FINAL
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR K001 (ADDENDUM) AND U051 (CREOSOTE)

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1. INTRODUCTION AND SUMMARY

This document provides the Agency's rationale and technical support for revisions to the numerical treatment standards for K001 wastes. Also presented in this document are the treatment standards for U051 (creosote) since they were also derived from the K001 performance data. It should be noted that the only changes to K001 are to the numerical standards. These changes were necessary because of misinterpretation of the K001 performance data and subsequent mathmatical errors in the K001 treatment standards promulgated in the First Third rulemaking. This document is an addendum to the supporting best demonstrated available technology (BDAT) background document for K001 wastewaters and nonwastewaters. The K001 treatment standards were originally promulgated as part of the First Third rulemaking (53 FR 31152, August 17, 1988).

This addendum provides the mathematical corrections to the original K001 treatment standards and presents the corrected K001 performance data and calculation of the revised K001 standards and U051 (creosote) standards. Information regarding other aspects of K001 wastes, i.e., industry affected and waste characterization, applicable/demonstrated treatment technologies, identification of best demonstrated available technology, and selection of regulated constituents can be accessed through the original final Best Demonstrated Available Technology (BDAT) Background Document for K001 Wastes (USEPA 1988).

This document, however, presents information on the industry affected and on waste characterization for U051 (creosote) since this information is not in the original K001 background document. Additional information on U051 with respect to applicable/demonstrated treatment technologies can be found in the Final Background Document for Organic U and P Waste and Multisource Leachate Volume C: Nonwastewater Forms of Organic U and P Waste and Multisource Leachate for Which There Are Concentration-Based Treatment Standards.

Table 1-1 BDAT Treatment Standards for K001 and U051 Wastes

Constituent	Maximum for any single grab sample Nonwastewater Total composition (mg/kg)	 Wastewater Total composition (mg/l)
Volatile Organics		
Toluene	28	0.028
Xylene(s)[a]	33	0.032
Semivolatile Organics		
Naphthalene	1.5	0.031
Pentachlorophenol	7.4	0.18
Phenanthrene	1.5	0.031
Pyrene	1.5	0.028
Metals		
Lead	0.51 (TCLP)[b]	0.037

[a]The Agency is proposing one standard for xylenes in K001 and U051, which will represent the sum of the concentrations of o-xylene, m-xylene, and p-xylene present in the waste treatment residual. The basis of concentration numbers will, therefore, be the sum of the areas under all peaks identified as o-xylene, m-xylene, or p-xylene in the chromatographic spectrum.

[b]TCLP leachate concentration (mg/l).

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industry affected by the land disposal restrictions for the polynuclear aromatic U051 waste (creosote), CAS number 8021-39-4, and presents available characterization data for these wastes. (For information on K001 waste, see The Final Best Demonstrated Available Technology (BDAT) Background Document for K001 (USEPA 1988).)

U051 wastes include discarded commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products, and spill residues, including contaminated water, soil, or debris, that are identified as toxic wastes (see 40 CFR Part 261.33). Because the methods of waste generation are so diverse, the composition of U051 wastes varies greatly. As a result, the constituents of concern may be present at concentrations from several parts per million to nearly the pure product.

2.1 Industry Affected

Table 2-1 (at the end of this section) presents the estimated number of facilities and volume of U051 waste handled in 1986. The industry that may be most affected by regulation of these wastes is the chemical manufacturing industry (SIC Codes 2865, 2869, 2899, 8071, 2951, and 2952). The degree to which an industry is affected by this proposed regulation is directly related to the degree to which the industry produces and/or uses the polynuclear aromatic hydrocarbon, creosote. Table 2-2 gives the major uses for each U051 waste.

The Agency recently conducted a survey of RCRA treatment, storage, disposal, and recycling (TSDR) facilities regarding the hazardous waste they managed in 1986. Information about 1986 volumes of U051 wastes has been extracted from the survey data base and is presented in Table 2-3.

Because of the nature of the survey, the Agency believes that the actual 1986 volumes of U051 wastes may be understated in Table 2-3. The volumes shown in Table 2-3 are given in gallons and tons; however, this should not be construed to mean that the hazardous wastes are necessarily in liquid form. The concentrations of the specific constituents in U051 wastes shown in Table 2-3 are not known, except that they are greater than zero.

2.2 Waste Characterization

Because of the varied and numerous uses for creosote and because of the many ways in which it may become hazardous waste, characterization of U051 wastes is impractical. U051 (creosote), like other polynulear aromatic hydrocarbons, is a fused-ring aromatic hydrocarbon composed solely of carbon and hydrogen. U051 wastes differ from other U wastes in that U051 wastes are not defined by one chemical or constituent, but by a group of chemicals designated by the generic term of "creosote." Cresote is a derivative of coal that contains a wide range of constituents including creosols, phenols, naphthalene, benz(a)anthracene, benzo(a)pyrene, fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and acenaphthalene.

Table 2-1[a] Estimated Number of Facilities
and Volume of U051 (Creosote) Waste Handled in 1986

Waste Code	Name	No. of generators	Volume (gal)
U051	Creosote	13	133,205

Table 2-2[b] Principal Uses for U051 (Creosote)

Waste Code	Name	Uses
U051	Creosote	Antipyretic, styptic, astringent, lubricant for die molds, agent for waterproofing, manufacture of chemicals for veterinary medicine (parasiticide, deodorant), external antiseptic and disinfectant, expectorant in treatment of chronic bronchitis, local anesthetic in dentistry, gastric sedative, and wood preservative.

Table 2-3[a] Facilites That May Generate U051 (Creosote)

Waste Code	Name	Facility	State	Quantity
U051	Creosote	Allied Signal Corp.	AL	9 ton
		Sequoia and Kings Canyon National Park	CA	4 gal
		Koppers Company	GA	1 ton
		USDOE Idaho National Engineering Lab.	ID	5 gal
		Koppers Company	IL	94 ton
		Reilly Tar and Chemical Corp.	IL	124 ton
		Koppers Company Inc.	KY	22 ton
		Clean Harbors of Braintree	MA	66 gal
		Southern Wood Piedmont Company	OH	200 ton
		Koppers Company Inc.	SC	15290 gal
		Rohm & Haas	TX	33 ton
		US Navy Norfolk Naval Base	VA	1 ton
		Koppers Company, Inc.	WI	7 ton

[a]USEPA 1986 Survey of Treatment Storage Disposal and Recycling Facilities.
[b]Hazardous Substance Databank, National Library of Medicine, 1989.

3. PERFORMANCE DATA

This section presents the corrected K001 performance data used to revise the K001 standards and calculate the U051 (creosote) standards. The performance data used to develop the K001 and U051 (creosote) treatment standards for the constituent identified in the tables in Section 2 are the performance data from incineration of K001 waste presented in Tables 3-1 through 3-9. Nonwastewater standards are based on incinerator ash residues, and wastewater standards are based on the incinerator scrubber water concentrations.

Table 3-1 Treatment Performance Data for Rotary Kiln Incinerator of K001 (Creosote) - Sample Set No. 1

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	56	<10	<0.010
Toluene	110	<10	<0.010
Ethyl benzene	57	<10	<0.010
Xylenes	120	<10	<0.010
Semivolatile Organics			
Acenaphthene	21,000	<0.13	<0.002
Anthracene	15,000	<0.13	<0.002
Chrysene	4,800	<0.17	<0.003
Fluorene	18,000	<0.13	<0.002
Naphthalene	42,000	<0.11	<0.002
Phenanthrene	41,000	<0.36	<0.006
Phenol	2,400	<0.10	<0.002
Pyrene	17,000	<0.13	<0.002

Table 3-1 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	0.035	<0.034
Arsenic	2.6	5.3	<0.004	0.041
Barium	63	81	0.38	0.76
Beryllium	<0.1	<0.1	<0.001	0.002
Cadmium	3.4	<0.4	0.004	0.87
Chromium	5.0	6.1	<0.007	0.35
Copper	35	86	0.020	0.42
Mercury	0.35	<0.25	<0.0005	0.016
Nickel	2.1	3.6	<0.015	0.48
Lead	170	<4.2	<0.042	2.5
Selenium	1.5	2.3	<0.004	0.057
Silver	<0.7	<0.7	<0.007	<0.035
Thallium	7.7	<0.5	<0.005	<0.028
Vanadium	<4.0	4.4	<0.008	0.040
Zinc	170	1.9	0.020	5.0

Source: Radian Corp. 1987.

Table 3-2 Treatment Performance Data for Rotary Kiln Incinerator of K009 (Creosote) - Sample Set No. 2

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	60	<10	<0.010
Toluene	120	<10	<0.010
Ethyl benzene	56	<10	<0.010
Xylenes	130	<10	<0.010
Semivolatile Organics			
Acenaphthalene	1,000	<0.13	<0.004
Acenaphthene	15,000	<0.13	<0.002
Anthracene	7,300	<0.13	<0.002
Chrysene	4,200	<0.17	<0.003
Fluorene	12,000	<0.13	<0.002
Naphthalene	40,000	<0.11	<0.002
Phenanthrene	32,000	<0.36	<0.006
Phenol	3700	<0.10	<0.002
Pyrene	13,000	<0.13	<0.002

Table 3-2 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	<0.034	<0.034
Arsenic	<0.4	5.3	<0.004	0.15
Barium	58	74	0.57	0.80
Beryllium	<0.1	<0.1	<0.001	<0.001
Cadmium	3.4	<0.4	<0.004	0.99
Chromium	4.8	5.3	<0.007	0.74
Copper	32	100	0.030	0.50
Mercury	0.35	<0.25	<0.0005	0.060
Nickel	<1.5	4.6	<0.015	0.51
Lead	160	<4.2	<0.042	4.5
Selenium	1.4	1.9	<0.004	0.11
Silver	<0.7	<0.7	<0.007	0.010
Thallium	8.0	<0.5	<0.005	2.4
Vanadium	<0.8	4.1	<0.008	0.060
Zinc	170	1.8	0.050	7.1

Source: Radian Corp. 1987.

Table 3-3 Treatment Performance Data for Rotary Kiln Incinerator of K001 (Creosote) - Sample Set No. 3

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	61	<10	<0.010
Toluene	100	<10	<0.010
Ethyl benzene	55	<10	<0.010
Xylenes	120	<10	<0.010
Semivolatile Organics			
Acenaphthene	19,000	<0.13	<0.004
Anthracene	12,000	<0.13	<0.002
Chrysene	4,800	<0.17	<0.003
Fluorene	16,000	<0.13	<0.002
Naphthalene	40,000	<0.11	<0.002
Phenanthrene	37,000	<1.36	<0.006
Phenol	3,600	<0.10	<0.002
Pyrene	16,000	<0.13	<0.002

Table 3-3 (Continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	0.040	<3.4
Arsenic	2.1	9.0	<0.004	0.16
Barium	70	61	0.53	0.56
Beryllium	<0.1	<0.1	<0.001	0.001
Cadmium	3.1	<0.4	<0.004	0.95
Chromium	6.4	5.8	<0.007	0.60
Copper	39	98	0.030	0.43
Mercury	<0.25	<0.25	<0.0005	0.008
Nickel	2.1	5.0	0.020	0.56
Lead	150	<4.2	<0.042	3.5
Selenium	1.2	1.8	<0.004	0.090
Silver	<0.7	<0.7	<0.007	0.010
Thallium	6.8	<0.5	<0.005	2.8
Vanadium	<0.8	4.1	<0.008	0.040
Zinc	160	3.2	0.080	9.1

Source: Radian Corp. 1987.

Table 3-4 Treatment Performance Rates for Rotary Kiln Incinerator for K001 (Creosote) - Sample Set No. 4

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	51	<0.10	<0.010
Toluene	110	<0.10	<0.010
Ethyl benzene	72	<0.10	<0.010
Xylenes	130	<0.10	<0.010
Semivolatile Organics			
Acenaphthene	16,000	<0.13	<0.004
Anthracene	8,500	<0.13	<0.002
Chrysene	4,100	<0.17	<0.003
Fluorene	14,000	<0.13	<0.002
Naphthalene	32,000	<0.11	<0.002
Phenanthrene	29,000	<0.36	<0.006
Phenol	3,900	<0.10	<0.002
Pyrene	12,000	<0.13	<0.002

Table 3-4 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	0.040	0.040
Arsenic	2.5	10	<0.004	0.28
Barium	59	48	0.31	1.0
Beryllium	<0.1	<0.1	<0.001	0.001
Cadmium	2.4	<0.4	<0.004	1.2
Chromium	7.0	8.7	<0.007	1.0
Copper	39	110	<0.006	0.51
Mercury	0.40	<0.25	<0.0005	0.29
Nickel	2.8	5.2	<0.015	0.60
Lead	110	<4.2	<0.042	5.4
Selenium	1.1	2.5	<0.004	0.12
Silver	<0.7	<0.7	<0.007	0.020
Thallium	5.3	<0.5	<0.005	3.4
Vanadium	0.82	0.8	<0.008	0.080
Zinc	120	2.8	0.010	11

Source: Radian Corp. 1987.

Table 3-5 Treatment Performance Data for Rotary Kiln Incinerator for K001 (Creosote) - Sample Set No. 5

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	58	<0.10	<0.010
Toluene	110	<0.10	<0.010
Ethyl benzene	71	<0.10	<0.010
Xylenes	130	<0.10	<0.010
Semivolatile Organics			
Acenaphthene	19,000	<0.13	<0.004
Anthracene	7,400	<0.13	<0.002
Chrysene	4,200	<0.17	<0.003
Fluorene	16,000	<0.13	<0.002
Naphthalene	29,000	<0.11	<0.002
Phenanthrene	32,000	<0.36	<0.006
Phenol	2,400	<0.10	<0.002
Pyrene	15,000	<0.13	<0.002

Table 3-5 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	0.040	<0.040
Arsenic	0.7	13	0.025	0.25
Barium	12	56	0.22	0.90
Beryllium	<0.1	<0.1	<0.001	0.002
Cadmium	0.79	<0.4	<0.004	0.45
Chromium	1.6	10	<0.007	0.65
Copper	12	130	0.008	0.45
Mercury	0.79	<0.25	<0.0005	0.19
Nickel	1.8	6.8	<0.015	0.70
Lead	37	<4.2	<0.042	3.3
Selenium	0.3	2.6	0.004	0.038
Silver	<0.7	<0.7	<0.007	0.010
Thallium	2.2	<0.5	<0.005	3.8
Vanadium	<0.8	5.2	0.020	0.050
Zinc	40	3.0	0.030	8.2

Source: Radian Corp. 1987.

Table 3-6 Treatment Performance Data for Rotary Kiln Incinerator for K001 (Creosote) - Sample Set No. 6

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Benzene	83	<0.10	<0.010
Toluene	170	<0.10	<0.010
Ethyl benzene	87	<0.10	<0.010
Xylenes	170	<0.10	<0.010
Semivolatile Organics			
Acenaphthene	17,000	<0.13	<0.004
Anthracene	9,100	<0.13	<0.002
Chrysene	4,300	<0.17	<0.003
Fluorene	14,000	<0.13	<0.002
Naphthalene	43,000	<0.11	<0.002
Phenanthrene	36,000	<0.36	<0.006
Phenol	3,300	<0.10	<0.002
Pyrene	13,000	<0.13	<0.002

Table 3-6 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) Total (mg/kg)	Treated nonwastewater (ash) TCLP (mg/l)	Treated wastewater (scrubber water) (mg/l)
Metals				
Antimony	<3.4	<3.4	0.040	0.040
Arsenic	2.6	11	<0.004	1.6
Barium	150	72	0.41	1.1
Beryllium	<0.1	<0.1	<0.001	0.001
Cadmium	3.5	<0.4	<0.004	0.46
Chromium	8.6	7.7	<0.007	0.89
Copper	38	86	0.070	0.35
Mercury	0.64	<0.25	<0.0005	0.54
Nickel	4.5	3.9	0.020	0.54
Lead	190	<4.2	<0.042	3.9
Selenium	1.1	2.8	<0.004	0.021
Silver	<0.7	<0.7	<0.007	0.020
Thallium	3.3	<0.5	<0.005	4.0
Vanadium	1.9	4.8	<0.008	0.060
Zinc	200	2.5	0.002	8.2

Source: Radian Corp. 1987.

Table 3-7 Treatment Performance Data for Rotary Kiln Incinerator for K001 (PCP) - Sample Set No. 7

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Toluene	16	<2	<0.002
Semivolatile Organics			
Acenaphthene	13,000	<0.5	<0.010
Anthracene	9,300	<0.5	<0.010
Benzo(b &/or k) fluoroanthrene	940	<0.5	<0.010
Fluoranthrene	13,000	<0.5	<0.010
Fluorene	8,200	<0.5	<0.010
Naphthalene	26,000	<0.5	<0.010
Pentachlorophenol	970	<2.5	<0.050
Phenanthrene	28,000	<0.5	<0.010
Pyrene	9,200	<0.5	<0.010

Table 3-7 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater Total (mg/kg)	Treated nonwastewater TCLP (mg/l)	Treated wastewater (mg/l)
Metals				
Antimony	<6.0	<6.0	<0.06	<0.06
Arsenic	2.9	0.8	<0.003	<0.002
Barium	30	74	0.32	0.12
Beryllium	<0.1	<0.1	<0.001	<0.001
Cadmium	0.5	<0.3	<0.003	<0.003
Chromium	1.5	8.2	<0.009	<0.009
Copper	6.7	6.8	<0.01	0.15
Lead	7.8	5.2	0.021	0.021
Mercury	0.11	<0.0002	<0.0002	<0.0002
Nickel	<2.0	<2.0	<0.02	<0.02
Selenium	<0.5	<0.5	<0.005	<0.005
Silver	<0.9	<0.9	<0.009	<0.009
Thallium	<0.3	<0.3	<0.01	<0.01
Vanadium	<2.0	<2.0	<0.02	<0.02
Zinc	64	11	<0.006	1.1

Source: USEPA 1987b.

Table 3-8 Treatment Performance Data for Rotary Kiln Incinerator for K001 (PCP) - Sample Set No. 8

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Toluene	10	<2	<0.002
Semivolatile Organics			
Acenapthene	18,000	<0.5	<0.010
Anthracene	13,000	<0.5	<0.010
Benz(a)anthracene	3,400	<0.5	<0.002
Benzo(a)pyrene	940	<0.5	<0.010
Benzo(b &/or k) fluoranthrene	2,300	<0.5	<0.010
Chrysene	3,600	<0.5	<0.010
Fluoranthrene	21,000	<0.5	<0.010
Fluorene	12,000	<0.5	<0.010
Naphthalene	43,000	<0.5	<0.010
Pentachlorophenol	3,000	<2.5	<0.050
Phenanthrene	42,000	<0.5	<0.010
Pyrene	15,000	<0.5	<0.010

Table 3-8 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater Total (mg/kg)	Treated nonwastewater TCLP (mg/l)	Treated wastewater (mg/l)
Metals				
Antimony	<6.0	<6.0	<0.06	<0.06
Arsenic	2.3	0.6	<0.003	0.12
Barium	19	21	0.19	0.24
Beryllium	<0.1	<0.1	<0.001	<0.001
Cadmium	0.6	<0.3	<0.003	<0.003
Chromium	2.7	1.1	<0.009	<0.009
Copper	11	3.0	<0.01	0.09
Lead	11	1.2	<0.01	0.18
Mercury	0.16	<0.0002	<0.0002	<0.0002
Nickel	<2.0	<2.0	<0.02	<0.02
Selenium	<0.5	<0.5	<0.005	<0.005
Silver	<0.9	<0.9	<0.009	<0.009
Thallium	<0.3	<0.3	<0.01	<0.01
Vanadium	<2.0	<2.0	<0.02	<0.02
Zinc	58	2.1	<0.006	0.61

Source: USEPA 1987b.

Table 3-9 Treatment Performance Data for Rotary Kiln Incinerator for K001 (PCP) - Sample Set No. 9

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater (ash) (mg/kg)	Treated wastewater (scrubber water) (mg/l)
Volatile Organics			
Toluene	39	<2	<0.002
Semivolatile Organics			
Acenapthene	14,000	<0.5	<0.010
Anthracene	8,500	<0.5	<0.010
Benz(a)anthracene	2,500	<0.5	<0.001
Benzo(a)pyrene	620	<0.5	<0.010
Benzo(b &/or k) fluroanthrene	1,600	<0.5	<0.010
Fluoranthrene	15,000	<0.5	<0.010
Fluorene	9,000	<0.5	<0.010
Naphthalene	37,000	<0.5	<0.010
Pentachlorophenol	920	<2.5	<0.050
Phenanthrene	32,000	<0.5	<0.010
Pyrene	11,000	<0.5	<0.010

Table 3-9 (continued)

BDAT list constituent	Untreated waste (mg/kg)	Treated nonwastewater Total (mg/kg)	Treated nonwastewater TCLP (mg/l)	Treated wastewater (mg/l)
Metals				
Antimony	<6.0	<6.0	<0.06	<0.06
Arsenic	1.1	0.4	<0.003	0.11
Barium	17	21	0.25	0.39
Beryllium	<0.1	<0.1	<0.001	<0.001
Cadmium	0.4	<0.3	<0.003	<0.003
Chromium	2.1	1.2	<0.009	0.045
Copper	10	2	<0.01	0.07
Lead	6.3	0.96	<0.002	0.20
Mercury	0.064	<0.0002	<0.0002	0.003
Nickel	<2.0	<2.0	<0.02	<0.02
Selenium	<0.5	<0.5	<0.005	<0.005
Silver	<0.9	<0.9	<0.009	<0.009
Thallium	<0.3	<0.3	<0.01	<0.01
Vanadium	<2.0	<2.0	<0.02	<0.02
Zinc	30	2.1	<0.006	0.88

Source: USEPA 1987b.

4. CALCULATION OF BDAT TREATMENT STANDARDS

The purpose of this section is to calculate revised treatment standards for K001 and treatment standards for U051 (creosote) using the available treatment performance data (presented in Chapter 3) from the BDAT treatment technologies. A discussion of how the treatment standards for these wastes were calculated is included in this section. The methodology used to calculate the K001 treatment standards is discussed in the original K001 Best Demonstrated Available Technology Background Document, August 1988. This addendum presents only the revisions to the numerical standards. (Note that the standards for lead in K001 were not changed because the K001 performance data were not used to derive the lead standard. Lead treatment data were transferred from stabilization of F006 nonwastewaters and from performanmce data for chemical precipitation and filtration and mixed waste sampled by EPA at Enviril and Co.

4.1 Revised Calculation of the K001 Treatment Standards

As stated earlier, the Agency determined that it was necessary to revise the K001 treatment standards because of misinterpretation of the K001 performance data. The misinterpretation resulted in errors to the K001 standards. For the K001 constituents, naphthalene, pentachlorophenol, phenanthrene, and pyrene, the values used to calculate the standards were incorrectly based on practical quantification limits (PQL) and not on detection levels. Since the PQL levels were 5 times higher (as stated in the K001 Onsite Engineering Report) than the detection limits, the PQL values were divided by 5 to give the detection limit. Correct standards should be based on detection limits.

For the K001 constituents toluene and xylene(s), not only were PQL values used in error, but the nonwastewater values were incorrectly stated as parts per *billion* instead of the correct units, parts per

million. These discrepancies resulted from errors and inconsistencies in the Onsite Engineering Report (OER); the inconsistencies were eliminated after the analytical data on which the OER information was derived were reviewed and reinterpreted.

4.2 Calculation of Treatment Performance Standards for U051 Waste

Treatment standards for U051 (creosote) waste are based on the transfer of performance data from incineration of K001 waste (bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol). Treatment standards for K001 wastewaters and nonwastewaters were promulgated in the First Third Final Rule on August 8, 1988, but are now being revised with the U051 standard. The standards for organics in K001 wastes were based on the performance of rotary kiln incineration of K001 nonwastewaters. Calculation of the K001 and U051 standards is shown in Tables 4-1 and 4-2.

Treatment standards for the leachable metal constituents in K001 nonwastewaters were established based on the performance of stabilization of F006 waste. Hence, treatment standards for metals (lead) in U051 nonwastewaters are also based on F006 data. (Note that the lead standards will not be revised because they were not based on K001 treatment data.)

The transfer of performance data from K001 waste treatment is particularly appropriate for U051 because K001-creosote waste (obviously) contains creosote. Because of the similarities in concentration of the major hazardous organic constituents anticipated in creosote (U051) to those in K001, and the primary use of creosote as a wood preservative (and hence the relationship to K001), the Agency has decided to regulate the same constituents in U051 that it regulated in K001.

Incineration in a rotary kiln will achieve a level of performance that represents BDAT for the organics in U051 because it treated the constituents in K001 to nondtectable levels; since U051 contains constituents similar to those in K001, the Agency believes that the same levels can be achieved for U051. Thus, EPA is promulgating concentration-based standards for six organic constituents in U051: naphthalene, pentachlorophenol, phenanthrene, pyrene, toluene, and xylenes. Based on the fact that the performance data for K001 indicate the presence of treatable quantities of lead in the incinerator ash and based on the anticipated similarities of U051 wastes to K001 wastes, EPA is also promulgating treatment standards for lead. The lead standards are based on stabilization as BDAT for U051 nonwastewaters and chemical precipitation followed by sludge filtration as BDAT for U051 wastewaters.

EPA notes, however, that if U051 is simply discarded before it is used, for example because it is off-specification, then it would not be likely to have all of the same contaminants as K001 wastes. On the other hand, when U051 is spilled at a wood preserving site, then it could contain the same contaminants, in particular pentachlorophenol and lead, as K001 wastes because of the high potential for cross-contamination from prior use of pentachlorophenol at the site. Since the Agency believes that much of the U051 waste comes from spill residues at wood preserving sites, EPA is conservatively promulgating standards that include those constituents likely to be present in this form of the waste. In situations where a facility never used pentachlorophenol or where the U051 is expected to be generated only as an off-specification product (and pentachlorophenol was never used in the production equipment), EPA anticipates that the facility's waste analysis plan could be revised so that only the constituents likely to be present in that form of the waste are monitored.

Table 4-1 Calculation of Treatment Standards for K001 (Revised) and U051 (Creosote) (Nonwastewaters)

Waste code	Constituent	Waste detection limit transferred from	Highest detection limit (DL) mg/kg	Accuracy correction factor (ACF)	Correction factor transferred from	Variability factor (VF)	Treatment standard (mg/kg) (DL x ACF x VF)
	Naphthalene	K001 (PCP)	0.5	1.06[a]	K001 (PCP)	2.8	1.5
	Pentachlorophenol	K001 (PCP)	2.5	1.05	K001 (PCP)	2.8	7.4
K001	Phenanthrene	K001 (PCP)	0.5	1.06[a]	K001 (PCP)	2.8	1.5
& U051	Pyrene	K001 (PCP)	0.5	1.04	K001 (PCP)	2.8	1.5
	Toluene	K001 (Creosote)	10.0	1.01	K001 (Creosote)	2.8	28
	Xylenes	K001 (Creosote)	10.0	1.16[b]	K001 (Creosote)	2.8	33

PCP - pentachlorophenol

[a] No recovery value was available for this constituent. Therefore, the lowest average percent recovery value was used from the K001 (PCP) semivolatiles duplicate spike data (see Appendix A, Table A-8). (Recovery values greater than 100 percent were considered to be just 100 percent for calculating the average and determining the accuracy-correction factors.)

[b] No recovery value was available for this constituent. Therefore, the lowest average percent recovery values were used from the K001 (creosote) volatile matrix spike recovery data (see Appendix A, Table A-3). (Recovery values greater than 100 percent were considered to be just 100 percent for calculating the average and determining the accuracy correction factors.)

Table 4-2 Calculation of Treatment Standards for K001 (Revised) and U051 (Creosote) (Wastewaters)

Waste code	Constituent	Waste detection limit transferred from	Highest detection limit (DL) mg/l	Accuracy correction factor (ACF)	Correction factor transferred from	Variability factor (VF)	Treatment standard (mg/l) (DL x ACF x VF)
	Naphthalene	K001 (PCP)	0.010	1.12[a]	K001 (PCP)	2.8	0.031
	Pentachlorophenol	K001 (PCP)	0.050	1.25[b]	K001 (PCP)	2.8	0.18
K001	Phenanthrene	K001 (PCP)	0.010	1.12[a]	K001 (PCP)	2.8	0.031
& U051	Pyrene	K001 (PCP)	0.010	1.0	K001 (PCP)	2.8	0.028
	Toluene	K001 (Creosote)	0.010	1.01	K001 (Creosote)	2.8	0.028
	Xylenes	K001 (Creosote)	0.010	1.15[c]	K001 (Creosote)	2.8	0.032

pcp - pentachlorophenol

[a] No recovery value was available for this constitutent; hence, the lowest average percent recovery value was used from the K001 (PCP) semivolatiles duplicate spike data (see Appendix A, Table A-7). (Recovery values greater than 100 percent were considered to be just 100 percent for calculating the average and determining the accuracy correction factors.)

[b] Recovery values for pentachlorophenol in K001 (PCP) wastewaters were below 20 percent; hence, the Agency chose the recovery value for pentachlorophenol in K001 cresote.

[c] No recovery value was available for this constituent; hence, the lowest average percent recovery value was used from the K001 (creosote) volatile matrix spike recovery data (see Appendix A, Table A-4). Recovery values greater than 100 percent were considered to be just 100 percent for calculating the average and determining the accuracy correction factors.

5. REFERENCES

National Library of Medicine. 1989. Hazardous substances data bank.

Radian Corp. 1987. Analytical results, Combustion Research Facility test burn, K001 creosote waste. Austin, Texas: Radian Corporation.

USEPA. 1986. U.S. Environmental Protection Agency, Office of Solid Waste. National survey of hazardous waste treatment, storage, disposal, and recycling facilities. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1987. U.S. Environmental Protection Agency, Office of Solid Waste. Onsite engineering report of treatment performance and operation for incineration of K001 - pentachlorophenol (PCP) and creosote at the U.S. Environmental Protection Agency Combustion Research Facility. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for K001 waste. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989. U.S. Environmental Protection Agency, Office of Solid Waste. Methodology for developing best demonstrated available technology (BDAT) treatment standards. Washington, D.C.: U.S. Environmental Protection Agency.

Windholz, M., ed. 1983. The Merck index. 10th ed. Rathway, New Jersey: Merck & Company.

Appendix A

Matrix Spike Recoveries* for K001 (Creosote and PCP), Kiln Ash Residue and Combustion Gas Scrubber Discharge Water

*All recovery values greater than 100 percent are considered as just 100 percent for the purpose of calculating accuracy correction factors.

Table A-1 K001 Creosote Ash Sample Semivolatile Organics Matrix Spike Recoveries (%)

Compound	Initial conc. (μg/g)	Amount added (μg/g)	% Recovery #1	% Recovery #2	RPD
Acid-Extractables					
Phenol	<4	67	72	65	9.7
2-Chlorophenol	<4	67	59	53	10
4-Chloro-3-methylphenol	<4	67	35	68	48
4-Nitrophenol	<20	67	1.2[a]	2.6[a]	54
Pentachlorophenol	<20	67	0[a]	0[a]	NC
Base/Neutral Extractables					
1,4-Dichlorobenzene	<4	33	48	46	4.2
N-nitroso-di-n-propylamine	<4	33	67	62	7.5
1,2,4-Trichlorobenzene	<4	33	30	30	0
Acenaphthene	<4	33	0[a]	3.4[a]	100
2,4-Dinitrotoluene	<4	33	0[a]	0[a]	NC
Pyrene	<4	33	0[a]	0[a]	NC
Percent average of recoveries			48.3	46	

NC - Not calculated.

[a]Recovery values below 20 percent were not considered in determining the average percent recovery.

Source: USEPA 1987.

Table A-2 K001 Creosote Water Sample Semivolatile Organic Matrix Spike Recoveries (%)

Compound	Initial conc. (μg/l)	Amount added (μg/l)	% Recovery #1	% Recovery #2	RPD
Acid Extractables					
Phenol	<10	100	65	61	6
2-Chlorophenol	<10	100	61	65	6
4-Chloro-3-methylphenol	<10	100	80	73	9
4-Nitrophenol	<50	100	0[a]	0[a]	NC
Pentachlorophenol	<50	100	80	85	6
Base/Neutral Extractables					
1,4-Dichlorobenzene	<10	50	61	51	16
N-nitroso-di-n-propylamine	<100	50	70	56	20
1,2,4-Trichlorobenzene	<10	50	72	54	25
Acenaphthene	<10	50	81	66	19
2,4-Dinitrotoluene	<10	50	21	17[a]	19
Pyrene	<10	50	62	60	3
Percent average of recoveries			61.2	57.4	

NC - Not calculated.

[a]Recovery values below 20 percent were not considered in determining the average percent recovery.

Source: USEPA 1987.

Table A-3 K001 Creosote Ash Sample ZK01C-3-B2
VOA Matrix Spike Recoveries (%)

	Spike level (μg/L)	S710125 ZK01C-3-B2 #1	#2	RPD
1,1-Dichloroethene	25	86	95	9.9
Toluene	25	99	110 [a]	10
Chlorobenzene	25	102 [a]	112 [a]	9.3
Benzene	25	78	88	12
Trichlorethylene	25	67	77	14
Average percent recovery		86	92	

Table A-4 K001 Creosote Water Sample ZK01C-3-B2
VOA Matrix Spike Recoveries (%)

	Spike level (μg/L)	S710125 ZK01C-3-B2 #1	#2	RPD
1,1-Dichloroethene	25	100 [a]	97	3.0
Toluene	25	103 [a]	99	4.0
Chlorobenzene	25	95	90	5.4
Benzene	25	90	85	5.7
Trichlorethylene	25	69	64	7.5
Average percent recovery		90.8	87	

[a]Recovery values greater than 100 percent are considered as just 100 percent in calculating the average percent recovery.

Source: USEPA 1987.

Table A-5 K001-PCP Ash Duplicate Matrix Spike Data
Volatile Organic Analysis

Compound	Original amount present, µg/liter	Amount spiked, µg/liter	Amount recovered, µg/liter		% Recovery	
			No. 1	No. 2	No. 1	No. 2
Toluene	3	25	30	30	108 [b]	108 [b]
Chlorobenzene	<2	25	31	30	124 [b]	120 [b]
Benzene	<2	25	22	22	88	88
Trichloroethene	<2	25	22	21	88	84
Average percent recovery					94	93

Table A-6 K001-PCP Scrubber Water Duplicate Matrix Spike Data
Volatile Organic Analysis

Compound	Original amount present, µg/liter	Amount spiked, µg/liter	Amount recovered, µg/liter		% Recovery	
			No. 1	No. 2	No. 1	No. 2
1,1-Dichloroethylene	<2	25	23	28	92	112 [b]
Toluene	<2	25	30	30	120 [b]	120 [b]
Chlorobenzene	<2	25	30	26	120 [b]	104 [b]
Benzene	<2	25	23	30	92	120 [b]
Trichloroethene	<2	25	21	21	84	84
Average percent recovery					93.6	96.8

Source: USEPA 1987.

Table A-7 K001-PCP Scrubber Water Duplicate Matrix Spike Data, Semivolatile Organic Analysis

Compound	Initial Concentration µg/g	Amount added, µg/g	Amount recovered µg/g		% Recovery	
			No. 1	No. 2	No. 1	No. 2
Acid Extractables						
Phenol	<2	200	60	45	30	22
2-Chlorophenol	<2	200	56	40	28	20
4-Chloro-3-methylphenol	<5	200	58	44	29	22
4-Nitrophenol	<10	200	3	1.5	1.5	0.8
Pentachlorophenol	<50	200	6	3.4	3	1.7
Base/Neutral Extractables						
1,4-Dichlorobenzene	<2	100	85	87	85	87
N-Nitrosodinipropylamine	<5	100	70	66	70	66
1,2,4-Trichlorobenzene	<5	100	110	120	110 [a]	120 [a]
Acenaphthene	<2	100	110	110	110 [a]	110 [a]
2,4-Dinitrotoluene	<50	100	79	84	79	84
Pyrene	<2	100	110	110	110 [a]	110 [a]
Average percent recovery					89.5	89.5

[a]Recovery values greater than 100 percent are considered as just 100 percent in calculating the average percent recovery.

Source: USEPA 1987.

Table A-8 K001-PCP Ash Duplicate Matrix Spike Data, Semivolatile Organic Analyses

Compound	Initial concentration, µg/liter	Amount added, µg/liter	Amount recovered, mg/l liter		% Recovery	
			No. 1	No. 2	No. 1	No. 2
Acid Extractables						
Phenol	2	200	170	160	85	80
2-Chlorophenol	<2	200	200	210	100	105
4-Chloro-3-methylphenol	<5	200	180	190	90	95
4-Nitrophenol	<10	200	200	180	100	90
Pentachlorophenol	<50	200	190	210	95	105
Base/Neutral Extractables						
1,4-Dichlorobenzene	<2	100	94	94	94	94
N-Nitrosodinipropyl-amine	<5	100	81	82	81	82
1,2,4-Trichlorobenzene	<5	100	95	100	95	100
Acenaphthene	<5	100	120	120[a]	120[a]	120
2,4-Dinitrotoluene	<50	100	120	120[a]	120[a]	120
Pyrene	<2	100	96	100[a]	96	100
Average percent recovery					94.3	96

[a]Recovery values greater than 100 percent are considered as just 100 percent for calculating the average percent recovery.

Source: USEPA 1987.