reduced via appropriate pretreatment or post-treatment technologies such that these wastes can meet the promulgated UTS limits.

Table 4-2 presents the treatment standards promulgated for nonwastewater forms of wood preserving waste by waste code. Details regarding the methodology used to develop these nonwastewater universal treatment standards and the treatment standards database are presented in Appendix A of this document. A more detailed discussion concerning the determination of 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.

4.4.2 Wastewaters

The Agency is promulgating universal treatment standards for regulated constituents in wastewater forms of F032, F034, and F035, as proposed. Universal treatment standards in wastewater forms of wastes are based on treatment performance data from several sources including the BDAT data base, the NPDES data base, the WERL data base, EPA-collected WAO/PACT® data, the EAD data base, industry-submitted leachate treatment performance data, data in literature that were not already part of the WERL data base, and data in literature submitted by industry on the WAO and PACT® treatment processes. Several commenters expressed concerns that F032 wastewaters cannot be treated via biological treatment to meet limits that EPA proposed for the regulation of specific PCDD and PCDF in wastewater forms of F032. EPA concurs with the commenters that F032 wastewaters as generated may not be readily amenable to biological treatment. Unlike the commenters, however, EPA believes that wood preserving facilities can optimize their existing wastewater treatment trains in order to meet the UTS limits promulgated for PCDD and PCDF regulated in wastewater forms of F032. In fact, EPA believes that: (1) pretreatment steps such as oil separation, pH adjustment, chemical precipitation/clarification, and equalization can manage the loading of deleterious pollutants to biological treatment processes; (2) acclimatation of microorganisms to the concentrations of pentachlorophenol, PCDD, PCDF, and metals in wastewaters; or (3) the addition of a carbon adsorption polishing step can enable F032 wastewaters to meet the UTS limits promulgated today for PCDD and PCDF in wastewater forms of F032. This determination is based on EPA's findings from the available data describing the characterization of F032 wastewaters, the performance of wastewater treatment practices at wood preserving facilities, the performance of treatment practices on wastewaters as difficult to treat as F032 wastewaters, and the performance of carbon adsorption as a polishing step of F032 wastewaters treated in bioreactors. EPA's review of the available data can be found in the document titled: "Treatability of UTS Constituents in F032, F034, and F035 Wastewaters" located in the docket for today's rulemaking. The performance data on treatment processes for wastewaters as difficult to treat as wastewater forms of F032 can be found in Appendix K. Because these standards reflect the performance of numerous industrial wastewater treatment systems, the Agency believes it is appropriate to transfer the universal treatment standards for wastewaters to the constituents proposed for regulation in wastewater forms of F032, F034, F035.

Table 4-3 presents the proposed treatment standards promulgated for wastewater forms of wood preserving waste by waste code. Details regarding the methodology used to develop these wastewater universal treatment standards and the treatment performance data base are presented in Appendix B of this document. A more detailed discussion concerning the determination of the wastewater universal treatment standards is provided in EPA's Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume B: Universal Standards for Wastewater Forms of Listed Hazardous Wastes.

4.5 Detailed Descriptions of Technologies Identified as BDAT

The detailed descriptions of treatment technologies that are presented in the following subsections are summarized from information provided in EPA's Treatment Technology Background Document, 1991.

Of the technologies identified as applicable and demonstrated for treatment of wood preserving nonwastewaters, three were identified as BDAT for constituents proposed for regulation in F032, F034, and F035. These technologies are as follows:

- Combustion (discussed in Section 5.0 of this report);
- Slag Vitrification; and
- Stabilization/Solidification.

4.5.1 Slag Vitrification

Slag vitrification is a treatment process that reduces the mobility of a metal species, such as arsenic, by dissolving metals into a glass or glass-like matrix. The metals become chemically bonded inside the matrix in many cases. For instance, arsenates are converted to silicoarsenates; other metals are converted into silicates. In all cases, metals are surrounded by a glass matrix that reduces the mobility of the metals, preventing their reintroduction into the environment.

Treatment Applicability. Slag vitrification is applicable to nonwastewaters containing arsenic or other characteristic toxic metal constituents that relatively nonvolatile at the temperatures at which the process is operated. This technology is also applicable to many wastes containing organometallic compounds, where the organic portion of the compound can be completely oxidized at process-operating conditions.

Treatment Process Parameters. In slag vitrification, finely ground slag from metal-refining processes and waste are premixed and fed to the same type of furnace as that used for glassmaking. The slag liquefies at the process temperatures (1100 to 1200°C). The waste constituents either dissolve in the melt or become suspended in the molten slag. Subsequent cooling of the slag causes it to solidify, trapping the waste inside a glasslike matrix and reducing the leachability of the waste.

Process Constraints. Waste characteristics affecting the performance of slag vitrification include the organic content of the waste, the concentrations of specific metal ions in the waste, the concentration of compounds that interfere with the glassmaking process, and the moisture content of the waste.

At the process temperature, the organic content is combusted to carbon dioxide, water, and other gaseous products. This liberates heat, reducing the external energy requirements for this process. However, the presence of refractory organic compounds, such as halogenated organics, results in incomplete combustion and the deposition of components, such as chlorides, that can affect the ability of the cooled matrix to achieve the desired reduction in mobility of waste constituents.

Metal oxides have solubility limits in glass matrices. Therefore, the amount of specific metal oxides in the wastes will determine the amount of glass-forming material required to form a satisfactory nonleachable slag.

Some common waste constituents, such as chlorides, fluorides, and sulfates, will interfere with the vitrification process. To compensate for these interferences, higher levels of slag forming materials have to be added.

The moisture content of the waste and additives should be less than 5 percent free moisture. Wastes with higher moisture content need to be dried before mixing with the slag-forming materials; otherwise, the final treated matrix will not have the desired characteristics to reduce the leachability of the metals in the waste.

4.5.2 Stabilization/Solidification

Stabilization/solidification refers to a broad class of treatment processes that immobilize hazardous constituents in a waste. Stabilization/solidification generally requires a chemical reaction between the waste constituents and the treatment additives for effective treatment to occur.

Treatment Applicability. This treatment is applicable to wastes containing leachable metals that also have a high filterable solids content, low organic carbon (TOC) content, and low oil and grease content. The most common wastes treated by this technology include residuals generated from the treatment of electroplating wastes, combustion ash residuals, and characteristic TC-metal wastes.

Treatment Process Parameters. During treatment, leachable metals (e.g., lead, chromium) become immobilized in a lattice structure that develops in the waste following the addition of stabilization agents and, possibly, other chemicals. In some cases, the leachable metals can form chemical bonds within the treated waste matrix, further reducing potential leachability. Treatment efficiency is improved if the metal constituents are in their least soluble form. For example, because hexavalent chromium is more soluble than trivalent chromium, chemical reduction of any hexavalent chromium in the waste should be done prior to adding the stabilization/solidification reagents. The two principal treatment processes are cement-based and lime/pozzolan-based.

Portland cement is a mixture of the oxides of calcium, silica, aluminum, and iron. It is produced by the kiln burning of calcium and silica rich material at high (1400 to 1500^{o}C) temperature. When mixed with water, the mixture begins to set. In the process, a complex matrix of interlacing, thin, densely packed silicate fibrils forms. Metals constituents present in the matrix, in their hydroxide and carbonate forms, become incorporated in these interstices.

Pozzolan contains finely divided silica. Upon the addition of lime, it becomes cementitious, producing a similar matrix as Portland cement when hydrated.

Process Constraints. Factors affecting the performance of stabilization include concentration of fine particles, the level of oil and grease, the concentration of other organic compounds, the amount of sulfate and chloride compounds, and the relative solubility of metal compounds.

Very fine particles, e.g., less than 74 μm, will weaken the bonding within the treated matrix due to coating of the waste particles. Pretreatment to reduce the concentration of fine particles or the addition of much larger amounts of treatment additives are required to achieve effective treatment.

The presence of oil and grease can result in the coating of the waste particles, weakening the bonds between the waste and the treatment additives. Organic compounds can also interfere with the formation of chemical bonds within the treated matrix and interfere with the formation of bonds between the waste and the treatment additives, which will decrease the resistance to leaching. Pretreatment of the waste may be required if the TOC levels are high.

Sulfate and chloride salts interfere with the chemical reactions within the treated matrix, weakening bond formation and strength and prolonging the setting and curing time. Sulfate and chloride salts may reduce the dimensional stability of the cured matrix, increasing the potential for leaching. Pretreatment of the waste may be required to reduce the concentration of sulfate and chloride salts.

The metal targeted for treatment should be in its least soluble state at the pH of the treated matrix. For example, hexavalent chromium should be reduced to its trivalent form to achieve optimum treatment efficiency.

4.6 Detailed Description of Technologies Identified as BDAT for Wastewaters

Of the technologies identified as applicable and demonstrated for treatment of wood preserving wastewaters, three were identified as BDAT for the regulated constituents in F032, F034, and F035. These technologies are as follows, each of which is described below:

- Biological Treatment;
- Chemically Assisted Clarification; and
- Steam Stripping.

4.6.1 Biological Treatment

The four most common biological treatment technologies are:

- Activated sludge;
- Aerated lagoon;
- Trickling filter; and
- RBC.

These technologies are discussed below.

Treatment Applicability. Biological treatment technologies are applicable to wastewaters that contain biodegradable organics.

Treatment Process Parameters. A typical activated sludge system includes an equalization basin, a settling tank, an aeration basin, a clarifier, and a sludge recycle line. Wastewater enters the system in the equalization basin, where it is homogenized to prevent process upsets. The wastewater then enters a settling tank where settleable solids are removed. From the settling tank, the wastewater is discharged to an aeration basin, where aerobic bacteria are maintained in suspension. Mechanical or diffused aeration is used to supply oxygen to the aeration basin. The wastewater containing the aerobic bacteria is continuously discharged from the aeration basin into a clarifier. In the clarifier, the biomass is separated from the treated wastewater. This treated wastewater is discharged. A portion of the biomass is discharged. This portion may be dewatered by sludge filtration or on sludge drying beds prior to discharge. The remainder of the biomass is returned to the aeration basin, maintaining the bacterial population.

An aerated lagoon system is similar to an activated sludge system in that suspended aerobic bacteria are used to degrade organic compounds in wastewater. An aerated lagoon, however, initially contains a smaller population of micro-organisms than an activated sludge system because there is no sludge recycle in an aerated lagoon. Therefore, water must remain in the aerated lagoon system longer to achieve similar effluent quality. The longer residence time, however, provides more time for degradation of complex organic chemicals. Additionally, process upsets due to feed variations are less likely in aerated lagoon than in activated sludge systems due to the larger tank volumes and longer residence time used in aerated lagoon treatment. The effluent from the aerated lagoon system can be discharged to a settling tank for solids removal or the mechanical aerators used in the aerated lagoon may be shut down to allow settling of solids in the treatment tank or pond. The settled solids are often dewatered prior to disposal.

A trickling filter system consists of an equalization basin, a settling tank, an filter, medium, an influent wastewater distribution system, an under drain system, a clarifier, and a recirculation line. The wastewater enters the equalization basin where it is homogenized. The equalization basin effluent is discharged to the settling tank where solids are removed. From the settling tank, the wastewater is distributed over the filter medium with a rotating distribution arm or a fixed distribution system. The filter medium consists of rocks or plastic rings with microorganisms attached to their surfaces. The wastewater forms on this layer as it flows down through the filter medium. Oxygen reaches the micro-organisms through spaces in the media promoting aerobic biological decomposition. A biomass is produced that is separated from the wastewater in a clarifier.

A rotating biological contactor is a series of closely spaced, parallel disks made of polystyrene, polyvinyl chloride, or similar materials. The disks are partly submerged in a tank containing wastewater and rotated at an average rate of two to five revolutions per minute. The disks are covered with a biomass that degrades dissolved organics. As the disk rotates out of the water, oxygen is available, promoting biological decomposition. A biomass is produced that sloughs off the disk. The biomass is separated from the treated effluent in a clarifier.

Process Constraints. Several waste characteristics affect the performance of aerobic biological treatments including ratio of biological oxygen demand (BOD) to TOC, concentration of surfactants, and concentration of toxic constituents of the wastes. The wastes' ratio of BOD to TOC content provides an estimation of the percentage of biodegradable organics in the waste. If the percentage of biodegradable organics is low, aerobic biological treatment systems may not effectively treat the waste. Surfactants can affect biological treatment performance by forming a film on organic constituents, thereby establishing a barrier to oxygen transfer and effective biodegradation.

A number of constituents and waste characteristics have been identified as potentially toxic to the micro-organisms used in aerobic biological treatments. These include metals and oil and grease, as well as high concentrations of total dissolved solids, ammonia, and phenols. Presence of these toxic constituents in a waste, therefore, may reduce the effectiveness of aerobic biological treatment. However, microorganisms can be acclimated to handle higher concentrations of such pollutant loadings. If acclimation is not feasible, appropriate upstream treatment trains and holding tanks can be used effectively to reduce the loading of pollutants to concentration ranges that can be handled by the microorganisms.

4.6.2 Chemically-Assisted Clarification

Chemically-assisted clarification includes chemical precipitation and sedimentation.

Treatment Applicability. Chemically-assisted clarification is applicable to the treatment of wastewaters containing suspended solids, colloidal solids, or dissolved solids that are not removed by simple sedimentation.

Treatment Process Parameters. Coagulants are added to chemically-assisted clarifiers to enhance liquid-solid separation, permitting solids denser than water to settle to the bottom and materials less dense than water (including oil and grease) to flow to the surface. Various coagulants and coagulant aids such as alum, ferric chloride, sodium sulfide, ferrous sulfide, organic polymers, and sodium hydroxide are used depending on the specific waste material to be removed. The coagulants are rapidly mixed with the wastewater and the colloidal particles allowed to agglomerate into a large enough floc to be removed by clarification.

Clarifiers are designed to let the wastewater flow slowly and quiescently, providing an adequate retention time to permit most solids more dense than water to settle to the bottom. The settling solids form a sludge at the bottom of the clarifier and are usually pumped out continuously or intermittently. Oil and grease and other floating materials may be skimmed off the surface.

Chemically-assisted clarification may be used alone or as part of a more complex treatment process. It may also be used as:

- The first process applied to wastewater containing high levels of settleable suspended solids.
- The second stage of most biological treatment processes to remove the settleable materials, including micro-organisms, from the wastewater; the micro-organisms can then be either recycled to the biological reactor or discharged to the plant's sludge handling facilities.
- The final stage of most chemical precipitation (coagulation/ flocculation) processes to remove the inorganic flocs from the wastewater.

Process Constraints. Waste characteristics affecting performance include chemical interactions, temperature, pH, solubility variances, and mixing effects.

Many coagulation reactions occur very rapidly, during which some soluble kinetic intermediates can be adsorbed on the colloidal surfaces. For these reasons, rapid and complete dispersion of coagulants is necessary. Failure to provide adequate coagulant distribution may cause localized pH or ion concentrations that can hinder the colloid destabilization to the point of requiring more coagulant addition.

Adequate retention time and a quiescent flow rate favorably impact the efficiency of solids settling within a clarifier.

4.6.3 Steam Stripping

Steam stripping utilizes steam to volatilize organic constituents out of a wastestream.

Treatment Applicability. Steam stripping is applicable to the treatment of wastes containing volatile organics. Steam stripping is typically applicable when the waste contains less than 1 percent volatile organics.

Treatment Process Parameters. The apparatuses required for steam stripping include a boiler, a stripping column, a condenser, and a collection tank. The stripping column consists of vertical columns filled with trays or packing. Liquid waste enters the top of the column. The boiler, located at the bottom of the column, produces vapor that rises through the column and meets the falling liquid. As the vapor and liquid come into contact at each equilibrium stage, volatile constituents are removed from the liquid phase into the vapor phase. Equilibrium stages are produced by the trays or packing in the column. The steam containing volatile compounds exits the top of the column and is condensed. The condensate is discharged to the collection tank, and the noncondensed vapors are vented to an air pollution control system or to the atmosphere. The remaining liquid in the column is discharged to the boiler and recycled to the stripper.

Process Constraints. Waste characteristics affecting the performance of steam stripping include the constituent boiling points, the concentration of suspended solids, the surface tension, and the concentration of oil and grease.

If the boiling points of the lower volatile and higher volatile constituents in the waste are similar, then the system may not treat the waste effectively. If the waste contains high concentrations of suspended solids or oil and grease, the solids and/or oil and grease may clog the column or coat heat transfer surfaces, inhibiting transfer of constituents from the liquid phase to the vapor phase. These wastes may require filtration prior to steam stripping treatment. If a waste has a high surface tension, it is more likely to foam. Defoaming compounds can be added to the waste to prevent foaming. Packed columns also reduce foaming.

4.7 Reuse, Reclamation, and Recycling Potential

EPA's progress in improving environmental quality through its media-specific pollution control programs has been substantial. Over the past two decades, standard industrial practice for pollution control concentrated to a large extent on "end of pipe" treatment or and disposal of hazardous and nonhazardous wastes. However, EPA realizes that there are limits to the degree of environmental improvement that can be achieved under these programs by emphasizing management after pollutants have been generated. EPA believes that eliminating or reducing discharges and/or emissions to the environment through the implementation of cost effective source reduction and environmentally sound recycling practices can provide additional environmental improvements. Reclamation processes that generate reusable wood and recover wood preservative could be applicable to wood preserving wastes. For example, reclamation of the constituents of phenolic or creosote formulations that have been applied to wood has recently been attempted in field pilot studies. The process tested achieved up to a 98.7 percent efficiency converting the treated wood to a usable wood fiber. The wood fiber and the recovered wood preservative is potentially recyclable (12).

4.8 Pollution Prevention and Waste Minimization

The three types of wood preserving processes (pentachlorophenol-, creosote-, and aqueous-based) are generally similar enough that most pollution prevention/waste minimization pollution prevention activities are applicable to all three processes. Specifically, each of the three processes involve receiving untreated lumber, placing it in a treating cylinder/retort, filling the retort with the preservative fluid, pressurizing the retort, releasing the pressure, applying vacuum, draining, removing the treated lumber, and storing the lumber (8,9).

For aqueous-based processes (e.g., copper/chrome/arsenic formulations), modern wood preservers typically recycle all aqueous wastes back to the processes, having to dispose of only contaminated solids filtered from recycled process streams since the potential waste fluids can be flushed and cleaned with water, rather than the oil-based solvents that are present with pentachlorophenol (PCP) and creosote-based systems. However, the following pollution prevention alternatives are available to most wood preservers.

4.8.1 Process Additions

The following capital expenditures would not be required to produce quality treated lumber. Their sole purpose is for pollution prevention:

- Enclose wood processing operations and drip pans - Building enclosures around all operations prevents precipitation events from washing contaminants into the environment or adding to the load in wastewater collection systems.
- Install drip pans - Placing containment under and around sources of drips and spills allows the materials to be collected rather than drain into the environment. For aqueous-based systems, the collected drippage can usually be recycled with minimal filtration.
- Automated lumber handling systems, including power rollers - Electronically and/or remote controlled lumber handling removes the need for personnel to be in

the area of contaminated drips/spills, thereby preventing tracking of contaminants throughout the operation.

- Spill containment - Similar to drip pans, dedicated spill containment devices can be designed to route spills to the appropriate treatment or recycle locations.
- Spill monitoring - Installing electronic monitors to detect spills (e.g., level sensors, conductivity probes) will prevent their overflowing containment areas, and alert operators to possible process failures.
- Computer controlled processes - Computerized controls will minimize the need to have operators walking in contaminated areas, and tracking contaminants.

4.8.2 Process Changes

The following changes in the wood preserving process involve capital expenses and are intended to minimize the possibility of spillage.

- Using higher pressures - The use of pressures in the range of 150 - 165 psi allow more rapid penetration of the preservative chemicals into the wood, thereby providing shorter cycle time and less chance for spills or leaks.

- High volume pumps - Having pumps that can fill the retorts more rapidly again minimize the opportunity for leaks from the retorts because they shorten cycle time.
- Large volume vacuum pumps - At the end of the treatment cycle, vacuum is pulled on the retort to remove excess treatment chemicals from the wood. If large volume vacuum pumps are used, cycle time is reduced, again minimizing the opportunity for leaks.

- Substitution of preservative formulations - While not yet popular, formulations such as borates (water soluble and hence only applicable to inside locations), ammoniacal copper/quaternary ammonium (ACQ), copper naphthalate, zinc naphthalate, and zinc sulfate are much less toxic and provide protection to the lumber.

4.8.3 Management Practices

The following activities are typically process changes that do not require significant capital expenditure, but are operating costs/procedures that are designed to minimize the opportunity for spills and excessive waste production, hopefully saving more money than the cost of implementing these activities.

- Using better quality lumber - Using a higher grade of lumber typically means less waste. If lumber must be scrapped after treatment, disposal must be as a hazardous waste, at extra cost.
- Cleaning lumber - If lumber is cleaned of dirt, debris, and chips prior to treating, then the removed material will not have the opportunity to become contaminated with the treating chemicals and not result in additional hazardous wastes.
- General housekeeping - If materials are stored neatly, away from property lines, in areas where spills can be contained, and arranged for ease of inspection, then leaks and breakage will be minimized.
- Cleaning wheels on fork lifts - Dedicating fork lifts to specific areas will prevent tracking of contaminated materials. Cleaning wheels on a daily basis, or whenever a fork lift leaves a contaminated area will also minimize tracking.

4.8.4 Alternative Wood Preserving Formulations

Alternatives to chromated copper arsenate (CCA) include replacing CCA with ammoniacal copper/quaternary ammonium compound (ACQ) as a wood preservative for treatment of wood products. By using ACQ, arsenic and chromium are eliminated from the wood preserving formulation use, which prevents the generation of hazardous wastes (13).

TABLE 4-1
CONSTITUENTS PROMULGATED FOR REGULATION IN F032, F034, and F035

Constituent	CAS No.	F032	F034	F035
Phenol	108-95-2	X		
2,4-Dimethylphenol	105-67-9	X		
2,4,6-Trichlorophenol	88-06-2	X		
2,3,4,6-Tetrachlorophenol	58-90-2	X		
Pentachlorophenol	87-86-5	X		
Acenaphthene	83-32-9	X	X	
Anthracene	120-12-7	X	X	
Benz(a)anthracene	56-55-3	X	X	
Benzo(a)pyrene	50-32-8	X	X	
Benzo(k)fluoranthene	[a]	X	X	
Chrysene	218-01-9	X	X	
Dibenz(a,h)anthracene	53-79-3	X	X	
Fluorene	86-73-7	X	X	
Indeno(1,2,3-cd)pyrene	193-39-5	X	X	
Naphthalene	91-20-3	X	X	
Phenanthrene	85-01-8	X	X	
Pyrene	129-00-0	X	X	
Arsenic	7440-38-2	X	X	X
Chromium	7440-47-3	X	X	X
Tetrachlorodibenzo-p-dioxins	---	X		
Pentachlorodibenzo-p-dioxins	---	X		
Hexachlorodibenozo-p-dioxins	---	X		
Tetrachlorodibenozofurans	---	X		
Pentachlorodibenzofurans	---	X		
Hexachlorodibenzofurans	---	X		

Source: U.S. EPA, June 1995.

[a] this constituent is regulated as the sum or benzo(b)fluoranthene (CAS No. 205-99-2) and benzo(k)fluorathene (CAS No. 207-08-9),since both of them coelute on gas chromatography .

Note: X indicates that the constituent is proposed for regulation in the individual wastestream.

TABLE 4-2
PROPOSED BDAT TREATMENT STANDARDS FOR NONWASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	CAS No.	F032 (mg/kg)	F034 (mg/kg)	F035 (mg/L)
Phenol	108-95-2	6.2		
2,4-Dimethylphenol	105-67-9	14.0		
2,4,6-Trichlorophenol	88-06-2	7.4		
2,3,4,6-Tetrachlorophenol	58-90-2	7.4		
Pentachlorophenol	87-86-5	7.4		
Acenaphthene	83-32-9	3.4	3.4	
Anthracene	120-12-7	3.4	3.4	
Benz(a)anthracene	56-55-3	3.4	3.4	
Benzo(a)pyrene	50-32-8	3.4	3.4	
Benzo(k)fluoranthene*	[a]	6.8 (sum)	6.8 (sum)	
Chrysene	218-01-9	3.4	3.4	
Dibenz(a,h)anthracene	53-70-3	8.2	8.2	
Fluorene	86-73-7	3.4	3.4	
Indeno(1,2,3-cd)pyrene	193-39-5	3.4	3.4	
Naphthalene	91-20-3	5.6	5.6	
Phenanthrene	85-01-8	5.6	5.6	
Pyrene	129-00-0	8.2	8.2	
Arsenic	7440-38-2	5.0 (mg/L TCLP)	5.0 (mg/L TCLP)	5.0 (TCLP)
Chromium	7440-47-3	0.86 (mg/L TCLP)	0.86 (mg/L TCLP)	0.86 (TCLP)
Tetrachlorodibenzo-p-dioxins	---	0.001		
Pentachlorodibenzo-p-dioxins	---	0.001		
Hexachlorodibenzo-p-dioxins	---	0.001		
Tetrachlorodibenozfurans	---	0.001		
Pentachlorodibenzofurans	---	0.001		
Hexachlorodibenzofurans		0.001		

Source: U.S. EPA, June 1995.

[a] This constituent is regulated as the sum of benzo(b)fluoranthene (CAS No. 205-99-2) and benzo(k)fluoranthene (CAS No. 207-08-9), since both of them coelute on gas chromatography.

TABLE 4-3
PROPOSED BDAT TREATMENT STANDARDS FOR WASTEWATER FORMS OF F032, F034, AND F035, WOOD PRESERVING WASTES

Constituent	F032 (mg/L)	F034 (mg/L)	F035 (mg/L)
Phenol	0.039		
2,4-Dimethylphenol	0.036		
2,4,6-Trichlorophenol	0.035		
2,3,4,6-Tetrachlorophenol	0.030		
Pentachlorophenol	0.089		
Acenaphthene	0.059	0.059	
Anthracene	0.059	0.059	
Benz(a)anthracene	0.059	0.059	
Benzo(a)pyrene	0.061	0.061	
Benzo(k)fluoranthene*	0.11 (sum)	0.11 (sum)	
Chrysene	0.059	0.059	
Dibenz(a,h)anthracene	0.055	0.055	
Fluorene	0.059	0.059	
Indeno(1,2,3-cd)pyrene	0.0055	0.0055	
Naphthalene	0.059	0.059	
Phenanthrene	0.059	0.059	
Pyrene	0.067	0.067	
Arsenic	1.4	1.4	1.4
Chromium	2.77	2.77	2.77
Tetrachlorodibenzo-p-dioxins	0.000063		
Pentachlorodibenzo-p-dioxins	0.000063		
Hexachlorodibenozo-p-dioxins	0.000063		
Tetrachlorodibenzofurans	0.000063		
Pentachlorodibenzofurans	0.000035		
Hexachlorodibenzofurans	0.000063		

Source: U.S. EPA, June 1995.

*Because benzo(b)fluoranthene and benzo(k)fluoranthene coelute on gas chromatography columns, this constituent is regulated as a sum of the two compounds.

5.0 COMBUSTION TREATMENT STANDARD AS A COMPLIANCE ALTERNATIVE FOR DIOXIN/FURAN (D/F) IN F032

5.1 Combustion Treatment Standard Alternative

EPA has established an alternative combustion treatment standard for the regulation of PCDD and PCDF in nonwastewater and wastewater forms of F032. As explained in Section 5.2, the CMBST treatment standard alternative is defined in Table 1 of the 40 CFR 268.42. Also, see Table 5-1 which presents the alternative compliance treatment standard codified today. Under this alternative compliance treatment standard monitoring of each regulated PCDD and PCDF constituent is not required as a prerequisite to land disposal if the specific PCDD and PCDF constituents in F032 are treated via combustion. Under this compliance treatment alternative, the specific UTS numerical limits of other regulated organic and metal hazardous constituents in F032 must also be met as a prerequisite to land disposal but those for PCDD/PCDF need not be. Additionally, EPA is limiting the availability of the promulgated compliance treatment alternative standard of CMBST to F032 wastes that are combusted in combustion units regulated under 40 CFR Part 266 or in a permitted combustion device operated under 40 CFR Part 264, Subpart O. Therefore, residues arising from the combustion of F032 in units operated under 40 CFR Part 265, Subpart O will have to meet applicable numerical limits for PCDD and PCDF constituents prior to disposal. EPA believes, however, that Part 265, Subpart O incinerators capable of demonstrating to EPA that the combustion of PCDD and PCDF in nonwastewater and wastewater forms of F032 would be protective of human health and the environment shall also be able to meet a CMBST treatment standard alternative. As such, EPA has established in today's final rule criteria and procedures that should enable EPA to make such determination on an ad-hoc basis pursuant to regulations under 40 CFR 268.42 (b). Section 5.5 discusses the criteria and procedures that must be met and followed for the purpose of soliciting and obtaining from EPA a CMBST treatment alternative for incinerators operating under a 265, Subpart O, permit.

Section 5.2 provides background information behind the proposed and promulgated CMBST treatment alternative. Section 5.3 presents a summary of EPA's Phase 4 Notice of Data

Availability (NODA) proposal for setting a CMBST treatment alternative for the regulation of PCDD and PCDF constituents in nonwastewater and wastewater forms of F032. And finally, Section 5.4 is a review of major comments on Phase IV NODA and EPA's rationale for promulgating a modified CMBST treatment standard alternative for nonwastewater and wastewater forms of F032. Since this alternative treatment standard is modeled after a similar treatment standard EPA established for F024 in the Third Third rule (see 55 FR 22580-22581, June 1, 1990), EPA is also amending the standard for F024.

Although EPA determined in today's final rule that a compliance CMBST treatment alternative is a feasible regulatory option for the regulation of PCDD and PCDF constituents in F032 wastes, EPA was not persuaded by the commenters' arguments that PCDD and PCDF shall be removed from the list of regulated constituents in F032, as EPA did in the promulgation of the F024 treatment standard. Current data on F032 waste streams show that the concentrations of PCDD and PCDF in F032 wastes may be, generally, within two to three orders of magnitude higher than their applicable UTS limit and that the concentrations of the regulated PCDD and PCDD in past remediation streams may reach concentrations of these constituents up to the ppm range. These hazardous constituents are routinely identified as constituents of environmental concern in clean up or remedial activities of wood preserving sites contaminated with PCP chemicals. Further, all the regulated PCDD and PCDF constituents in F032 do support the listing of F032 as a RCRA hazardous wastes. EPA is thus retaining the proposed list of regulated PCDD and PCDF constituents in F032 wastes. EPA has also promulgated in today's rule treatment limits for these constituents.

5.2 Background

Several members of the regulated community expressed concerns that EPA's proposal to regulate PCDD and PCDF constituents in F032 may result in problems finding treatment facilities willing to accept the waste. PCDD and PCDF are very controversial hazardous waste constituents that often trigger public opposition if documented at any concentrations regardless of the actual risks presented. PCDD and PCDF monitoring also adds significantly to monitoring costs. (See generally, 55 FR at 22580-81.) Commenters emphasized that owners and operators of combustion devices had informed them that their combustion facilities will not accept F032 if EPA requires the monitoring of PCDD and PCDF in combustion residues.

The American Wood Preservers Institute (AWPI) and the Penta Task Force asked EPA to consider establishing an alternative treatment standard that sets a method of treatment as an alternative to the numerical limits for F032. Because combustion is the basis for the PCDD and PCDF numerical limits, and because properly conducted combustion should effectively destroy PCDD and PCDF constituents, today's rule establishes combustion as an optional method of treatment for the regulation of specific PCDD and PCDD in nonwastewater and wastewater forms of F032. (See 40 CFR Parts 268.42 (b), Table 1, CMBST, and the CMBST footnote.) If this method of treatment is used to treat F032 in certain specified combustion devices, there is no need to monitor compliance with the PCDD and PCDF numerical limits established for PCDD and PCDF constituents. However, other organic and metal constituents regulated in F032 will require monitoring prior to disposal. This approach is patterned after EPA's promulgation of a similar treatment standard for F024, a group of several hazardous waste residues from the manufacture of chlorinated aliphatics, see 55 FR 22580-81 (June 1, 1990). See detailed discussion of this proposal in the NODA published in the Federal Register of May 10, 1996 (61 FR 21418). Also, this NODA is summarized below under Section 5.3.

In general, however, EPA agrees that providing a method of treatment as an alternative to actual PCDD and PCDF measurement will be equally protective, and will assure availability of effective treatment for these wastes. EPA is setting such treatment alternative pursuant to EPA's authority under Section 3004 (m) of HSWA directing EPA to promulgate regulations specifying levels or methods of treatment that substantially diminish the toxicity of the waste or substantially reduce the mobility of hazardous constituents from the waste. The alternative, namely not providing the alternative treatment standard, leaves open the real possibility of these wastes being refused treatment, an environmentally worse result. EPA is promulgating both levels and methods of treatment based on the experience gained with F024 waste treatment, for which there is a parallel treatment regime, has been satisfactory: these wastes are effectively treated by combustion technology, and sufficient treatment capacity has remained available once EPA promulgated the alternative treatment standard which did not require analysis of PCDD and PCDF in treatment residues.

5.3 Summary of Phase IV NODA for F032

The Penta Task Force submitted data to show that the concentrations of PCDD and PCDF in F032 are substantially lower than those EPA reported in the F032 Listing Background Document. These data consist of typical concentrations of PCDD and PCDF measured in Pentachlorophenol commercial grades used by Wood Preserving facilities as well as in F032 wastes. See Appendix K for a summary of such data. The Penta Task Force and AWPA stated their belief that F032 should be regulated like F024.

Based on: (1) the new PCP and F032 characterization data; (2) available characterization data on F024 wastes; (3) rotary kiln incineration treatment data on F024 wastes; (4) combustion studies supporting the proposed maximum achievable control technology (MACT) rule for incinerators, cement kilns, and light weight aggregate kilns combusting RCRA hazardous wastes (61 FR 17358 (April 19, 1996)); and (5) other studies examining the potential mechanisms behind the generation of PCDD and PCDF in combustion devices; EPA believes that it is technically feasible to set CMBST as an alternative method of treatment for F032 wastes. See Appendix K and Appendix L for a list of the consulted data and studies in support of the development of the CMBST treatment standard alternative. Based on these studies, EPA believes further that well operated and well designed combustion practices that operate good combustion practices can meet the treatment requirements sought by a compliance CMBST treatment standard alternative. As such, EPA also requested comments on potential regulatory controls on combustion devices to assure that PCDD and PCDF destruction is conducted in well-designed and well-operated combustion devices. EPA proposed three regulatory suboptions for implementing a CMBST standard:

> Suboption 1 -- apply the existing F024 alternative combustion treatment standard to F032 with applicable regulatory controls in 40 CFR Part 264 Subpart O, 265 Part Subpart O, or 266.

Suboption 2 -- revise the F024, and establish for F024 and F032, a CMBST standard alternative, that would have limited the combustion of F032 and F024 to RCRA permitted or interim status facility whose combustion devices demonstrate their ability to achieve a dioxin toxicity equivalent (TEQ) air emission discharge limit of 0.2 ng/dscm.

Suboption 3 -- revise the existing F024 combustion standard, namely CMBST, and to establish an alternative combustion standard for F024 and F032 that limits the combustion of F024 and F032 to RCRA permitted combustion devices under the 40 CFR 264 Subpart O.

(See NODA as published in the Federal Register of May 10, 1996 (61 FR 21418).)

5.4 Review of Major Comments on Phase IV NODA and Promulgation of a Modified Version of Suboption Three

The majority of commenters supported the proposed compliance alternative setting CMBST as a method of treatment. In addition, the majority of commenters preferred suboption 1 (i.e., allow combustion in a RCRA interim status or permitted device) to ensure that combustion is conducted in well-designed and well-operated devices. a significant number of commenters also expressed concerns that adoption of suboption 3 may exclude the use of well designed and well operated interim combustion devices operated under Part 266 rules applicable to boilers and industrial furnaces.

The majority of commenters argued that it would be premature for the Agency to adopt suboption 2 whereby a PCDD and PCDF emission limit of 0.2 ng/dscm TEQ would be established given that the Agency has only recently proposed such an emission standard for hazardous waste burning incinerators, cement, and lightweight aggregate kilns under the maximum achievable control technology (MACT) rule. See 61 FR 17358 (April 19, 1996).[5] The Agency believes that this concern is warranted given that EPA has received substantial comments on whether that standard is appropriate for those devices and has not made a final decision as to an appropriate standard.

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[5] Also available via Internet: “http:// www.epa.gov/epaoswer/ cmbust.htm”.

The Agency believes that suboption 3 (i.e., allow combustion of F024 and F032 only in RCRA-permitted devices), as proposed, was too restrictive. EPA agrees with the commenters that well designed and well operated interim units operated under 266 also qualify for the proposed alternative CMBST compliance standard. Virtually all hazardous waste incinerators have already been issued RCRA permits, and thus have demonstrated compliance with the destruction and removal efficiency (DRE) performance standard that ensures destruction of toxic organics in the waste feed. In addition, although other RCRA-regulated boilers and industrial furnaces (e.g., cement and lightweight aggregate kilns) have not yet been issued permits[6], these devices are subject to substantive interim status combustion controls. The controls limit carbon monoxide or total hydrocarbon levels in combustion gases, thus ensuring that the devices operate under good combustion conditions, and can include explicit control of PCDD and PCDF under specified conditions (see section 266.103 (c) (1)). Although these controls do not provide the explicit demonstration of destruction of toxic organics in the waste feed that the DRE standard provides, the Agency believes that they establish good combustion, and may, in some cases, provide even better assurance of operations under good combustion conditions than the DRE standard. For example, incinerators have often been able to meet the DRE standard while operating at higher carbon monoxide levels (an indicator of good combustion conditions) than allowed under the interim status standards for boilers and industrial furnaces.

Accordingly, the Agency believes that it is not necessary to restrict burning to RCRA-permitted devices because boilers and industrial furnaces operating under interim status are required to operate under good combustion conditions which should ensure destruction of toxic organic compounds in the waste feed.

The Agency acknowledges that ensuring that the combustion device operates under good combustion conditions (i.e., either under a DRE standard or by limiting carbon monoxide and total hydrocarbon levels in stack gas) may not necessarily ensure control of PCDD and PCDF emissions. This is because PCDD and PCDF can be formed in the post-combustion zone of the device--in the duct work and particulate matter control devices that operate at temperatures

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[6] We note, however, that Ashgrove Cement in Chanute, KS, was recently issued a RCRA permit.

above 350°F. However, under existing omnibus permit authority, permit writers can prescribe, on a case-by-case basis, operating requirements that can ensure appropriate combustion performance for the treatment of hazardous wastes (see 40 CFR 264.345 (a) and 266.102 (e)(2)). This authority has been invoked frequently to justify controls on permitted hazardous waste incinerators which controls are more stringent than those explicitly authorized by the regulations in 40 CFR Part 264, Subpart O. EPA believes that these authorities can be used to minimize threats to the human health and the environment that may arise from the combustion of F032 and F024.

EPA currently lacks similar Omnibus permit authorities for hazardous wastes that are combusted in incinerators regulated under Part 265.345, Subpart O. Subpart in addition, unlike the standards for interim status boilers and industrial furnaces, the interim status standards for hazardous waste incinerators do not contain controls on good combustion (i.e. CO or HC controls), a DRE requirement, or explicit standards for PCDD and PCDF. EPA is concerned, therefore, that the combustion of F032 and F024 in Part 265 incinerators may not consistently achieve the treatment objectives sought by the alternative combustion compliance treatment standard. (See also 265.352 (a), forbidding combustion of the acutely hazardous PCDD and PCDF-containing wastes in interim status hazardous waste incinerators.) As a result, EPA cannot support the promulgation of suboption 1 for incinerators operated under Part 265, Subpart O.

5.5 Criteria and Procedures for Obtaining a Determination of Equivalent Treatment that May Make a CMBST Treatment Standard Also Available for an Incinerator Combusting F032 under a Part 265, Subpart O, Permit

Although EPA has determined that an incinerator operated under Part 265, Subpart O, is generally inadequate for qualifying for a CMBST treatment standard for D/F, EPA believes that on an ad-hoc basis, a site-specific determination can be made pursuant to 268.42 (b) to extend the availability of the CMBST treatment standard to incinerators operated under Part 265, Subpart O. In considering whether to extend the availability of a CMBST treatment standard to a facility combusting F032 or F024 in a 265 incinerator, the Agency will seek to ensure that the incinerator is operating under proper combustion conditions which may be shown by meeting requirements under such provisions as 264.345 (a) and 266.102 (e)(2).

The process for obtaining the availability of a CMBST treatment standard for a facility currently combusting F032 or F024 in a Part 265 incinerator will require the accomplishment of two steps. One step is for the facility to demonstrate to a permit approving Official[7] whether or not the combustion of D/F in F032 (or F024, if applicable) at this facility (specify name and location) operating an incinerator under Part 265, Subpart O (not applicable to interim status incinerator) satisfies applicable site-specific criteria showing the device performs as well as permitted incinerators or regulated BIFs with respect to combustion efficiency and PCDD/PCDF control. This would normally require a showing that CO/HC levels are the same as those required for Part 266 BIFs or Part 264 incinerators and that CDD controls are comparable as well. The second step follows when an approving permit Official issues a written certification that such demonstration satisfies applicable site-specific combustion criteria and the facility solicits from EPA's Headquarters an equivalent treatment determination under 268.42(b) stating a determination of equivalent treatment of a CMBST compliance treatment alternative is made available to the applicant's facility burning F032 or F024. Once EPA Headquarters issues a

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[7] For the purpose of this rule, a permit approving Official shall be construed as the designated RCRA permit state Official, if the State is authorized under RCRA to issue RCRA incineration permits (under the 40 CFR 264, Subpart O; Part 265 Subpart O; and Part 266) at the State jurisdiction the facility's incinerator is located; or an EPA Regional permit Official, when the State jurisdiction that the facility is located, lacks RCRA authority to issue RCRA permits pursuant to equivalent regulations under 40 CFR Part 264, Subpart O; Part 265, Subpart O; and Part 266 .

written determination of equivalent treatment, a facility operating a 265, Subpart O incinerator will be able to meet LDR for F032 or F024 via the “CMBST” treatment standard alternative.

TABLE 5-1
COMPLIANCE TREATMENT ALTERNATIVE FOR DIOXIN AND FURAN CONSTITUENTS IN F032 WASTES

Constituent	CAS Number	Treatment Method*
Tetrachlorodibenzo-p-dioxins	---	CMBST
Pentachlorodibenzo-p-dioxins	---	CMBST
Hexachlorodibenzo-p-dioxins	---	CMBST
Tetracholorodibenzo-p-furans	---	CMBST
Pentachlorodibenzo-p-furans	---	CMBST
Hexachlorodibenzo-p-furans	---	CMBST

Compliance with this treatment method is limited only to combustion devices regulated under 40 CFR Part 264 Subpart O and Part 266. Also, a Part 265 incinerator that have obtained from EPA a treatment equivalency pursuant to the 40 CFR 268.42 (b).

6.0 DEBRIS AND MEDIA CONTAMINATED WITH WOOD PRESERVING WASTES

6.1 Land Disposal Restrictions Apply to Wood Preserving Wastes

The promulgated treatment standards for wastewater and nonwastewater forms of F032, F034, and F035 also apply to debris contaminated with these RCRA hazardous wastes and environmental media that contain these RCRA hazardous wastes (e.g., soils and groundwaters). Therefore, contaminated debris and media that contain F032, F034, or F035 may have to meet the treatment standards codified in 40 CFR Part 268.40, as a prerequisite to land disposal unless waivers from the treatment standard are obtained pursuant to appropriate regulations under RCRA or CERCLA. (See Section 6.6 for a discussion of potential waivers or variances from the treatment standards promulgated today.) For all the regulated PCDD and PCDF constituents in F032 wastes, debris contaminated with F032, and media that contain F032, EPA has promulgated an alternative compliance treatment standard that specifies combustion as prescribed treatment method of treatment. If the F032 stream is treated in accordance with such alternative combustion treatment standard, the monitoring of all the regulated PCDD and PCDF constituents is not required as prerequisite to land disposal. (For a discussion of the promulgated treatment standard compliance alternative of CMBST, see EPA's discussion in today's Phase IV preamble and Chapter 5 in this document.) In addition, hazardous debris contaminated with F032, F034, or F035 may be treated in accordance with the treatment alternative for hazardous debris in the 40 CFR Part 268.45, as a compliance alternative to the numerical limits promulgated today.

Section 6.2 summarizes major comments and EPA's responses regarding EPA's October 24, 1991, Advance Notice of Proposed Rulemaking (ANPR); the August 22, 1995, Phase IV proposed rule; and the May 10, 1996, Notice of Data Availability (NODA). Section 6.3 discusses the overlap between today's promulgated treatment standards and ongoing remedial activities. Section 6.4 summarizes EPA's rationale for regulating PCDD and PCDF in F032 wastes, debris, as well as contaminated media. Section 6.5 summarizes EPA's responses to comments regarding the proposed UTS and the performance of remediation treatment technologies. And finally, Section 6.6 discusses the availability of potential waivers or variances from the treatment standards promulgated today.

6.2 Major Comments on Soils and Debris to the Proposed Phase 4 Rulemaking and EPA Notices on the Available Data for Developing Treatment Standards for Wood Preserving Wastes

Comments to EPA’s October 24, 1991, ANPR; the August 22, 1995, Phase IV proposed rule; and the May 10, 1996, NODA emphasized generally four major concerns[8] regarding the development of treatment standards: (1) EPA's policy to apply treatment standards to wastes from remedial activities and contaminated media should be abandoned; (2) EPA should defer subjecting F032, F034, and F035 contaminated media to LDR to a schedule concurrent with EPA’s regulatory initiatives under the Hazardous Waste Identification Rule for contaminated media; (3) EPA should forgo the regulation of PCDD and PCDF constituents in F032; and (4) EPA should reconcile discrepancies for technology selection and treatment standard development among the Land Disposal Restriction and other remediation programs under CERCLA/SARA and RCRA/HSWA , namely the Superfund and the RCRA Corrective Action programs, such that risk considerations are taken into account in the developed treatment standard . In addition, other commenters argued that the proposed treatment standards for PCDD and PCDF constituents are unachievable by remediation technologies.

The above first, second, and fourth major concerns raised by the commenters are raised often on every rule setting treatment standards for hazardous wastes under the land disposal restrictions. EPA had already settled these issues in the final rule of Phase 2, as well as earlier rules. EPA is not reopening, therefore, such issues in today’s rulemaking. (See, generally, 50 FR at 47986-7 (September 19, 1994).) In addition, EPA believes that it will be illegal to adopt the commenters suggested options that EPA delays applying or exempts from the promulgated treatment standards, any media or remedial waste contaminated with F032, F034, and F035. The statue compels their prohibition from subsequent land disposal, like any other newly listed hazardous wastes (RCRA Section 3004 (g) (4); see also Chem Waste Management vs. EPA, 869

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[8] For EPA’s responses to other comments that are not addressed in this Chapter, please consult Appendix K in this Final BDAT Background Document for Wood Preserving Wastes (F032, F034, and F035) and Phase 4 Response to Comments Background Document.

F.2d, D.C. Cir. 1989). The land disposal restrictions, generally, will apply to soils or debris which are contaminated with newly listed wastes already prohibited from land disposal.

6.3 Overlap of Today's Treatment Standards and On-going Remedial Activities

Because media and debris contaminated with F032, F034, and F035 will carry wastes that are now prohibited from land disposal; the contaminated media or debris may become subject to the same land disposal restrictions applicable to these wastes. Compliance with the treatment standards may be required as a prerequisite for land disposal except for media or debris that are managed in compliance with EPA approved waivers or variances (see Section 6.6 below) from the treatment standard. EPA notes, however, that land disposal restrictions only apply to contaminated debris and media that contain hazardous waste that will be "placed" after the effective date of the applicable land disposal prohibition -- in the case of soil containing F032, F034 or F035 that will be on the date the National Capacity Variance (NCV) (see below) expires. It is important to note that not all contaminated media and debris managed during cleanups will contain hazardous waste or be restricted from land disposal. (See, for a general discussion of this issues, 61 FR 18804-06, April 29,1996.)

EPA believes any disruption to on-going cleanups of F032, F034 and F035 media or debris containing F032, F034 or F035 will be mitigated by the two year NCV. Under the NCV, debris contaminated by F032, F034, or F035 and media containing F032, F034 or F035 may be land disposed without treatment. The NCV does not, however, affect other minimum technical requirements such as lining of surface impoundments and the lining of secure landfills, which generally must be met as a prerequisite to land disposal. In addition, even after the NCV expires, on-site remedies that have already been selected and prescribed in a Record of Decision (ROD) under CERCLA's National Contingency Plan are not subject to newly promulgated regulations (including the treatment standards for F032, F034, and F035 promulgated today) unless the ROD is modified or contaminated debris or media containing F032, F034 or F035 are managed (e.g., land disposed) off the CERCLA site.[9], [10] In contrast, a ROD emphasizing the off-site treatment

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[9] Note, there is no similar exemption from new regulations for on-going remedies under the RCRA corrective action program; land disposal of contaminated debris and media containing F032, F034 or F035 would have to

and disposal of CERCLA remedial soils and remedial wastes will have to comply with the applicable treatment standards promulgated today. While EPA agrees with commenters that, generally, application of land disposal restriction treatment standards developed for “generated wastes” to remediation wastes and remedial process has a chilling effect on remediation and may be inappropriate, EPA is addressing that issue for all remediation waste through a variety of other initiatives, most notably, the Hazardous Waste Identification Rule for Contaminated Media, proposed April 26, 1996 (61 FR 18780). In the meantime, the existing construct of the land disposal restriction program, including application of land disposal treatment standards to debris contaminated with restricted waste and media containing restricted waste, will continue to apply.

6.4 Regulation of PCDD and PCDF in F032

The third major issue raised by the commenters is that by establishing treatment limits for PCDD and PCDF in F032 wastes, EPA may disrupt ongoing remediation activities and discourage voluntary clean ups. The commenters pointed out to the outcome of Solvent and Dioxin rule as an example of an EPA LDR regulation that have discouraged, generally, the remediation of media contaminated with dioxin and furan bearing wastes. This is because commercial treatment facilities often shy away from the management of hazardous wastes/soils containing PCDD and PCDF whenever EPA requires that such constituents are monitored prior to land disposal. Other commenters asked EPA to prescribe, instead, a treatment standard of CMBST for F032 wastes (and F032 contaminated debris and media that contain F032) and to delete each one of the proposed PCDD and PCDF constituents from the list of regulated constituents in F032, as EPA did for F024 in the Third Third rule. (See Third Third proposal, 54 FR 48450, November 22, 1989, and Third Third final rule, 55 FR 22580-81, June 1, 1990 (as later amended by Phase 3, see 61 FR 15588, April 8, 1996)).

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comply, as appropriate, with the F032, F034 and F035 treatment standards when the NCV expires.

[10] Additional, general, information on application of the land disposal restrictions to the CERCLA program can be found in a number of EPA guidance documents, including: Overview of RCRA Land Disposal Restrictions (LDRs) (Superfund LDR Guide # 1), Treatment Standards and Minimum Technology Requirements Under LDRs (Superfund LDR Guide # 3); Determining When the LDRs are Applicable to CERCLA Responses (Superfund LDR # 5), Obtaining a Soil and Debris Treatability Variance for Remedial (Superfund LDR # 6A) and Removal (Superfund LDR # 6B); and Determining When the LDRs are Relevant and Appropriate to CERCLA Responses (Superfund LDR Guide # 7).

EPA acknowledges the industry's concerns that today's treatment standards may drive up the demand for the combustion of hazardous soils and debris contaminated with PCDD and PCDF in F032. This is because combustion is the BDAT model technology supporting the numerical treatment limits promulgated for PCDD and PCDF and such treatment limits can be achieved, generally, by combustion technologies. EPA also agrees that the treatment standard may have a chilling effect on current or future voluntary clean up efforts by increasing the cost for complying with the land disposal restrictions and discouraging remedies that call for ex-situ treatment trains or offsite treatment and disposal. Based on the experience gained with chlorinated aliphatic (F024) and acutely dioxin (F020-23, and F026) hazardous wastes, EPA is also sensitive to concerns emphasizing that access to combustion capacity may be hindered if the combustion residues are compelled to undergo the monitoring of PCDD and PCDF constituents in F032 wastes. Normally, EPA does not change a treatment standard expressed as a concentration limit to accommodate the demands of a recalcitrant industry. However, EPA has determined today that the treatment of PCDD and PCDF in F032 (i.e. containing hazardous soils, debris, and wastes) in combustion devices that are well designed and operated meets the legal criteria under 3004 (m) for establishing treatment standards that can be expressed as a prescribed treatment method. EPA believes, further, that the combustion of these streams can be conducted in a manner that is protective of the human health and the environment. EPA believes, therefore, that is feasible to established a treatment standard expressed as Combustion and EPA has done so in today's final rule. Therefore, EPA believes that the promulgated compliance treatment standard alternative of combustion will address the commenters concern that F032 contaminated media can be treated in offsite commercial combustion facilities . (See Chapter 5 in this Final BDAT document for a discussion of EPA's rationale for setting the compliance treatment alternative of combustion.)

EPA also agrees with the commenters that the promulgated treatment standard for wood preserving wastes may not always be appropriate or achievable by some debris or hazardous media contaminated with F032, F034, and F035. Under such circumstances, EPA believes that the treatability variance process under 268.44 (h) will be able, generally, to address these concerns. Other potential waivers or variances allowed under CERCLA and RCRA may also be applicable and available. (See Section 6.6 for a discussion of potential waivers or variances from the treatment standards.)

EPA disagrees, therefore, on the recommendation urging EPA to withdraw from the list of hazardous constituents, all the PCDD and PCDF proposed for regulation in F032. First, all the PCDD and PCDF are still regulated as UTS constituents in F032. These constituents are also toxic constituents supporting the listing of F032 as a hazardous waste under Subtitle C of RCRA. Second, numerous RODs where wood preserving sites show PCP contaminants clearly show instances where PCP, PNAs, PCDD, and PCDF constituents have also contaminated groundwater bodies, surface waters, debris, and soils. Third, the concentrations of regulated PCDD and PCDF found at some of these wood preserving sites have been determined to pose a potential risk to the human health and the environment warranting the adoption of clean up and corrective measures to contain, source control, or permanently destroy the concentrations of PCDD and PCDF contaminants pursuant to EPA's authorities under the Superfund and RCRA Corrective programs.

The experience gained at wood preserving sites is that in spite of the hydrophobicity behavior of PCDD and PCDF, these constituents certainly can migrate from soils and contaminate surface waters and groundwaters. The migration of PCDD and PCDF has been attributed to the vertical and lateral displacement of Nonaqueous Phase Liquids arising from spills of PCP oils, creosote oils, and fuels at wood preserving sites practicing PCP formulations.
In addition to such organic liquids or mixtures to provide an advection migration vector for the transport of PCDD and PCDF, soluble fractions of these organic liquids or mixtures that may be left untreated in soils can also enhance the solubility of PCDD and PCDF in water due to cosolvent effects. This pervasive type of pollution has prompted EPA to impose the adoption of remedies such as containment; the soil excavation and incineration of "hot spots"[11]; and the pump and treat of groundwater, surface waters, Dense Nonaqueous Phase Liquids, and Light Nonaqueous Phase Liquids at several wood preserving facilities in order to protect the human health and the environment. EPA believes, therefore, that forgoing the regulation of PCDD and

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[11] This BDAT model technology has also been used at Superfund's National Priority List (NPL) and non-NPL sites to abate PCP, PNA, PCDD, and PCDF from soils and debris.

PCDF in F032 will be contrary to the Congressional intent for enacting HSWA seeking to a reduction of short- and long-term uncertainties associated with the land disposal of untreated hazardous wastes. In agreement with this 3004(m)'s legislative history and EPA’s construct of 3004 (m) allowing the establihment of technology based treatment standards, EPA believes that promulgation of treatment standards for the regulation of PCDD and PCDF in F032 are warranted and legal. As a result, EPA is promulgating, therefore, the treatment standards for the list of toxic PCDD and PCDF constituents proposed for regulation in F032.

6.5 UTS Limits and the Performance of Remedial Treatment Technologies

Another key concern raised by the commenters is whether or not the UTS limits promulgated can be achieved by all remediation technologies being used at wood preserving facilities. Also, commenters disputed whether some remediation treatment technologies identified in the BDAT Background Document and the Phase 4 proposal were demonstrated or not for wood preserving wastes/contaminated media. In addition, commenters believed that none of the remedial technologies reviewed by EPA can meet the UTS limits proposed for the regulation of PCDD and PCDF in F032.

To support their views that the proposed UTS limits for PCDD and PCDF are generally unachievable in soils using remediation technologies, the commenters cited disagreements among limits for the targeted clean up goals in RODs reviewed by EPA and the proposed UTS limits; other performance data for remedial technologies cited in the BDAT Background Document; the opinion of authors from other literature cited by EPA on demonstrated technologies for the treatment of soils/debris contaminated with RCRA hazardous wastes; and finally, several EPA data bases describing the commercial status or performance of remedial technologies. The cited EPA data bases include the Alternative Treatment Technology Information Center (ATTIC) Online System and the Vendor Information System for Innovative Treatment Technologies (VISITT). Based on these data bases and the Presumptive Remedy guidance for wood preserving sites, the commenters urged EPA to set treatment limits that reflect the performance of remedial technologies being used to abate or contain pollutants in contaminated soils and debris at wood preserving sites, rather than based on treatment data supporting the UTS limits.

Under the land disposal restriction program, the selection and identification of one treatment technology or various technologies as available, demonstrated, and best is driven by EPA's criteria and methodology discussed in the October 23, 1991, document titled: "Final Best Demonstrated Available Technology (BDAT) Background Document for Quality Assurance and Quality Control Procedures and Methodology." The published criteria call for the establish-ment of treatment standards which rely on the performance of technologies that can provide hazardous wastes with treatment levels that can substantially reduce the concentration of organics or the mobility of metals prior to land disposal and that can substantially minimize short- and long-term threats to the human health and the environment.

In order to implement this EPA technology based criteria, EPA compares the performance from potentially applicable and demonstrated technologies and the treatment standard is subsequently based on a technology or group of technologies that can perform "best." In order to be denoted as "best", the technology must substantially reduce the concentration or mobility of hazardous constituents being land disposed. As a result of these criteria, a technology selected as "best" may result on treatment levels that may ensure the permanent destruction of organics or the least mobile form of a metal. Based on these BDAT criteria, EPA has reviewed the available data bases and those other studies/data suggested by the commenters and re-evaluted what remediation technologies may qualify as "best." In examining the available data, EPA looked for information that will help EPA determine the developmental stage or commercial status of such technologies (e.g. full versus pilot, available, and demonstrated) and to identify performance data on such technologies (e.g. is this treatment "best"). When data were not available specifically on soils contaminated with F032, F034, or F035, EPA considered data on the treatment of other wastes, sludges, oils, or soils that are believed as difficult to treat as F032, F034, and F035.

In an effort to obtain more recent information on the remedial technologies identified in the Proposed BDAT Background Document and the proposed Phase IV rule's preamble discussion seeking data on the performance of specific remedial technologies, EPA looked for the information in the data bases/references cited by the commenters. EPA placed copies of the consulted reports/references in the administrative or public docket of today's final rule. EPA also summarized in Table 6.1 the type of information consulted and where EPA's findings or the consulted documents can be found. For example, EPA findings with regard to the commercial status of some remedial technologies can be found in Appendix K (see in particular Table K-6 for EPA responses to comments emphasizing the developmental stage of specific remedial technologies). Another example is Appendix C which summarizes all the data reviewed in support of the proposed rule including treatment data from field studies conducted on wastes as difficult to treat as wood preserving wastes.

The information described by these data bases consisted of electronically available reports or vendor/technology profiles from ATTIC, CLU IN, the Internet, and EPA guidance documents. The data available in these documents, generally, were limited to enable EPA to conduct an exhaustive or routine BDAT analyses regarding the treatment performance of the treatment technologies under review. EPA routinely examines data for the following: (1) the availability of quality assurance/quality control of data test method collection, analytical testing, validation and reporting, (2) pair data points for untreated and treated waste streams, and (3) availability of operational and design data on a given technology/test study. For instance, the vendors/EPA reports often described reduction levels that the technology was capable of achieving in terms of percent level reductions, but no data were provided with regard to the influent concentration ranges routinely managed by the technology. Other reports just provided anecdotal discussions emphasizing whether a given remediation technology or set of remediation technologies were able to meet or fail treatment standards promulgated today.

In Appendix C, EPA summarized the available performance data from field studies or the published literature which reported the concentrations of organics or the mobility of metals measured treated wastes/soils/wastewaters/remedial wastes believed as difficult to treat as F032, F034, or F035. These data appear to suggest that most remedial technologies would fail, generally, the proposed limits. However, in Table C-5 a closed examination of the studies show that deviations from the treatment standard may be up to two orders of magnitude higher than the treatment standard promulgated for most of the technologies examined except for bioremediation. Based on data: (1) in Appendix A through C; (2) Appendix F; (3) Appendix J; (4) Appendix K; (5) Appendix L; (6) in the BDAT Background Document for Newly Listed Petroleum Refining Wastes F037 and F038; and (7) in the Proposed BDAT Background Document for Hazardous

Soils; EPA believes that energy and chemical intensive technologies often can yield generally one of several out comes: (1) treat hazardous constituents in the soil/waste within the same or up to two orders of magnitude higher than the UTS limits promulgated today; (2) treat the hazardous constituents of concern in soils/wastes/ remedial wastes to a treatment level that represent a reduction of at least 90% the total concentration of hazardous constituents in wastes or soils; or (3) treat high concentrations of the constituents of concern in hazardous wastes/soils/remedial wastes up to or below the UTS limit promulgated today. These findings are in full agreement with EPA's findings in several EPA Superfund guidance documents published for the management of remedial wastes and contaminated media at wood preserving sites (see citations of Superfund documents in the fourth row in Table 6.1). These documents emphasize the need that combinations of various remedial technologies may be needed to meet targeted treatment objectives.

Based on all the available information, EPA believes, therefore, that energy and chemical intensive technologies such as thermal desorption, chemical dehalogenation, and critical fluids/solvent extraction often can reduce the amount of hazardous constituents in soils and debris prior to disposal within the context of an alternative treatability variance under the 40 CFR 268.44 (h) and normally, to the treatment limits for hazardous wastes of concern. The ex-situ application of these technologies can be engineered to provide more contact between the contaminants in soils or debris through better mixing or turbulence such that hazardous organics of concern can be brought into contact with heat or chemical reagents and to subsequently undergo further treatment prior to disposal. Likewise, for metals being treated via stabilization. These technologies along with the appropriate pretreatment of soils or debris can be optimized, generally, to overcome potential matrix interferences from recalcitrant organic and metal constituents in soils and debris. For instance, thermal desorption has been optimized to meet the UTS limits promulgated for organics at several Superfund and RCRA remedial sites within the context of 268.44(h) and of 268.45. In addition, optimization of one thermal desorption unit had allowed the delisting of F037 and F038 petroleum refining sludges from Subtitle C requirements. In contrast, EPA has determined that alternative technology options that rely in design and operational principles that are less chemical and energy intensive will perform worse than the BDAT model or other noncombustion technologies such as those emphasized above. One technology example is bioremediation. Bioremediation is a highly matrix dependant technology and often will fail to meet UTS limits. One reason is the technology's inability to remove and to destroy all the organic constituents present in the matrix. Another reason is that the technology's performance is also more sensitive to contaminant shock loadings in the soils or debris than other technologies such as thermal desorption or incineration. Like the noncombustion technologies discussed above, however, bioremediation may perform best if used as part of a treatment train that include other physical/chemical technologies that substantially reduce the organic loadings in soils. New advances on bio-augmentation research may also improve the long-term feasibility of the technology. Further, EPA's Presumptive Remedies document for wood preserving sites emphasizes the need that bioremediated soils are managed in combination with containment controls in order to minimize the potential migration of residual organics from the disposal site. This document also emphasizes the need that the technology may have to comply with the provisions of a no-migration petition in order to be used for the remediation of soils that contain hazardous wastes prohibited from land disposal.

The UTS limits promulgated for organics and PCDD and PCDF regulated in nonwastewater forms of F032 wastes (including contaminated debris and soils that contain F032 waste) are based on the performance of (and are generally achievable by) combustion technologies. The treatment limits promulgated for PCDD and PCDF constituents in nonwastewater forms of F032 are based on the combustion of solids, liquids, and soils with PCDD and PCDF bearing wastes, namely the acutely hazardous wastes F020-F023 and F026 (see 51 FR 1733, January 14, 1986). EPA's existing technical guidance documents describing technological options for treating contaminants found at wood preserving facilities often recommend incineration as a viable technology for cleaning up "hot spots" of organics and PCDD and PCDF and other organic contaminants. These guidance documents also emphasize that incineration is usually able to treat below cleanup levels and LDR treatment limits. (See <u>Presumptive Remedies for Soils, Sediments, and Sludges at Wood Treater Sites,</u> Directive 9200.5-162, NTIS #PB-95-963410; <u>Technology Selection Guide for Wood Treater Sites</u>, EPA 540-F-93-020 or Pub.9360.0-46FS; and <u>Contaminants and Remedial Options at Wood Preserving Sites,</u> EPA/600/R-92/182.)

EPA has determined that the following non-combustion technologies are also available and demonstrated for wood preserving wastes/remedial streams: (1) thermal desorption, critical fluid extraction/solvent extraction, and chemical dehalogenation for organic or chlorinated organics in nonwastewater forms of F032 and F034 and (2) stabilization and vitrification for metals in nonwastewater forms of F032, F034, and in F035. Available data on the performance of these non-combustion technologies do not necessarily support the commenters' claim that these remedial technologies will fail to meet the treatment limits promulgated today. Based on performance data available from the treatment of PNA organics in petroleum refining hazardous wastes (see BDAT Background Document for F037 and F038 Petroleum Refining Wastes) by thermal desorption and critical fluids/solvent extraction and from the treatment of organics, PCBs and PCP oils, soils, and sludges treated by chemical dehalogenation (e.g. KPEG and NaPEG) (see Appendix C), EPA believes that chemical dehalogenation (for PCDD, PCDF, and chlorinated organic constituents), critical fluid (CF-5 passes study for PNA) /solvent extraction (organics), and thermal desorption (for organics and PCDD and PCDF constituents) generally could be optimized to meet the UTS limits promulgated today for F032 and F034 and for contaminated media within the context of 268.44 (h) . In situations where EPA determines that the treatment standards are inappropriate for contaminated soils, EPA may allow the use of a remedial technology that achieve, instead, a site-specific, risk-based cleanup levels, but may not achieve the more stringent land disposal treatment standards. (See, generally, LDR treatment variance procedures under 40 CFR 268.44 (h) and for guidance on land disposal treatment variances see, September 1990 implementation guidance documents : OSWER 9347.3-06FS and 9347.3-06BFS, also known as LDR Guide # 6A and #6B, respectively and the January 8, 1997 EPA guidance memo, "Use of Site-Specific Land Disposal Restriction Treatability Variances Under 40 CFR 268.44(h) During Cleanups." Each one is available in Appendix H .) For the purpose of today's rule, EPA does not find, however, that each one of these technologies should be classified as best. For instance, the available performance data on thermal desorption show that the technology can be optimized to yield sludges, and presumably soils, with concentrations of organics well below the UTS treatment limits promulgated today.[12] Although the soil, debris, and sludges treated by thermal desorption may meet the treatment standards, residues from

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[12] See thermal desorption data in the BDAT Background Document for F037 and F038 Petroleum Refining Wastes and in the Marathon Oil Delisting Petition (see Federal Register Notice in Appendix F).

thermal desorption such as PCP oils and carbon filters will have to undergo chemical dehalogenation or combustion in order to meet the treatment standards promulgated for F032. As explained above, EPA has found that the feasibility of nonthermal treatment technologies for remediating contaminated debris or soil that contains F032 waste at wood preserving sites may require the combined use of two or more of these technologies along with other chemical/physical treatment for the purpose of meeting clean up levels or treatment objectives. This is, however, a site-specific determination, and the ability of a treatment train to meet or fail UTS or a treatability variance limit will be assessed through the findings of a feasibility study.

6.6 Potential Waivers or Variances from the Treatment Standards Promulgated Today

EPA has always stated that there is a presumption treatment standards promulgated for hazardous wastes prohibited from land disposal which may not be appropriate for contaminated soils. EPA believes, further, that such presumption can readily be verified and addressed through treatability variance procedures promulgated in the 40 CFR Part 268.44 (a), (h), and (o). In fact, it has been EPA experience under Superfund (Remedial and Removal) and the RCRA Corrective Action Programs that Part 268.44 (h) can address, generally, difficult to treat soil-matrices or contaminated soils for which EPA has determined that the nationally applicable treatment standards are inappropriate. In any case, a facility seeking such treatability variance compliance alternative will be required to meet, generally, alternative treatment limits or a level of performance that EPA believes fully satisfies 3004 (m) statutory directives.

Two other treatment alternatives available in the 40 CFR Part 268 can be found in: (1) the 40 CFR Part 268.45 (Hazardous Debris Compliance Alternative) and (2) 40 CFR Part 268.42 (b) (Alternative Treatment Methods). These treatment alternative variances may allow the establishment of other treatment limits or treatment methods, respectively.

Another compliance option that may waive treatment standards can be found in the 40 CFR Subtitle S, Part 264.552 (Corrective Action Management Units). These Corrective Program regulations under Subtitle S may allow EPA to waive LDR requirements under limited circumstances, allowing the disposal of treated or untreated soils in a Corrective

Action Management Units (CAMU) (see 58 FR 8683 (February 16, 1993)). These CAMU waivers are available for RCRA and Superfund soils contaminated with prohibited wastes. However, EPA proposed to withdraw CAMU from the 40 CFR 264, Subtitle S, once EPA finalizes the proposed regulations for hazardous media under the proposed Hazardous Waste Identification Rule. Finally, petitioners who can meet the provisions of a no-migration variance under the 40 CFR 268.6 are not required to treat. This other legal venue takes into account site-specific characteristics of the land disposal practice under review and risks models to assess whether hazardous constituents of concern will migrate or not from the disposal unit as long as the hazardous constituents remain hazardous. As a result, a facility which is granted a no-migration petition may land dispose of untreated hazardous wastes or contaminated media at the land disposal unit for which EPA has approved the no-migration petition.

In addition, it should be emphasized that not all remedial activities may trigger the land disposal restrictions. For instance, facilities which re-consolidate hazardous wastes within an area of contamination or which close the disposal unit as a landfill, also known as capping, generally would not trigger the land disposal restrictions. Similarly, facilities which remediate prohibited wastes with in-situ treatment technologies would not trigger treatment standards except for remedial wastes that are routed to an ex-situ treatment unit and the collected and the treated remedial wastes are subsequently land disposed on-site or off-site.

Section 121(d)(4) provides that under certain circumstances the Administrator may waive CERCLA remedial and removal responses from full compliance with Applicable or Relevant and Appropriate Requirements (ARARs) that have been determined by the Agency as being practicable. The application of these statutory waivers to a removal or remedial action is described below:

- o Interim measures: Compliance with an ARAR is not necessary when the removal action does not involve final clean up of a site and the final clean up will attain the ARAR.
- o Compliance will result in greater risk to the human health and the environment:

If the ARAR forces an action that would pose a greater risk to the human health and the environment, the ARAR can be waived.

- Technical impracticability: it is technically impracticable or impossible to meet from an engineering stand point.
- Equivalent standard of performance: Compliance with the ARAR is not necessary if the removal/remedial action would achieve a standard of performance that is equivalent to that required by the ARAR.[13]
- Inconsistent application: An otherwise applicable or relevant and appropriate State requirement is not an ARAR and need not to be attained when that requirement is not consistently applied to hazardous waste sites or facilities through out the State (CERCLA as well as non-CERCLA sites).
- Fund balancing: It is not a requirement of the removal or remedial program. However, when complying with an ARAR requires an expenditure that jeopardizes the Fund's ability to address other sites, the ARAR can be waived.[14]

If needed, EPA may call these CERCLA authorities to waive ARARs that trigger land disposal restrictions at Superfund sites in the National Priority List (NPL) or at sites that undergo a Removal Response. However, it has been EPA experience with NPL sites that the concerns raised by the commenters can be addressed, generally, through the treatability variance process in the 40 CFR 268.44 (h).

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[13] However, a technology -based standard may not be replaced by a risk based analysis. See 1990 NCP (44 FR 8748).

[14] See 55 FR 8750 (March 8, 1990).

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