INCINERATION OF CREOSOTE AND PENTACHLOROPHENOL WOOD-PRESERVING WASTEWATER TREATMENT SLUDGES

by

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FOREWORD

Today's rapidly developing and changing technologies and industrial products and practices frequently carry with them the increased generation of materials that, if improperly dealt with, can threaten both public health and the environment. The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. These laws direct the EPA to perform research to define our environmental problems, measure the impacts, and search for solutions.

The Risk Reduction Engineering Laboratory is responsible for planning, implementing, and managing of research, development, and demonstration programs to provide an authoritative, defensible engineering basis in support of the policies, programs, and regulations of the EPA with respect to drinking water, wastewater, pesticides, toxic substances, solid and hazardous wastes, and Superfund-related activities. This publication is one of the products of that research and provides a vital communication link between the researcher and the user community.

This report provides the results of two incineration tests performed on wood preserving wastewater treatment sludges, RCRA Waste K001. Those wishing additional information on these evaluations are urged to contact the EPA Project Officer.

E. Timothy Oppelt, Director
Risk Reduction Engineering Laboratory

ABSTRACT

Rotary Kiln incineration tests were performed on two wastewater treatment sludges generated by wood preserving processes, RCRA Waste Code K001. This summarizes the information on waste characteristics, presents an evaluation of the treatment technology (incineration), discusses sampling and analytical problems/corrective actions, and presents the results of emission tests and the analysis of wastewater discharges. This report supplements earlier reports entitled "Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K001-Pentachlorophenol (PCP) Waste at the U.S. Environmental Protection Agency Combustion Research Facility" and "Onsite Engineering Report of Treatment Technology Performance and Operation for Incineration of K001-Creosote Waste at the John Zink Co. Test Facility."

The work described in this report was submitted by PEI Associates as partial fulfillment of Contract 68-03-3389. These reports were prepared in support of OSW's development of best demonstrated available technology (BDAT) for complying with the restriction rules on land disposal. This report covers a period from March 1987 to September 1989 and work was completed as of September 1989.

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SECTION 1

INTRODUCTION

PROJECT BACKGROUND

The Risk Reduction Engineering Laboratory (RREL) of the U.S. Environmental Protection Agency (EPA) collected data for the Office of Solid Waste (OSW) in support of OSW's development of the land disposal restriction regulations. It is OSW's responsibility to set treatment standards and performance levels based on best demonstrated available technology (BDAT).

The information collected by RREL was to be used to identify the current generators of K001, to select generators for obtaining a waste sample of K001 from a wood-preserving process that uses pentachlorophenol (K001-PCP) and one that uses creosote (K001-creosote), to select a treatment technology for evaluation, and to develop Quality Assurance Project Plans (QAPP's).[1,2] The selected treatment technology, incineration, was then tested for each K001-PCP and K001-creosote, and facility- and waste-specific onsite engineering reports were prepared.[3,4]

In addition to the OSW-required documentation of waste- and facility-specific treatment technology performance and operation, RREL was responsible for supplemental evaluations and sampling and analysis activities. These supplemental evaluations and activities, which are covered in this report, were not addressed in either the K001-PCP or K001-creosote Onsite Engineering Reports (OER's).[3,4] They were conducted as part of RREL's ongoing evaluation of the treatment of hazardous wastes.

Additional information pertaining to this study is available in the previously mentioned K001 OER's and in the "Site Test Plan/Quality Assurance Project Plan (Parts A and B): Incineration Tests of K001 and K015 at the John Zink Co. Test Facility" (revised July 10, 1987) and the "Site Test Plan/Quality Assurance Project Plan for the Combustion Research Facility Test Burn of K001."

PURPOSE

The purpose of this document is to present the data gathered on the generation and treatment of K001 (bottom sediment sludge from the treatment of wastewaters from wood-preserving processes that use pentachlorophenol or creosote) and on the incineration tests that were conducted. The combination

of this report and the OER's and QAPP's for the test burns provide all the data that were collected by PEI Associates, Inc., and U.S. EPA RREL on K001-PCP and K001-creosote during the course of producing the OER's for OSW.

SCOPE AND OBJECTIVES

The scope of this report covers a discussion of the process that generates K001, estimates of the quantities generated and their current disposition, a review of available waste characterization data, and test burns of K001. It also includes an assessment of the applicability and effectiveness of incineration as a treatment option.

Some analytical data collected during the test burn, but not presented in the K001 OER's, are also included in this report--specifically, the results of emission testing. Supplemental analytical data on the characteristics of untreated waste and the residues of incineration (i.e., scrubber water) are also presented. The K001 OER presented analytical data in terms of Practical Quantitation Limits (PQL's), which were defined as being the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions (i.e., five times the detection limit). This report includes all analytical results that were above the detection limits. Analytical results that were above the detection limit, but were less than the PQL, were not reported in the K001 OER's.

REPORT ORGANIZATION

Section 2 summarizes the findings and conclusions. Section 3 presents waste characteristics. Section 4 contains an evaluation of incineration as a treatment technology. Section 5 discusses sampling problems and corrective actions, and Section 6 presents and discusses the results of the emission tests and the analysis of wastewater discharges.

SECTION 2

SUMMARY OF FINDINGS

GENERATION OF K001

The bottom sediment sludge from the treatment of wastewaters from wood-preserving processes that use pentachlorophenol (PCP) or creosote is called K001 waste. The four-digit Standard Industrial Classification (SIC) code most often reported for the wood-preserving industry is 2491. The EPA estimates that at least 400 facilities have wood-preserving processes that could generate K001 waste.[5] Figure 1 shows, by State EPA Region, the number of wood-preserving processes that could generate K001.

WASTE CHARACTERISTICS

Table 1 presents an estimate of the major constituents in the waste and their approximate concentrations. Engineering judgment was used to determine the concentration percentage of each major constituent in the waste, based on chemical analyses of K001 wastes from wood-preserving processes using creosote and from pentachlorophenol-based treatment chemicals. Samples of K001 from two generators (one K001-PCP and one K001-creosote) were characterized during this project; results of these characterizations are described later under Waste Feed Characteristics.

CURRENT TREATMENT

Applicable treatment technologies were identified based on available waste composition data, contacts with industry, and technical publications. The technologies considered to be applicable to the untreated waste are those that treat hazardous organic compounds by reducing their concentrations.

The chemical composition of K001 waste has the greatest direct effect on the applicability of the technologies to the waste. The waste primarily consists of high concentrations of BDAT-list organic constituents, high concentrations of filterable solids, a moderate amount of water, and less than 1 percent concentrations of BDAT-list metals. Treatment technologies are needed for both BDAT-list organics and BDAT-list metals.

Incineration and fuel substitution were the treatment technologies identified as being applicable to BDAT-list organic constituents in K001. Incineration destroys the organic constituents in wastes. Like incineration,

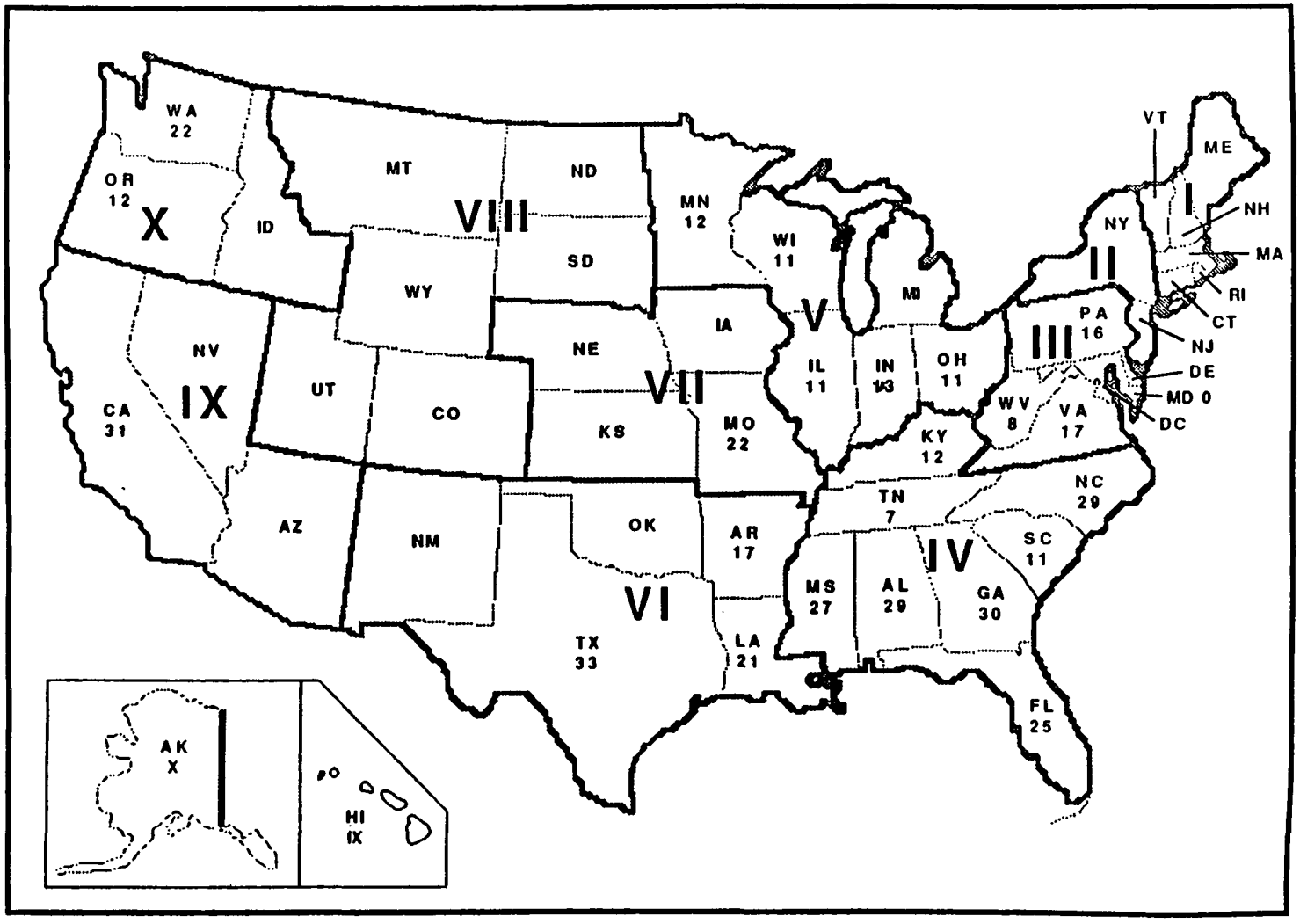

Figure 1. Number of U.S. wood-preserving facilities by State and EPA Region.

TABLE 1. MAJOR CONSTITUENTS OF UNTREATED K001 WASTE[15]

Major constituents	Concentration, %[a]
Soil	35
BDAT-list organic constituents	
Naphthalene	4.0
Phenanthrene	3.5
Fluoranthene	2.0
Acenaphthene	2.0
Pyrene	1.5
Fluorene	1.5
Anthracene	1.0
Pentachlorophenol	<1.0
Others	8.5
Water	20
Other organic compounds	14
Wood chips	5
BDAT-list metals	<1
	100

[a] Percent concentrations presented here were determined from engineering judgment based on chemical analyses.

fuel substitution destroys the organic constituents of a waste while deriving a fuel value from the waste.

The goal of incineration is the thermal destruction (oxidation) of the organic constituents of a waste. The types of incineration systems normally demonstrated on wastes are fluidized-bed, rotary-kiln, fixed-hearth, and liquid-injection systems. The EPA selected the performance of rotary-kiln incineration as adequately representing the performance achievable by other well-designed, well-operated thermal destruction technologies (including fuel substitution) capable of handling sludges of this type.[5]

Incineration technologies generally result in the formation of two treatment residuals: ash and scrubber water. For the BDAT-list metals present in the wastewater residual (i.e., scrubber water), chemical precipitation and filtration were identified as applicable treatment technologies. Chemical precipitation removes dissolved metals from solution, and filtration removes suspended solids that result from the use of an underdesigned clarifier or from the generation of precipitates that do not settle easily. The filter cake generated from filtration contains BDAT-list metals and requires stabilization before land disposal.

For the BDAT-list metals present in the nonwastewater residuals (wastewater treatment filter cake and ash), high-temperature metals recovery and stabilization were identified as applicable treatment technologies. The high-temperature metals recovery process recovers metals from wastes primarily through volatilization and subsequent condensation and collection steps. The process yields a metal product for reuse and reduces the amount of waste requiring land disposal. Stabilization chemically and physically binds metal constituents of the waste into the microstructure of a cementitious matrix, which reduces their leaching potential. Various reagents (including portland cement, cement kiln dust, hydrated limes, quick lime, fly ash, and other pozzalanic materials) have been demonstrated to act as binding reagents for various types of wastes containing metals.

RESULTS OF TEST BURNS

Nine data sets (untreated and treated waste) were collected during the test burns to characterize the treatment performance of rotary kiln incineration on K001. Three of these data sets represent K001 wastes from wood-preserving processes using PCP-based preservative chemicals, and six are from K001 wastes containing creosote. The K001-PCP used for the test burn at the U.S. EPA Combustion Research Facility (CRF) in Jefferson, Arkansas, came from Allied Chemicals in Fairfield, Alabama. Allied obtained the K001-PCP from the American Wood Division of Power Timber Company, Richton, Mississippi. The K001-creosote data sets were collected during test burns at the John Zink Co. Incineration Test Facility in Tulsa, Oklahoma. Both John Zink and the CRF used a rotary-kiln incineration system to treat the K001. The K001-creosote used for the burns at John Zink also came from Allied Chemicals. Allied obtained this particular K001-creosote from Pearl River Wood Preserving Corporation, Picayune, Mississippi. Each of the sources of K001 periodically removes the K001 from their water-treatment ponds and sends it to

Allied Chemicals for treatment in Allied's pyrolytic incinerator. Correspondence with Allied Chemicals and the trip report for the initial Allied site visit are presented in Appendix A.

Both K001 wastes proved to be incinerable; the waste streams generated by both were ash and scrubber water effluent. Four samples of K001-PCP feed taken from the CRF K001-PCP test burn were analyzed, but only three of them were representative of the incinerator feed. Because all of the waste was not incinerated, three samples each of scrubber effluent and incinerator ash were also taken from the CRF test burn and analyzed. Six samples of K001-creosote feed and six samples each of scrubber water and ash were taken from the John Zink K001-creosote test burn and analyzed. The original analytical data tables, as received from the laboratory, are included in Appendix B.

Waste Feed Characteristics

The K001-PCP waste used for the CRF test burn contained the expected levels of various analytes typically found in bottom sediment sludges of wastewaters from wood-preserving processes that use PCP. The PCP concentrations in the feed samples ranged from 920 to 3000 µg/g. The feed samples also contained fairly high levels of polynuclear aromatic hydrocarbons (PNA's) ranging up to 50,000 µg/g.

The K001-creosote (K001-C) waste used for the John Zink test burn contained the expected levels of various analytes typically found in bottom sediment sludges of wastewaters from wood-preserving processes that use creosote. The BDAT-list volatiles detected in the K001-C feed above the PQL's were benzene (up to 83 µg/g) and toluene (up to 170 µg/g). Analyses for the BDAT-list semivolatiles in the feed samples showed several polynuclear aromatic hydrocarbons and phenols that are typical of creosote waste. Naphthalene, for example, was present in concentrations up to 43,000 µg/g, and anthracene, fluoranthene, fluorene, phenanthrene, and pyrene were all present in concentrations exceeding 10,000 µg/g.

Characteristics of Incinerator Residuals

K001-PCP--

No BDAT volatiles or semivolatiles were detected above the PQL in the K001-PCP ash, ash TCLP, and scrubber water samples. The BDAT-list metals found in the ash that were above the PQL were arsenic (up to 0.8 ppm), barium (up to 74 ppm), chromium (up to 8.2 ppm), copper (up to 6.8 ppm), lead (up to 5.2 ppm), and zinc (up to 11 ppm). Only lead (0.021 µg/ml in one sample) and zinc (0.03 µg/ml in one sample) were detected above the PQL in the TCLP extracts of the ash. Arsenic, barium, copper, lead, and zinc were detected above the PQL in the scrubber water samples.

No BDAT-list dioxins or furans were detected above the method detection limit in any of the K001-PCP samples.

K001-Creosote--

With one exception, no BDAT-list volatiles or semivolatiles were detected in the K001-C ash, ash TCLP, or scrubber water samples above the

PQL. One ash sample contained 0.93 µg/g of di-n-butylphthalate.

Barium (up to 150 ppm), copper (up to 39 ppm), lead (up to 190 ppm), and zinc (up to 200 ppm) were the major BDAT-list metals found in the feed samples. The ash contained arsenic, barium, chromium, copper, selenium, vanadium, and zinc above the PQL, but the TCLP extracts contained only barium and zinc above the PQL (both were less than 1 mg/liter). Lead (up to 5.4 mg/liter), thallium (up to 4.0 mg/liter), and zinc (up to 11 mg/liter) were the major metals present in the scrubber water samples.

No BDAT-list organophosphorous pesticides, organochlorine pesticides, polychlorinated biphenyls (PCB's), organochlorine herbicides, dioxins, or furans were detected above the PQL in any of the K001-C samples.

Atmospheric Emissions

K001-PCP--

Atmospheric emission test results during the K001-PCP test burn suggest that this waste can be incinerated in compliance with the incinerator regulations governing principal organic hazardous constituent (POHC) destruction and removal efficiency (DRE).[6] Eleven POHC's were designated for the waste: pentachlorophenol and 10 polynuclear aromatic hydrocarbon (PNA) compounds. For both tests, DRE's were greater than 99.99 percent for 10 of the 11 POHC's. The DRE's for the eleventh POHC (naphthalene for one test and acenaphthylene for the other) were 99.984 percent.[6]

K001-Creosote--

Atmospheric emission test results during the K001-C test burn suggest that this waste can be incinerated in compliance with the incinerator regulations governing POHC DRE. Anthracene, acenaphthene, naphthalene, phenanthrene, and fluroanthene were designated as POHCs during the test. For all three emission tests, DRE's were greater than 99.99 percent for the five POHC's.

EFFECTIVENESS OF TREATMENT

As demonstrated by these tests, incineration appears to be an effective method for treating K001-PCP and K001-C. The CRF rotary-kiln incineration system appeared to operate normally during the K001-PCP test and the John Zink rotary kiln incineration system appeared to operate normally during the K001-C test.

SECTION 3

WASTE CHARACTERIZATION

By definition, K001 is the bottom sediment sludge from the treatment of wastewaters from wood-preserving processes that use creosote or pentachlorophenol. This waste contains toxic organic substances, carcinogens, and suspected carcinogens (including PCP, toluene, phenanthrene, fluoranthene, and naphthalene). An estimated 400 facilities in the United States have wood-preserving processes that could generate K001 waste.[5] This waste is currently landfilled or incinerated.

This waste characterization includes 1) a description of how the waste is generated, 2) results of laboratory analyses to determine the major constituents present in the waste, and 3) the significant parameters of the waste. [Analytical data on constituents detected in the waste samples taken during the test burns EPA conducted at the CRF (K001-PCP) and the John Zink Test Facility (K001-C) are reported in Section 4.]

WASTE GENERATION

As shown in Figure 2, wood preservation in which pentachlorophenol or creosote is used generates wastewaters containing the hazardous constituents present in the preservatives. Creosote is a derivative of coal containing a wide range of constituents, including creosols, phenol, 2,4-dimethylphenol, naphthalene, benz(a)anthracene, benzo(a)pyrene, fluoranthene, benzo(b)fluoranthene, chrysene, benzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and acenaphthalene. Treatment of these wastewaters by any means (including simple settling) generates the listed waste K001.

The wood-preserving process consists of two steps: 1) pretreatment of the wood to reduce its natural moisture content, and 2) impregnation of the wood with preservatives, including pentachlorophenol and/or creosote. These agents are added to the wood to increase its resistance to natural decay, attack by insects, and microorganisms. Drippings and condensed vapors generated during the preservation treatment are sent to an oil-water separator. In the oil-water separator, wood treatment chemicals are recovered and recycled back to the preserving process. The wastewater, which is contaminated with components of pentachlorophenol, creosote, and/or other related compounds, is pumped to a wastewater treatment plant. The treatment residual generated is the listed waste K001.[5]

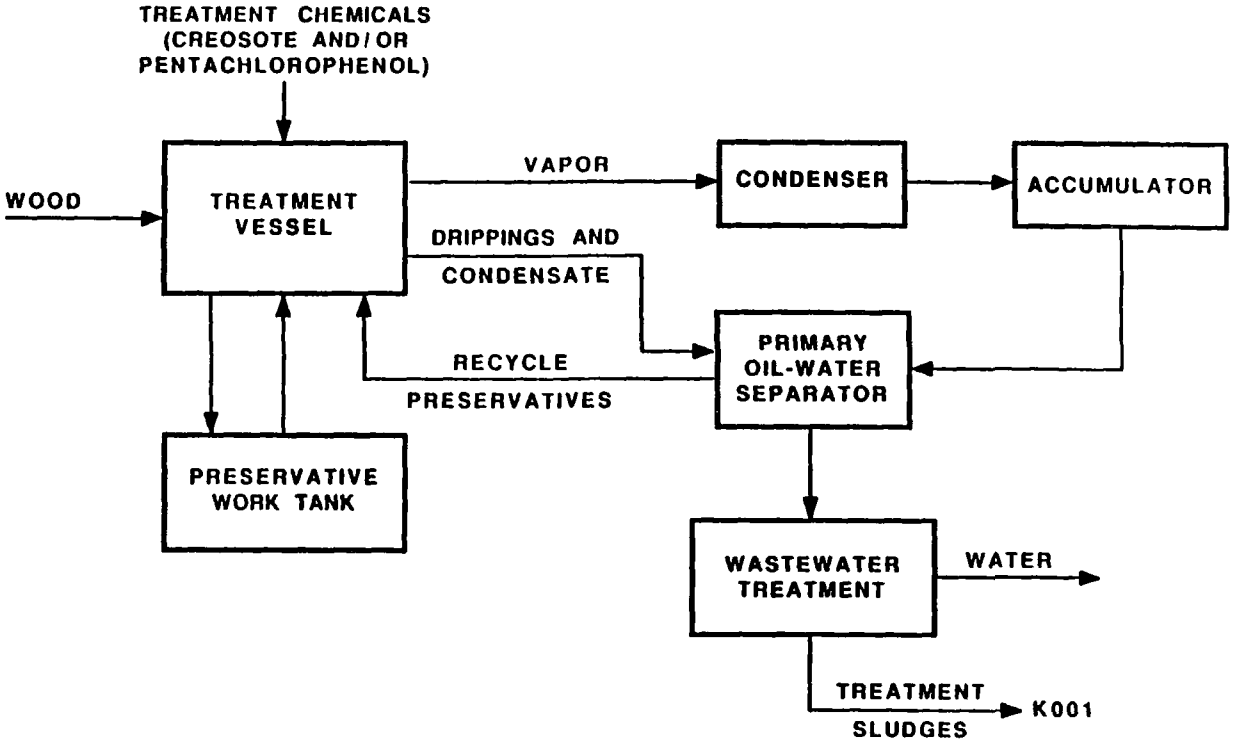

Figure 2. Schematic of wood-preserving process.

ANALYSIS FOR MAJOR CONSTITUENT

Both the K001-PCP burned at the CRF and the K001-C burned at John Zink were black "sloshy sludges." Laboratory analyses were used to determine the concentrations of the major constituents of the untreated K001 waste samples obtained for the test burns. These concentrations, which are documented in Section 4, are summarized as follows:

K001-PCP

Constituent	Concentration, percent
Soil	40
Water	30
Wood chips	10
BDAT constituents	15
Other organic compounds	5
	100

K001-Creosote

Constituent	Concentration, percent
Soil	30
Water	20
Wood chips	10
Naphthalene	4.0
Phenanthrene	3.5
Fluoranthene	2.5
Other BDAT-list constituents	14
Other organic compounds	20
	100

The preceding compositions were determined by engineering judgment based on chemical analyses.

The EPA has obtained compositional data from this testing program and from numerous literature sources.[5] Table 2 summarizes the ranges of BDAT-list constituents present in the K001 wastes, including the data collected from the CRF and John Zink burns.

The data in Table 2 show the wide ranges of concentrations of hazardous organics that may be present in the wastes. Such variations may be attributed to the type of preservative chemicals used and the type of waste-water treatment systems used. Generally, these K001 wastes contain numerous polynuclear aromatic compounds and chlorinated phenolics present in the wood preservatives. No characterization data identified in the literature for K001 had values for BDAT-list metals. The K001 wastes from two generators (one K001-PCP and one K001-creosote) were characterized during this project.

TABLE 2. UNTREATED KOO1 WASTE TOTAL COMPOSITION
(ppm)

BDAT-list constituent	Source of data*						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
Acenaphthene	-+	3,000	-	-	-	15,000-21,000	13,000-18,000
Anthracene	8,410	-	-	-	-	7,300-15,000	8,500-13,000
Chrysene	-	45	9.29	4.5	2.1	4,100-4,800	<2,500-3,400
Fluoranthene	5,090	1,400	-	-	-	BQL**	13,000-21,000
Naphthalene	43,640	1,200	-	-	-	29,000-43,000	26,000-43,000
Pyrene	604	52	-	-	-	12,000-17,000	9,200-15,000
Phenanthrene	8,410	3,200	-	-	-	28,000-42,000	28,000-43,000
Pentachlorophenol	1.84	-	4.8	302	58	BQL	920-3,000
2,4-Dichlorophenol	1,650	-	-	-	-	BQL	BQL
p-Chloro-m-cresol	1,690	-	-	-	-	BQL	BQL
2,4-Dimethyl phenol	-	8.2	-	4.4	3.4	BQL	BQL
Benzo(g,h,i)perylene	-	84	-	-	-	BQL	BQL
Fluorene	-	1,400	-	-	-	12,000-18,000	8,200-12,000
Dibez(a,h)anthracene	-	-	0.052	-	-	BQL	BQL
Benz(a)anthracene	-	-	1.25	3.7	0.149	BQL	<2,500-3,400
Benzo(a)pyrene	-	-	5.98	-	-	BQL	<250-340
Phenol	-	-	4.5	9.0	16	2,400-3,900	BQL
2-Chlorophenol	-	-	0.30	39	1.2	BQL	BQL
2,4,6-trichlorophenol	-	-	-	-	25	BQL	BQL
Benzo(b and/or k) fluoranthrene	-	-	-	-	-	BQL	940-2,300

+ - = No data.

* (a) Reference 7.
(b) Reference 7.
(c) Reference 8.
(d) Reference 8.
(e) Reference 8.
(f) Reference 9.
(g) Reference 10.

** BQL = Below quantitation limit.

TABLE 2 (continued)

BDAT-list constituent	Source of data*							
	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
Acenaphthene	-+	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	-	-
Chrysene	-	-	-	1-170	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-
Naphthalene	20,000	-	-	-	1.7-150	-	-	-
Pyrene	-	-	-	-	0.17-440	-	-	-
Phenanthrene	-	-	-	3.5-900	-	-	-	-
Pentachlorophenol	50,000-200,000	10,000	0.034	-	-	55-1,500	0.18-30	20,000-50,000
2,4-Dichlorophenol	-	-	-	-	-	165	-	-
p-Chloro-m-cresol	-	-	-	-	-	0.17	-	-
2,4-Dimethyl phenol	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-
Fluorene	-	-	-	0.93-560	-	-	-	-
Dibez(a,h)anthracene	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	0.014-0.37	1-260	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-
Phenol	-	10,000	5.043	-	-	<5.0	0.45-1.6	-
2-Chlorophenol	-	-	-	-	-	-	0.12-39.6	-
2,4,6-trichlorophenol	-	-	-	-	-	2.5	-	-
2,4-Dinitrophenol	-	-	0.024	-	-	-	0.3-0.8	-
"Creosote"	-	-	10	-	-	-	-	-

+ - = No data.

* (h) Reference 7.
(i) Reference 11.
(j) Reference 8.
(k) Reference 12.
(l) Reference 13.
(m) Reference 13.
(n) Reference 14.
(o) Reference 15.

The results of these characterizations were presented earlier under Waste Characteristics in Section 2.

SIGNIFICANT PARAMETERS

Selected parameters of the waste sampled that would affect treatment performance were characterized. These selected parameters of the sampled K001 waste from Allied were as follows:

K001-PCP[3]

Parameter	Range of determined values
Ash content	12 to 51%
Heating value	3800 to 8300 Btu/lb
Water	8 to 41%
PCP	970 to 3000 ppm

K001-Creosote[4]

Parameter	Range of determined values
Ash content	10 to 35%
Heating value	10,000 to 11,000 Btu/lb
Water	5 to 20%
Volatile matter	45 to 85%

SECTION 4

TREATMENT TECHNOLOGY EVALUATED

Currently, K001 generators dispose of the waste in one of two ways: 1) by incineration at permitted incinerators (several generators send their waste to Allied Chemicals), or 2) by landfilling.

Because of the high organic content of K001 waste and the current use of incineration as a treatment technique, rotary kiln incineration was evaluated for possible treatment of this waste. Two rotary kiln incineration systems were tested: 1) one at the U.S. EPA Combustion Research Facility (CRF) near Jefferson, Arkansas (for K001-PCP), and 2) the other at the John Zink Company in Tulsa, Oklahoma (K001-creosote). The tests are described in detail in the QAPP and OER.[1,4]

DESCRIPTION OF INCINERATION SYSTEMS

U.S. EPA Combustion Research Facility

The unit selected for the incineration of the K001-PCP samples was a pilot-scale rotary kiln incinerator managed by the U.S. EPA at its Combustion Research Facility in Jefferson, Arkansas. Table 3 presents the design characteristics of this system. Although the kiln is designed to operate at temperatures up to 1000°C (1832°F), it has reached temperatures of 1150°C (2100°F) when incinerating feed material with a high heating value. Figure 3 presents a schematic diagram of the overall system.

The combustion gases from the kiln pass through an afterburner for further incineration. The design temperature of the afterburner is 1200°C (2200°F). Both the kiln and the afterburner use propane as startup fuel and as supplementary fuel during a waste burn.

During the test burn of K001-PCP, a ram feeder was used to inject 1.5-gallon, cylindrical, fiber packs containing the feed material. One or two fiber packs were manually placed in the ram feeder, the access door was closed, and the ram was activated to inject the fiber packs directly into the rotary kiln. The ram feeder operator (stationed at the equipment) controlled the feed rate.

The hot combustion gases leaving the afterburner entered a venturi scrubber and then a packed tower, a carbon bed, and a high efficiency particulate air (HEPA) filter in series (Figure 3). An induced-draft (I.D.) fan followed the HEPA filter in line. Typical rotary kiln gas-handling systems

TABLE 3. DESIGN CHARACTERISTICS OF THE CRF ROTARY-KILN SYSTEM

Characteristics of the main chamber		
Length (inside)	2.13 m (7 ft)	
Diameter (inside)	0.95 m (3.12 ft)	
Chamber volume	1.74 m^3 (61.4 ft^3)	
Rotation	Clockwise or counterclockwise 0.1 to 1.5 ppm	
Construction	0.63-cm (0.25-in.) thick cold rolled steel	
Refractory	12.7-cm (5-in.) thick high-alumina castable refractory with variable depth to produce a frustroconical effect for moving inerts	
Solids retention time	1 h (at 0.2 rpm)	
Burner	American Combustion	
Primary fuel	Propane	
Feed system	Liquids:	Front-face, water-cooled lance with positive-displacement pump
	Semiliquids:	Front-face, water-cooled lance with double-diaphragm pump
	Solids:	Ram feeder or metered twin-auger screw feeder
Temperature[a]	1000°C (1832°F)	
Characteristics of the afterburner chamber		
Length (inside)	2.74 m (9 ft)	
Diameter (inside)	0.91 m (3 ft)	
Chamber volume	1.80 m^3 (63.6 ft^3)	

(continued)

TABLE 3 (continued)

Construction	0.63-cm (0.25-in.) thick cold rolled steel
Refractory	15.24-cm (6-in.) thick high-alumina castable refractory
Retention time	Depends on temperature and excess air (1.2 to 2.5 seconds)
Burner	Iron Fireman, Model C-120-G-SMG, rated at 530 kW (1.8×10^6 Btu/h or 31.6 MJ/s)
Primary fuel	Propane
Temperature	1200°C (2200°F)
Characteristics of the air pollution control system	
System capacity	Inlet gas flow of 106.8 m^3/min (3773 acfm) at 1200°C (2200°F) and 101 kPa (14.7 psia)
Pressure drop	Venturi, 7.5 kPa (30 in. WC) Packed tower, 1.0 kPa (4 in. WC)
Liquid flow	Venturi, 77.2 liters/min (20.4 gal/min) at 69 kPa (10 psig) Tower, 115 liters/min (30 gal/min) at 69 kPa (10 psig) Blowdown, 7.6 to 9.5 liters/min (2 to 2.5 gpm)
pH control	Feedback control by NaOH solution addition
Packing	Saddles

[a] Operating temperatures in excess of 1000°C (1837°F) have been generated. Waste treatment effectiveness under these conditions should not be affected.

SAMPLE ID	SITE DESCRIPTION	SAMPLE DESCRIPTION
A	Drums	Waste Feed Before Packing
B	Ash Bin	K001-PCP Ash
C	Venturi Scrubber	Scrubber Makeup
D	Recirculation Tank	Scrubber Blowdown

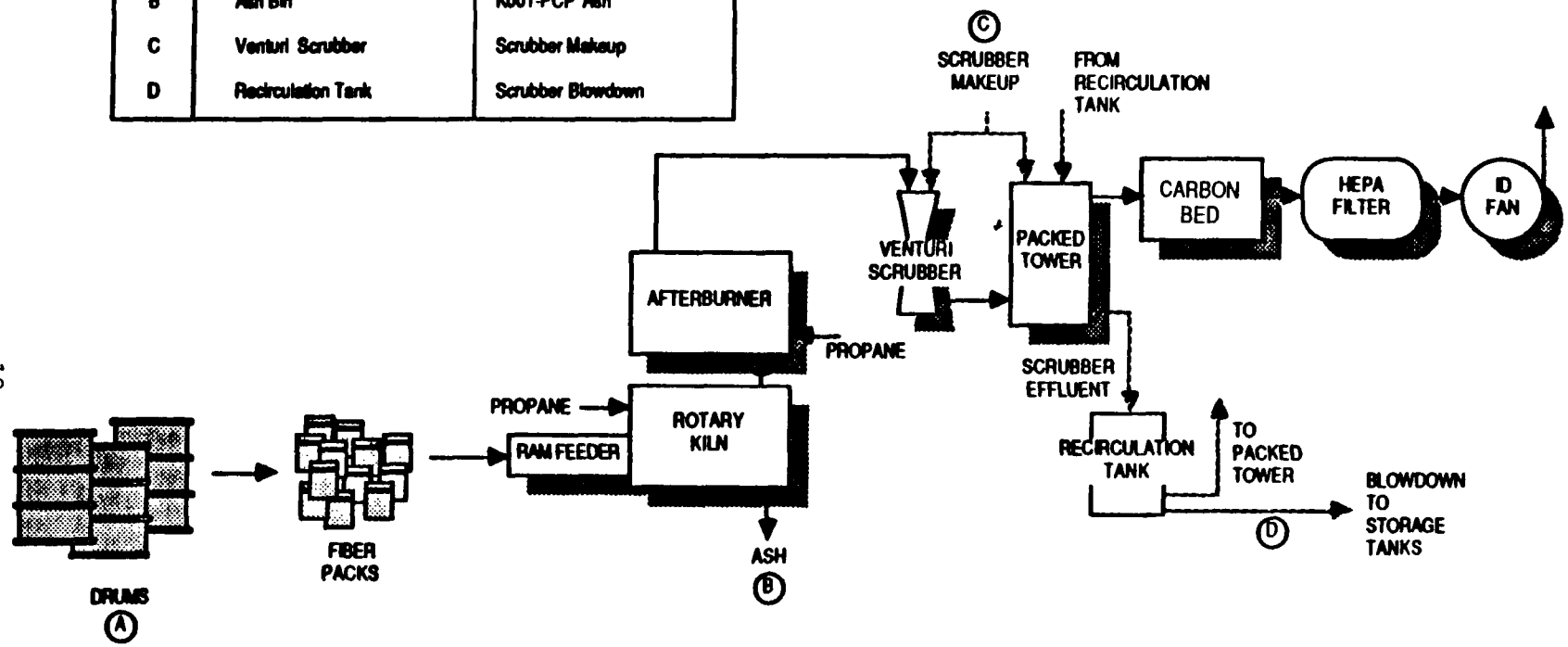

Figure 3. CRF rotary-kiln incineration system and sampling points.

consist of a venturi scrubber for particulate control and a packed column for gaseous pollutant control (i.e., hydrogen chloride). The carbon bed and HEPA filter were added to the CRF system because of operating permit requirements.

Sodium hydroxide was added to the scrubbing system (venturi and packed tower) to maintain a pH greater than 7. Makeup water was added at a rate of 5 to 10 gallons per minute, and the water system was blown down continuously at a rate of 2.0 to 2.5 gallons per minute.

The exits of the afterburner and the packed-bed scrubber were equipped with continuous monitoring and recording equipment for oxygen (O_2), carbon monoxide (CO), and carbon dioxide (CO_2). A computer recorded other operating parameters every 20 seconds (e.g., propane flows, combustion air, temperature). Every 15 minutes, an operator manually recorded critical parameters, which included O_2, CO, CO_2, temperature, scrubber pressure drop, feed rate, and makeup and blowdown water flows.

The temperature in the kiln was controlled by adjusting the waste feed rate, combustion air, and/or supplementary fuel. Waste feed rate was manually controlled by changing the rate of waste-filled fiber packs fed to the incinerator. Combustion air and supplementary fuel were also manually controlled by valve adjustments.

Detailed data collected during the test (manually by operators and on computer printouts) are presented in the K001-PCP OER[3] and in the Acurex report of the K001-PCP CRF Test.[6] The Acurex test report is presented as Appendix B.

John Zink Co. Incineration Test Facility

The John Zink incineration test facility was selected for the incineration of the K001-creosote samples. Figure 4 presents a schematic of the test facility used. The test system consisted of a rotary kiln and afterburner for combustion, a ram feeder for feeding waste-filled fiber packs into the kiln, a water quench for kiln ash, and a venturi scrubbing system for flue gas treatment. In addition to this equipment, the Oklahoma State Department of Health (OSDH) requires that an additional afterburner (a fume incinerator) be used during all tests involving hazardous waste. This unit provides further thermal treatment of the flue gas from the primary combustion system. All process monitoring and sampling for the BDAT program were conducted upstream of this unit.

The minimum input to rotary kiln incineration systems (including waste and natural gas supplementary fuel) is 2 million Btu/h; the maximum is 3 million Btu/h. The waste feed rate was controlled by ramming the fiber packs containing K001-creosote into the kiln at specified time intervals. Supplementary fuel input was manually controlled through a valve. The kiln provided a 1-hour solids residence time at 0.25 rpm (adjustable, 0.25 to 2 rpm). The kiln afterburner provided a flue gas residence time of 2.2 seconds at 2000°F (design residence time is 2.4 seconds at 2200°F).

SAMPLE ID	SITE DESCRIPTION	SAMPLE DESCRIPTION
A	Drums	Waste Feed During Packing
B	Ash Bin	Bottom Ash
C	Solids Separator	Fly Ash
D	Water Separator	Scrubber Water Before Waste Feed
E	Water Separator	Scrubber Water During Waste Feed

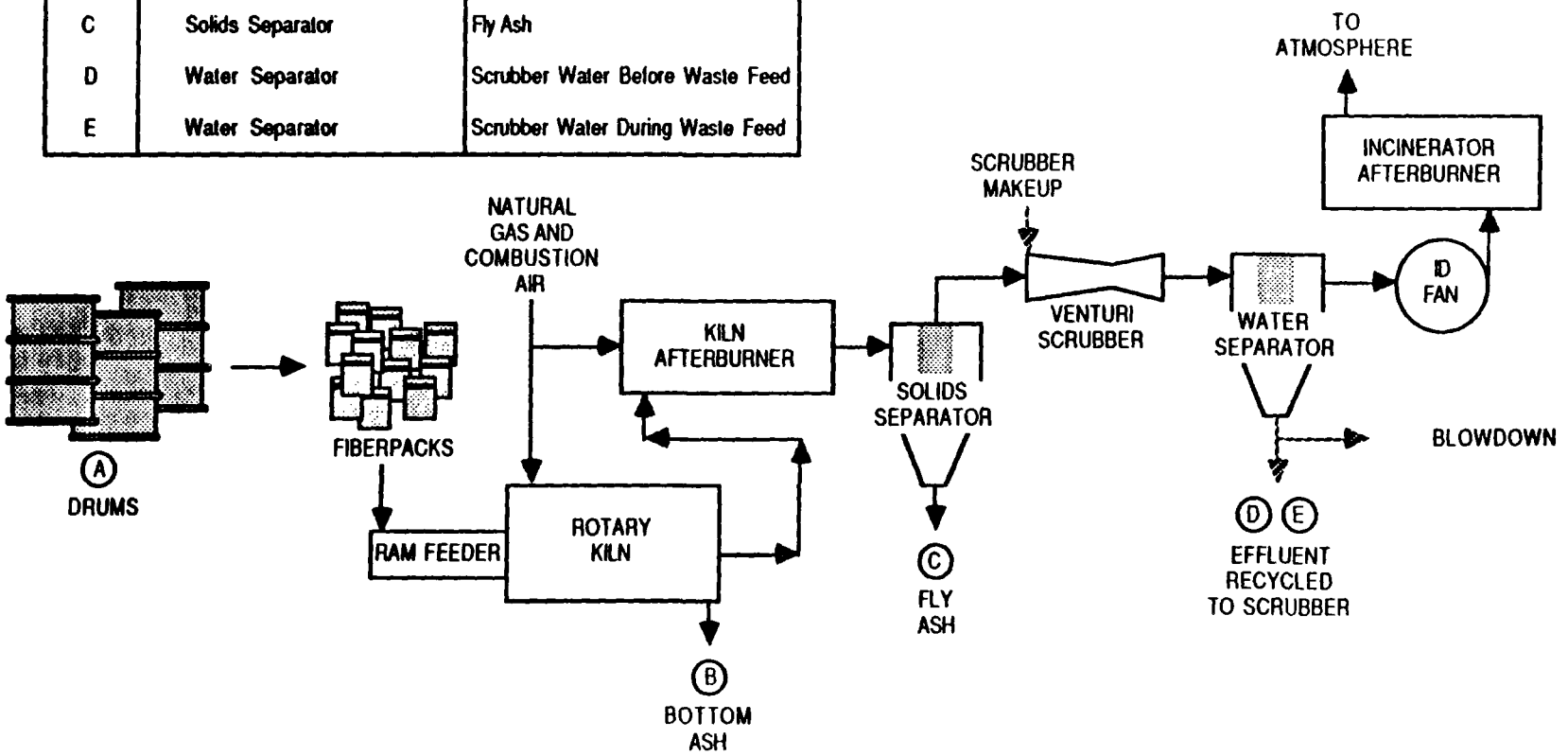

Figure 4. John Zink rotary-kiln incineration system and sampling points.

The hot combustion gases leaving the kiln afterburner entered a solids separator (cyclonic), which elevated the flue gas (i.e., the duct exiting the separator is higher than the duct entering the separator) and removed any large pieces of fly ash that might damage downstream equipment. The gases then entered an adjustable-throat venturi scrubber, which was followed by a droplet separator consisting of a cyclonic-flow knockout chamber and a vent stack.

No chemicals were added to the scrubber water during the K001-C tests, and the scrubber did not require blowdown because the waste contained no halogens, sulfur, or other compounds that would significantly affect the recycled scrubber water. Makeup water, however, was continuously added to the scrubbing system because of evaporation losses.

The rotary kiln incineration system was equipped with multiple temperature- and pressure-measuring devices that were monitored by plant operators and engineers. At 30-minute intervals, the operator recorded temperatures in the incinerator (kiln and afterburner). PEI monitored these parameters at 15-minute intervals during the K001-creosote tests. The following data also were recorded manually from pressure gauges, rotometers, manometers, and other instruments located on the incinerator and associated equipment:

- % O_2 in stack gas
- Fiber pack feed rate
- Natural gas rotometer (%/psi)
- Venturi rotometer (% of full scale)
- Combustion air (ΔP)
- pH of scrubber and quench water (litmus)
- Scrubber recycle tank water level (inches)
- Makeup water rotometer (% of full scale)
- Effluent rotometer (% of full scale)
- Venturi ΔP (in. H_2O)

Temperatures were controlled by manually changing the supplementary fuel feed rate, the waste feed rate, and/or the combustion air flow rate. Supplementary fuel and combustion air are controlled by manually operated valves.

Continuous monitoring and recording of CO_2, CO, O_2, and temperature took place at the exit of the kiln afterburner, at a point prior to the solids separator. Other system performance monitoring conducted by John Zink Co. consisted of continuous monitoring of temperature, CO, O_2, and NO_x in stack gases exiting the OSDH-required afterburner on the test system.

Detailed data collected during the K001-creosote test are presented in the K001-creosote OER[4] and the John Zink test report. The John Zink test report is included as Appendix C.

TEST DATA

Detailed analyses of the K001 incinerator feed and of the residues of incineration (ash and scrubber water) were made to determine the presence of

BDAT-list compounds and selected non-BDAT compounds. The types of compounds analyzed in each sample are listed in Table 4 (K001-PCP) and Table 5 (K001-creosote). One sample each of the untreated K001-creosote and the resulting bottom ash and scrubber water was analyzed for all BDAT-list compounds.

Separate tables giving results for each parameter class (e.g., volatile organics, semivolatile organics) are presented for each sample type. These tables also present the quantitation limits for each analyzed constituent, which is five times the detection limit achieved on a given analysis. The multiple used to derive a quantitation limit from the detection limit is laboratory-specific. As the concentration of an analyte approaches the detection limit, the accuracy and precision of the determination diminish. The quantitation limit is used to flag results where greater variation is expected. Compounds that were detected, but are below the quantitation limit, are noted in the tabulations.

K001-PCP

The time and dates of samples collected for the K001-PCP test burns at the CRF are presented in Table 6. The following is a listing of the tables that show the samples types and the results for each parameter class:

Sample type	Analytical results table
K001-PCP composition	
Volatile organics (tetraglyme extract)	7
Volatile organics (methanol extract)	8
Semivolatile organics	9
Metals	10
Total organic carbon	11
Dioxins/furans	12
Ash composition	
Volatile organics (tetraglyme extract)	7
Volatile organics (methanol extract)	8
Semivolatile organics	13
Metals	14
Total organic carbon	15
Dioxins/furans	16
TCLP volatile	17
TCLP semivolatiles	18
TCLP metals	19
Scrubber water composition (makeup and effluent)	
Volatile organics	20
Semivolatile organics	21
Metals	22
Purgeable/nonpurgeable organic carbon	23
Dioxins/furans	24

TABLE 4. ANALYTE DECISION MATRIX FOR WASTE CODE K001-PCP

Parameter class	Untreated K001-PCP	Scrubbing liquid		Ash
		Makeup	Effluent	
BDAT list[a]				
Volatiles	X	X	X	X
Semivolatiles	X	X	X	X
Metals	X	X	X	X
Inorganics				
Organochlorine pesticides				
Phenoxyacetic acid herbicides				
Organophosphorous insecticides				
PCB's				
Dioxins and furans	X		X	X
OAQPS				
Inorganics				
Volatiles	X			
Semivolatiles	X			
Alcohols				
POC	X	X	X	X
NPOC	X	X	X	X
TCLP				
Metals				X
Volatiles				X
Semivolatiles				X
Proximate and ultimate analyses	X			
pH, dissolved solids, dissolved metals, COD, TOX, and chloride		X	X	

[a] Represent major peaks beyond BDAT.

TABLE 5. ANALYTE DECISION MATRIX FOR WASTE CODE K001-CREOSOTE

Parameter class	Untreated K001-creosote	Scrubbing liquid		Ash	
		Makeup	Effluent	Fly[a]	Bottom
BDAT list[b]					
Volatiles	X	X	X	X	X
Semivolatiles	X	X	X	X	X
Metals	X	X	X	X	X
Inorganics					
Organochlorine pesticides					
Phenoxyacetic acid herbicides					
Organophosphorous insecticides					
PCB's					
Dioxins and furans					
OAQPS					
Inorganics	X				
Volatiles	X				
Semivolatiles	X				
Alcohols					
POC	X	X	X	X	X
NPOC	X	X	X	X	X
TCLP					
Metals				X	X
Volatiles				X	X
Semivolatiles				X	X
Proximate and ultimate analyses	X				
pH, dissolved solids, COD, TOX, and chloride		X	X		

[a] Sufficient fly ash was collected for only one sample.

[b] Represent major peaks beyond BDAT.

TABLE 6. K001-PCP SAMPLE INFORMATION

Test No.	Sample No.	Date collected	Time (24-h) collected
	K001-PCP feed samples		
1	CK01P-1-AX	6/25/87	a
2	CK01P-2-AX	6/25/87	a
3	CK01P-3-AX	6/26/87	a
b	CK01P-4-AX	6/26/87	a
	Ash samples		
1	CK01P-1-B1	6/30/87	c
2	CK01P-2-B1	7/1/87	c
3	CK01P-3-B1	7/1/87	c
	Makeup water sample		
1	CK01P-1-1C	6/26/87	1530
	Scrubber blowdown samples		
1	CK01P-1-D1	6/26/87	1915
2	CK01P-2-D1	7/1/87	1230
3	CK01P-3-D1	7/1/87	1745

[a] The feed samples were collected while the fiber packs were being packed.

[b] The drum of K001-PCP from which sample CK01-4-AX was collected was not used for the test burn.

[c] The ash samples were collected from the ash bin after the ash had cooled.

TABLE 7. K001-PCP FEED AND ASH COMPOSITION--ANALYSIS OF VOLATILE ORGANICS BY USING TETRAGLYME EXTRACT
(µg/g)

Analyte	Quantitation limits	Feed CK01P-1-AX	Feed CK01P-2-AX	Ash CK01P-1-B1	Feed CK01P-3-AX	Feed CK01P-4-AX	Ash CK01P-2-B1	Ash CK01P-3-B1
Acetonitrile	250	ND[a]	ND	ND	ND	ND	ND	ND
Acrolein	250	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND
Benzene	10	ND	ND	ND	ND	ND[b]	ND	ND
Bromodichloromethane	10	ND	ND	ND	ND	8.5[b]	ND	ND
Bromomethane	10	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	10	ND	ND	ND	ND	ND[b]	ND	ND
Carbon disulfide	10	ND	ND	ND	ND	5.3[b]	ND	ND
Chlorobenzene	10	ND	ND	ND	ND	ND	ND	ND
2-chloro-1,3-butadiene	0.25	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	10	ND	ND	ND	ND	ND	ND	ND
Chloroethane	10	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	1	ND	ND	ND	ND	ND	ND	ND
Chloroform	10	ND	ND	ND	ND	ND	ND	ND
Chloromethane	10	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	10	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	10	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	10	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	10	ND	ND	ND	ND	ND	ND	ND
Trans-1,4-dichloro-2-butene	0.25	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	10	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	10	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	10	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	10	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-dichloroethene	10	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	25	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-dichloropropene	25	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-dichloropropene	25	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	250	ND	ND	ND	ND	ND	ND	ND
Ethyl cyanide	0.5	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	10	ND	ND	ND	ND	ND	ND	ND
Iodomethane	10	ND	ND	ND	ND	ND	ND	ND
Isobutyl alcohol	1	ND	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	50	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	10	ND	ND	ND	ND	ND	ND	ND
Methyl methane sulfonate	25	ND	ND	ND	ND	ND	ND	ND
Methylacrylonitrile	1	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	50	ND	ND	ND	ND	ND	ND	ND
Pyridine	25	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	10	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	10	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	10	ND	ND	ND	ND	ND	ND	ND
Toluene	10	16	10	ND	39	41	ND	ND
Tribromomethane	10	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	10	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	10	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	10	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	10	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	250	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	10	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 7 (continued)

Analyte	Quantitation limits	Feed CKO1P-1-AX	Feed CKO1P-2-AX	Ash CKO1P-1-B1	Feed CKO1P-3-AX	Feed CKO1P-4-AX	Ash CKO1P-2-B1	Ash CKO1P-3-B1
Non-BDAT Parameters								
2-Chloroethyl vinyl ether	50	ND	ND	ND	ND	ND	ND	ND
Ethylene oxide	250	ND	ND	ND	ND	ND	ND	ND
Acetonitrile	250	ND	ND	ND	ND	ND	ND	ND
Acrolein	250	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	10	ND	ND	ND	38	41	ND	ND
Xylenes	10	21	12	ND	110	130	ND	ND
Styrene	10	31	18	ND	64	68	ND	ND
Ethyl ether	250	ND	ND	ND	ND	ND	ND	ND
Ethyl acetate	10	ND	ND	ND	ND	ND	ND	ND
Epichlorohydrin	10	ND	ND	ND	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND	ND	ND	ND
Methyl isobutyl ketone	50	ND	ND	ND	ND	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Less than quantitation limit (5 times the detection limit).

TABLE 8. KOO1-PCP FEED AND ASH COMPOSITION--ANALYSIS OF VOLATILE ORGANICS BY USING METHANOL EXTRACT (µg/g)

BDAT No.	Analyte	Quantitation limit	Feed				Ash		
			CKO1P 1-AX	CXO1P 2-AX	CKO1P 3-AX	CKO1P 4-AX	CKO1P 1-B1	CKO1P 2-B1	CKO1P 3-B1
1	Acetonitrile	250	ND[a]	ND	ND	ND	ND	ND	ND
2	Acrolein	250	ND	ND	ND	ND	ND	ND	ND
3	Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND
4	Benzene	10	ND	ND	ND	ND	ND	ND	ND
5	Bromodichloromethane	10	ND	ND	ND	ND	ND	ND	ND
6	Bromomethane	10	ND	ND	ND	ND	ND	ND	ND
7	Carbon tetrachloride	10	ND	ND	ND	ND	ND	ND	ND
8	Carbon disulfide	10	ND	ND	ND	ND	ND	ND	ND
9	Chlorobenzene	10	ND	ND	ND	ND	ND	ND	ND
10	2 Chloro-1,3-butadiene	0.25	ND	ND	ND	ND	ND	ND	ND
11	Chlorodibromomethane	10	ND	ND	ND	ND	ND	ND	ND
12	Chloroethane	10	ND	ND	ND	ND	ND	ND	ND
13	2-Chloroethyl vinyl ether	50	ND	ND	ND	ND	ND	ND	ND
14	Chloroform	10	ND	ND	ND	ND	ND	ND	ND
15	Chloromethane	10	ND	ND	ND	ND	ND	ND	ND
16	3-Chloropropene	10	ND	ND	ND	ND	ND	ND	ND
17	1,2-Dibromo-3-chloropropane	10	ND	ND	ND	ND	ND	ND	ND
18	1,2-Dibromoethane	10	ND	ND	ND	ND	ND	ND	ND
19	Dibromomethane	10	ND	ND	ND	ND	ND	ND	ND
20	Trans-1,4-dichloro-2-butene	0.25	ND	ND	ND	ND	ND	ND	ND
21	Dichlorodifluoromethane	10	ND	ND	ND	ND	11	ND	ND
22	1,1-Dichloroethane	10	ND	ND	ND	ND	ND	ND	ND
23	1,2-Dichloroethane	10	ND	ND	ND	ND	ND	ND	ND
24	1,1-Dichloroethylene	10	ND	ND	ND	ND	ND	ND	ND
25	Trans-1,2-dichloroethene	10	ND	ND	ND	ND	ND	ND	ND
26	1,2-Dichloropropane	25	ND	ND	ND	ND	ND	ND	ND
27	Trans-1,3-dichloropropene	25	ND	ND	ND	ND	ND	ND	ND
28	Cis-1,3-dichloropropene	25	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 8 (continued)

BDAT No.	Analyte	Quantitation limit	Feed				Ash		
			CKO1P 1-AX	CXO1P 2-AX	CKO1P 3-AX	CKO1P 4-AX	CKO1P 1-B1	CKO1P 2-B1	CKO1P 3-B1
29	1,4-dioxane	NA[b]	ND	ND	ND	ND	ND	ND	ND
30	Ethyl cyanide	0.5	ND	ND	ND	ND	ND	ND	ND
31	Ethyl methacrylate	10	ND	ND	ND	ND	ND	ND	ND
32	Iodomethane	10	ND	ND	ND	ND	ND	ND	ND
34	Methyl ethyl ketone	50	650	720	720	770	770	540	590
35	Methyl methacrylate	10	ND	ND	ND	ND	ND	ND	ND
36	Methyl methanesulfonate	25	ND	ND	ND	ND	ND	ND	ND
37	Methyl acrylonitrile	NA[b]	ND	ND	ND	ND	ND	ND	ND
38	Methylene chloride	50	ND	ND	ND	ND	ND	ND	ND
39	Pyridine	25	ND	ND	ND	ND	ND	ND	ND
40	1,1,1,2-Tetrachloroethane	10	ND	ND	ND	ND	ND	ND	ND
41	1,1,2,2-Tetrachloroethane	10	ND	ND	ND	ND	ND	ND	ND
42	Tetrachloroethene	10	ND	ND	ND	ND	ND	ND	ND
43	Toluene	10	14	23	32	25	ND	ND	ND
44	Tribromomethane	10	ND	ND	ND	ND	ND	ND	ND
45	1,1,1-Trichloroethane	10	ND	ND	ND	ND	ND	ND	ND
46	1,1,2-Trichloroethane	10	ND	ND	ND	ND	ND	ND	ND
47	Trichloroethene	10	ND	ND	ND	ND	ND	ND	ND
48	Trichlorofluoromethane	10	ND	ND	ND	ND	ND	ND	ND
49	1,2,3-Trichloropropane	250	ND	ND	ND	ND	ND	ND	ND
50	Vinyl chloride	10	ND	ND	ND	ND	ND	ND	ND
	Non-BDAT Parameters								
	Ethylene oxide	250	ND	ND	ND	ND	ND	ND	ND
	Ethylbenzene	10	20	31	33	26	ND	ND	ND
	Xylene	10	73	98	110	89	ND	ND	ND
	Styrene	10	18	29	42	36	ND	ND	ND
	Ethyl ether	250	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 8 (continued)

BDAT No.	Analyte	Quantitation limit	Feed CKO1P 1-AX	Feed CXO1P 2-AX	Feed CKO1P 3-AX	Feed CKO1P 4-AX	Ash CKO1P 1-B1	Ash CKO1P 2-B1	Ash CKO1P 3-B1
	Non-BDAT Parameters (cont'd)								
	Ethyl acetate	250	ND	ND	ND	ND	ND	ND	ND
	Epichlorohydrin	10	ND	ND	ND	ND	ND	ND	ND
	Acetone	10	ND	ND	ND	ND	ND	ND	ND
	Methyl isobutyl ketone	250	ND	ND	ND	ND	ND	ND	ND

[a] ND = The compound was not detected in concentrations above the detection limit.

[b] NA = The standard is not available; the compound was searched by using an NBS data base of 42,000 compounds.

TABLE 9. SEMIVOLATILE ORGANICS RESULTS FOR KOO1-PCP FEED SAMPLES (μg/g)

Analyte	CAS Number	Quantitation limits	Reagent blank	CKO1P-1-AX	CKO1P-2-AX	CKO1P-3-AX	CKO1P-4-AX
Acenaphthalene	208-96-8	2,500	ND[a]	ND	ND	ND	ND
Acenaphthene	83-32-9	2,500	ND	13,000	18,000	14,000	18,000
Acetophenone	96-86-2	2,500	ND	ND	ND	ND	ND
2-Acetylaminofluorene	53-96-3	5,000	ND	ND	ND	ND	ND
4-Aminobiphenyl	92-67-1	5,000	ND	ND	ND	ND	ND
Aniline	62-53-3	5,000	ND	ND	ND	ND	ND
Anthracene	120-12-7	2,500	ND	9,300	13,000	8,500	11,000
Aramite	140-57-8	b	ND	ND	ND	ND	ND
Benz(a)anthracene	56-55-3	2,500	ND	ND	3,400	2,500	2,900
Benzenethiol	108-98-6	b	ND	ND	ND	ND	ND
Benzidine	92-87-5	5,000	ND	ND	ND	ND	ND
Benzo(a)pyrene	50-32-8	2,500	ND	ND	940[c]	620[c]	800[c]
Benzo(b &/or k)fluoranthrene	205-99-2	2,500	ND	940[c]	2,300[c]	1,600[c]	2,000[c]
Benzo(g,h,i)perylene	191-24-2	2,500	ND	ND	ND	ND	ND
Benzo(k)fluoranthrene	207-08-9	2,500	ND	ND	ND	ND	ND
p-Benzoquinone	106-51-4	5,000	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	111-91-1	2,500	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	111-44-4	2,500	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether	39638-32-9	2,500	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	117-81-7	2,500	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	101-55-3	2,500	ND	ND	ND	ND	ND
Butylbenzylphthalate	85-68-7	2,500	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinitrophenol	88-85-7	b	ND	ND	ND	ND	ND
p-Chloroaniline	106-47-8	12,500	ND	ND	ND	ND	ND
Chlorobenzilate	510-15-6	b	ND	ND	ND	ND	ND
p-Chloro-m-cresol	59-50-7	5,000	ND	ND	ND	ND	ND
2-Chloronaphthalene	91-58-7	2,500	ND	ND	ND	ND	ND
2-Chlorophenol	95-57-8	2,500	ND	ND	ND	ND	ND
3-Chloropropionitrile	54-27-67	b	ND	ND	ND	ND	ND
Chrysene	218-01-9	2,500	ND	1,900[c]	3,600	2,400[c]	3,000
Ortho-cresol	95-48-7	2,500	ND	ND	ND	ND	ND
Para-cresol	106-44-5	2,500	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	53-70-3	2,500	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	192-65-4	2,500	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	189-55-9	2,500	ND	ND	ND	ND	ND
m-Dichlorobenzene	541-73-1	2,500	ND	ND	ND	ND	ND
o-Dichlorobenzene	95-50-1	2,500	ND	ND	ND	ND	ND
p-Dichlorobenzene	106-46-7	2,500	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	91-94-1	5,000	ND	ND	ND	ND	ND
2,4-Dichlorophenol	120-83-2	5,000	ND	ND	ND	ND	ND
2,6-Dichlorophenol	87-65-0	5,000	ND	ND	ND	ND	ND
Diethyl phthalate	84-66-2	2,500	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	119-90-4	5,000	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	60-11-7	5,000	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	119-93-7	5,000	ND	ND	ND	ND	ND
2,4-Dimethylphenol	105-67-9	2,500	ND	ND	ND	ND	550[c]
Dimethyl phthalate	131-11-3	2,500	ND	ND	ND	ND	ND
Di-n-butylphthalate	84-74-2	2,500	ND	ND	ND	ND	ND
1,4-Dinitrobenzene	100-25-4	5,000	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	534-52-1	5,000	ND	ND	ND	ND	ND
2,4-Dinitrophenol	51-28-5	5,000	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	121-14-2	5,000	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	606-20-2	5,000	ND	ND	ND	ND	ND
Di-n-octylphthalate	117-84-0	2,500	ND	ND	ND	ND	ND
Di-n-propylnitrosamine		d	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	122-39-4/ 86-30-6	5,000	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	122-66-7	5,000	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	2,500	ND	13,000	21,000	15,000	20,000
Fluorene	86-73-7	2,500	ND	8,200	12,000	9,000	9,500

(continued)

TABLE 9 (continued)

Analyte	CAS Number	Quantitation limits	Reagent blank	CK01P-1-AX	CK01P-2-AX	CK01P-3-AX	CK01P-4-AX
Hexachlorobenzene	118-74-1	5,000	ND	ND	ND	ND	ND
Hexachlorobutadiene	87-68-3	5,000	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	77-47-4	5,000	ND	ND	ND	ND	ND
Hexachloroethane	67-72-1	5,000	ND	ND	ND	ND	ND
Hexachlorophene	70-30-4	b	ND	ND	ND	ND	ND
Hexachloropropene	1,888-71-7	5,000	ND	ND	ND	ND	ND
Ideno(1,2,3-cd)pyrene	193-39-5	2,500	ND	ND	ND	ND	ND
Isosafrole	120-58-1	5,000	ND	ND	ND	ND	ND
Malononitrile	169-77-3	12,500	ND	ND	ND	ND	ND
Methapyrilene	91-80-5		ND	ND	ND	ND	ND
3-Methylcholanthrene	56-49-5	2,500	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	101-14-4	5,000	ND	ND	ND	ND	ND
Naphthalene	91-20-3	2,500	ND	26,000	43,000	37,000	50,000
1,4-Naphthoquinone	130-15-4	5,000	ND	ND	ND	ND	ND
1-Naphthylamine	134-32-7	5,000	ND	ND	ND	ND	ND
2-Naphthylamine	91-59-8	5,000	ND	ND	ND	ND	ND
p-Nitroaniline	100-01-6	12,500	ND	ND	ND	ND	ND
Nitrobenzene	98-95-3	2,500	ND	ND	ND	ND	ND
4-Nitrophenol	100-02-7	5,000	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	924-16-3	5,000	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	55-18-5	5,000	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	62-75-9	5,000	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	10,595-95-6	5,000	ND	ND	ND	ND	ND
N-Nitrosomorpholine	59-89-2	5,000	ND	ND	ND	ND	ND
N-Nitrosopiperidine	100-75-4	5,000	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	930-55-2	5,000	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	99-55-8	5,000	ND	ND	ND	ND	ND
Pentachlorobenzene	608-93-5	5,000	ND	ND	ND	ND	ND
Pentachloroethane	76-01-7	5,000	ND	ND	ND	ND	ND
Pentachloronitrobenzene	82-68-8	5,000	ND	ND	ND	ND	ND
Pentachlorophenol	87-86-5	25	ND	970	3,000	920	1,200
Phenacetin	62-44-2	5,000	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	2,500	ND	28,000	42,000	32,000	42,000
Phenol	108-95-2	2,500	ND	ND	ND	ND	ND
2-Picoline	109-06-8	5,000	ND	ND	ND	ND	ND
Pronamide	23,950-58-5	5,000	ND	ND	ND	ND	ND
Pyrene	129-00-0	2,500	ND	9,200	15,000	11,000	13,000
Resorcinol	108-46-3	5,000	ND	ND	ND	ND	ND
Safrole	94-59-7	5,000	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	95-94-3	2,500	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	58-90-2	5,000	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	120-82-1	2,500	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	95-95-4	2,500	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	88-06-2	2,500	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	126-72-7	b	ND	ND	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Detection limit not given, standard unavailable.

[c] Less than the quantitation limit (5 times the detection limit).

[d] Not detected by reverse search. PQL not determined.

TABLE 10. METALS ANALYSIS FOR K001-PCP FEED SAMPLES
(μg/g)

Analyte	Analysis type	Quantitation limit	CK01P-1-AX	CK01P-2-AX	CK01P-3-AX	CK01P-4-AX
Silver	ICPES	4.5	ND[a]	ND	ND	ND
Arsenic	AA	0.01	2.9	2.3	1.1	1.3
Barium	ICPES	0.045	30	19	17	21
Beryllium	ICPES	0.5	ND	ND	ND	ND
Cadmium	ICPES	0.015	0.5	0.6	0.4	0.6
Chromium	ICPES	0.045	1.5	2.7	2.1	1.3
Copper	ICPES	0.05	6.7	11	10	10
Mercury	C. vapor	0.001	0.11	0.16	0.064	ND
Nickel	ICPES	10	4[b]	3[b]	3[b]	ND
Lead	AA	0.01	7.8	11	6.3	5.3
Antimony	ICPES	30	ND	ND	ND	ND
Selenium	AA	2.5	ND	ND	ND	ND
Thallium	AA	1.5	0.4[b]	ND	ND	ND
Vanadium	ICPES	10	ND	ND	ND	ND
Zinc	ICPES	0.03	64	58	30	40

[a] ND = Not detected above the detection limit.

[b] Less than the quantitation limit (5 times the detection limit).

TABLE 11. TOTAL ORGANIC CARBON DATA FOR KO01-PCP FEED SAMPLES
(percent)

	CKO1P-1-AX	CKO1P-2-AX	CKO1P-3-AX	CKO1P-4-AX
TOC	30	47	34	47

TABLE 12. KO01-PCP FEED DIOXIN/FURAN RESULTS
(ng/g)

Analyte	Reagent blank,	CKO1P-1-AX	CKO1P-2-AX,	CKO1P-3-AX,	CKO1-4-AX,
Total TCDD	<15	ND[a]	<3.5	<6.3	<3.6
Total TCDF	<8.6	ND	<2.4	<4.2	<2.5
Total PCDD	<14	ND	<3.4	<6.2	<3.4
Total PCDF	<12	ND	<2.4	<5.0	<3.0
Total HxCDD	<19	ND	<5.0	<9.6	<4.9
Total HxCDF	<15	ND	<3.7	<6.8	<4.0

[a] ND = Not detected; surrogates could not be recovered and detection limits could not be calculated.

TABLE 13. SEMIVOLATILE ORGANIC RESULTS FOR KO01-PCP ASH EXTRACT (µg/g)

Analyte	CAS Number	Quantitation limits	Reagent blank	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
Acenaphthalene	208-96-8	2.5	ND[a]	ND	ND	ND
Acenaphthene	83-32-9	2.5	ND	ND	ND	ND
Acetophenone	96-86-2	2.5	ND	ND	ND	ND
2-Acetylaminofluorene	53-96-3	250	ND	ND	ND	ND
4-Aminobiphenyl	92-67-1	50	ND	ND	ND	ND
Aniline	62-53-3	5	ND	ND	ND	ND
Anthracene	120-12-7	2.5	ND	ND	ND	ND
Aramite	140-57-8	b	ND	ND	ND	ND
Benz(a)anthracene	56-55-3	2.5	ND	ND	ND	ND
Benzenethiol	108-98-6	b	ND	ND	ND	ND
Benzidine	92-87-5	250	ND	ND	ND	ND
Benzo(a)pyrene	50-32-8	2.5	ND	ND	ND	ND
Benzo(b)fluoranthrene	205-99-2	2.5	ND	ND	ND	ND
Benzo(g,h,i)perylene	191-24-2	2.5	ND	ND	ND	ND
Benzo(k)fluoranthrene	207-08-9	2.5	ND	ND	ND	ND
p-Benzoquinone	106-51-4	250	ND	ND	ND	ND
Bis(2-Chloroethoxy)ethane	111-91-1	2.5	ND	ND	ND	ND
Bis(2-Chloroethyl)ether	111-44-4	2.5	ND	ND	ND	ND
Bis(2-Chloroisopropyl)ether	39638-32-9	2.5	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	117-81-7	2.5	ND	ND	ND	ND
4-Bromophenyl phenyl ether	101-55-3	2.5	ND	ND	ND	ND
Butylbenzylphthalate	85-68-7	2.5	ND	ND	ND	ND
2-sec-Butyl-4,6-dinitrophenol	88-85-7	b	ND	ND	ND	ND
p-Chloroaniline	106-47-8	25	ND	ND	ND	ND
Chlorobenzilate	510-15-6	b	ND	ND	ND	ND
p-Chloro-m-cresol	59-50-7	2.5	ND	ND	ND	ND
2-Chloronaphthalene	91-58-7	2.5	ND	ND	ND	ND
2-Chlorophenol	95-57-8	2.5	ND	ND	ND	ND
3-Chloropropionitrile	54-27-67	b	ND	ND	ND	ND
Chrysene	218-01-9	2.5	ND	ND	ND	ND
Ortho-cresol	95-48-7	2.5	ND	ND	ND	ND
Para-cresol	106-44-5	2.5	ND	ND	ND	ND
Dibenz(a,h)anthracene	53-70-3	2.5	ND	ND	ND	ND
Dibenzo(a,e)pyrene	192-65-4	2.5	ND	ND	ND	ND
Dibenzo(a,i)pyrene	189-55-9	2.5	ND	ND	ND	ND
m-Dichlorobenzene	541-73-1	2.5	ND	ND	ND	ND
o-Dichlorobenzene	95-50-1	2.5	ND	ND	ND	ND
p-Dichlorobenzene	106-46-7	2.5	ND	ND	ND	ND
3,3'-Dichlorobenzidine	91-94-1	5	ND	ND	ND	ND
2,4-Dichlorophenol	120-83-2	2.5	ND	ND	ND	ND
2,6-Dichlorophenol	87-65-0	2.5	ND	ND	ND	ND
Diethylphthalate	84-66-2	2.5	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	119-90-4	2500	ND	ND	ND	ND
p-Dimethylaminoazobenzene	60-11-7	50	ND	ND	ND	ND
3,3'-Dimethylbenzidine	119-93-7	2500	ND	ND	ND	ND
2,4-Dimethylphenol	105-67-9	2.5	ND	ND	ND	ND
Dimethylphthalate	131-11-3	2.5	ND	ND	ND	ND
Di-n-butylphthalate	84-74-2	2.5	ND	ND	ND	ND
1,4-Dinitrobenzene	100-25-4	25	ND	ND	ND	ND
4,6-Dinitro-o-cresol	534-52-1	12.5	ND	ND	ND	ND
2,4-Dinitrophenol	51-28-5	12.5	ND	ND	ND	ND
2,4-Dinitrotoluene	121-14-2	2.5	ND	ND	ND	ND
2,6-Dinitrotoluene	606-20-2	2.5	ND	ND	ND	ND
Di-n-octylphthalate	117-84-0	2.5	ND	ND	ND	ND
Di-n-propylnitrosamine		c	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	122-39-4/ 86-30-6	2.5	ND	ND	ND	ND
1,2-Diphenylhydrazine	122-66-7	2.5	ND	ND	ND	ND
Fluoranthene	206-44-0	2.5	ND	ND	ND	ND
Fluorene	86-73-7	2.5	ND	ND	ND	ND

(continued)

TABLE 13 (continued)

Analyte	CAS Number	Quantitation limits	Reagent blank	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
Hexachlorobenzene	118-74-1	2.5	ND	ND	ND	ND
Hexachlorobutadiene	87-68-3	2.5	ND	ND	ND	ND
Hexachlorocyclopentadiene	77-47-4	2.5	ND	ND	ND	ND
Hexachloroethane	67-72-1	2.5	ND	ND	ND	ND
Hexachlorophene	70-30-4	a	ND	ND	ND	ND
Hexachloropropene	1888-71-7	2.5	ND	ND	ND	ND
Ideno(1,2,3-cd)pyrene	193-39-5	2.5	ND	ND	ND	ND
Isosafrole	120-58-1	25	ND	ND	ND	ND
Malononitrile	169-77-3	2500	ND	ND	ND	ND
Methapyrilene	91-80-5	a	ND	ND	ND	ND
3-Methylcholanthrene	56-49-5	25	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	101-14-4	50	ND	ND	ND	ND
Naphthalene	91-20-3	2.5	ND	ND	ND	ND
1,4-Naphthoquinone	130-15-4	2.5	ND	ND	ND	ND
1-Naphthylamine	134-32-7	25	ND	ND	ND	ND
2-Naphthylamine	91-59-8	25	ND	ND	ND	ND
p-Nitroaniline	100-01-6	12.5	ND	ND	ND	ND
Nitrobenzene	98-95-3	2.5	ND	ND	ND	ND
4-Nitrophenol	100-02-7	12.5	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	924-16-3	25	ND	ND	ND	ND
N-Nitrosodiethylamine	55-18-5	25	ND	ND	ND	ND
N-Nitrosodimethylamine	62-75-9	25	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	621-64-7	25	ND	ND	ND	ND
N-Nitrosomethylethylamine	10595-95-6	25	ND	ND	ND	ND
N-Nitrosomorpholine	59-89-2	50	ND	ND	ND	ND
N-Nitrosopiperidine	100-75-4	50	ND	ND	ND	ND
N-Nitrosopyrrolidine	930-55-2	50	ND	ND	ND	ND
5-Nitro-o-toluidine	99-55-8	50	ND	ND	ND	ND
Pentachlorobenzene	608-93-5	2.5	ND	ND	ND	ND
Pentachloroethane	76-01-7	2.5	ND	ND	ND	ND
Pentachloronitrobenzene	82-68-8	25	ND	ND	ND	ND
Pentachlorophenol	87-86-5	12.5	ND	ND	ND	ND
Phenacetin	62-44-2	25	ND	ND	ND	ND
Phenanthrene	85-01-8	2.5	ND	ND	ND	ND
Phenol	108-95-2	2.5	ND	ND	ND	ND
2-Picoline	109-06-8	25	ND	ND	ND	ND
Pronamide	23950-58-5	25	ND	ND	ND	ND
Pyrene	129-00-0	2.5	ND	ND	ND	ND
Resorcinol	108-46-3	2.5	ND	ND	ND	ND
Safrole	94-59-7	25	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	95-94-3	25	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	58-90-2	25	ND	ND	ND	ND
1,2,4-Trichlorobenzene	120-82-1	2.5	ND	ND	ND	ND
2,4,5-Trichlorophenol	95-95-4	12.5	ND	ND	ND	ND
2,4,6-Trichlorophenol	88-06-2	2.5	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	126-72-7	a	ND	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Detection limit not given, standard unavailable.

[c] Not detected by reverse search. PQL not determined.

TABLE 14. METALS ANALYSIS FOR K001-PCP ASH SAMPLES
(μg/g)

Analyte	Analysis type	Quantitation limit	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
Silver	ICPES	4.5	1.3[a]	ND[b]	ND
Arsenic	AA	0.01	0.8	0.6	0.4
Barium	ICPES	0.045	74	21	21
Beryllium	ICPES	0.5	0.7[a]	ND	ND
Cadmium	ICPES	1.5	ND	ND	ND
Chromium	ICPES	0.045	8.2	1.1	1.2
Copper	ICPES	0.05	6.8	3.0	2
Mercury	C. vapor	0.001	ND	ND	ND
Nickel	ICPES	10	7[a]	ND	ND
Lead	AA	0.01	5.2	1.2	0.96
Antimony	ICPES	30	ND	ND	ND
Selenium	AA	2.5	ND	ND	ND
Thallium	AA	1.5	ND	ND	ND
Vanadium	ICPES	10	7[a]	ND	ND
Zinc	ICPES	0.03	11	2.1	2.1

[a] Less than quantitation limit (5 times the detection limit).

[b] ND = Not detected above the detection limit.

TABLE 15. TOTAL ORGANIC CARBON DATA FOR KO01-PCP ASH SAMPLES
(percent)

	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
TOC	0.2[a]	0.5	0.2[a]

[a] Less than the quantitation limit of 0.5 percent (5 times the detection limit of 0.1 percent)

TABLE 16. KO01-PCP ASH DIOXIN/FURAN RESULTS
(ng/g)

Analyte	Reagent blank,	CK01P-1-B1,	CK01P-2-B1,	CK01P-3-B1
Total TCDD	<0.089	<0.093	<0.073	<0.077
Total TCDF	<0.075	<0.057	<0.050	<0.051
Total PCDD	<0.25	<0.097	<0.090	<0.086
Total PCDF	<0.20	<0.085	<0.075	<0.072
Total HxCDD	<0.60	<0.19	<0.21	<0.18
Total HxCDF	<1.2	<0.34	<0.27	<0.21

TABLE 17. VOLATILE ORGANIC RESULTS FOR K001-PCP ASH SUBJECTED TO TCLP (µg/liter)

Analyte	Quantitation limits	Ash CK01P-1-B1	Ash CK01P-3-D1	Ash CK01P-3-B1
Acetonitrile	250	ND[a]	ND	ND
Acrolein	250	ND	ND	ND
Acrylonitrile	50	ND	ND	ND
Benzene	10	ND	ND	ND
Bromodichloromethane	10	ND	ND	ND
Bromomethane	10	ND	ND	ND
Carbon tetrachloride	10	ND	ND	ND
Carbon disulfide	10	ND	ND	ND
Chlorobenzene	10	ND	ND	ND
2-Chloro-1,3-butadiene	0.25	ND	ND	ND
Chlorodibromomethane	10	ND	ND	ND
Chloroethane	10	ND	ND	ND
2-Chloroethyl vinyl ether	1	ND	ND	ND
Chloroform	10	ND	ND	ND
Chloromethane	10	ND	ND	ND
3-Chloropropene	10	ND	ND	ND
1,2-Dibromo-3-chloropropane	10	ND	ND	ND
1,2-Dibromoethane	10	ND	ND	ND
Dibromomethane	10	ND	ND	ND
Trans-1,4-dichloro-2-butene	0.25	ND	ND	ND
Dichlorodifluoromethane	10	ND	ND	ND
1,1-Dichloroethane	10	ND	ND	ND
1,2-Dichloroethane	10	ND	ND	ND
1,1-Dichloroethylene	10	ND	ND	ND
Trans-1,2-dichloroethene	10	ND	ND	ND
1,2-Dichloropropane	25	ND	ND	ND
Trans-1,3-dichloropropene	25	ND	ND	ND
Cis-1,3-dichloropropene	25	ND	ND	ND
1,4 Dioxane	250	ND	ND	ND
Ethyl cyanide	0.5	ND	ND	ND
Ethyl methacrylate	10	ND	ND	ND
Iodomethane	10	ND	ND	ND
Isobutyl alcohol	1	ND	ND	ND
Methyl ethyl ketone	50	ND	ND	ND
Methyl methacrylate	10	ND	ND	ND
Methyl methane sulfonate	25	ND	ND	ND
Methylacrylonitrile	1	ND	ND	ND
Methylene chloride	50	ND	ND	ND
Pyridine	25	ND	ND	ND
1,1,1,2-Tetrachloroethane	10	ND	ND	ND
1,1,2,2-Tetrachloroethane	10	ND	ND	ND

(continued)

TABLE 17 (continued)

Analyte	Quantitation limits	Ash CK01P-1-B1	Ash CK01P-3-D1	Ash CK01P-3-B1
Tetrachloroethene	10	ND	ND[b]	ND[b]
Toluene	10	ND	3.0[b]	2.9[b]
Tribromomethane	10	ND	ND	ND
1,1,1-Trichloroethane	10	ND	ND	ND
1,1,2-Trichloroethane	10	ND	ND	ND
Trichloroethene	10	ND	ND	ND
Trichlorofluoromethane	10	ND	ND	ND
1,2,3-Trichloropropane	250	ND	ND	ND
Vinyl chloride	10	ND	ND	ND
Non-BDAT Parameters				
2-Chloroethyl vinyl ether	50	ND	ND	ND
Ethylene oxide	250	ND	ND	ND
Acetonitrile	250	ND	ND	ND
Acrolein	250	ND	ND	ND
Ethylbenzene	10	ND	ND	ND
Xylenes	10	ND	ND	ND
Styrene	10	ND	ND	ND
Ethyl ether	250	ND	ND	ND
Ethyl acetate	10	ND	ND	ND
Epichlorohydrin	10	ND	ND	ND
Acetone	250	ND	ND	ND
Methyl isobutyl ketone	50	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Less than quantitation limit (5 times the detection limit).

TABLE 18. TCLP SEMIVOLATILES ORGANIC RESULTS FOR K001-PCP ASH (mg/liter)

Analyte	Practical quantitation limits	Leachate blank	Reagent blank	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
Acenaphthalene	10	ND[a]	ND	ND	ND	ND
Acenaphthene	10	ND	ND	ND	ND	ND
Acetophenone	10	ND	ND	ND	ND	ND
2-Acetylaminofluorene	1,000	ND	ND	ND	ND	ND
4-Aminobiphenyl	200	ND	ND	ND	ND	ND
Aniline	20	ND	ND	ND	ND	ND
Anthracene	10	ND	ND	ND	ND	ND
Aramite	b	ND	ND	ND	ND	ND
Benz(a)anthracene	10	ND	ND	ND	ND	ND
Benzenethiol	b	ND	ND	ND	ND	ND
Benzidine	1,000	ND	ND	ND	ND	ND
Benzo(a)pyrene	10	ND	ND	ND	ND	ND
Benzo(b &/or k)fluoranthrene	10	ND	ND	ND	ND	ND
Benzo(b)fluoranthrene	10	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	10	ND	ND	ND	ND	ND
Benzo(k)fluoranthrene	10	ND	ND	ND	ND	ND
p-Benzoquinone	1,000	ND	ND	ND	ND	ND
Bis(2-Chloroethoxy)ethane	10	ND	ND	ND	ND	ND
Bis(2-Chloroethyl)ether	10	ND	ND	ND	ND	ND
Bis(2-Chloroisopropyl)ether	10	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	10	ND	ND	ND	4.4[c]	ND
4-Bromophenyl phenyl ether	10	ND	ND	ND	ND	ND
Butylbenzylphthalate	10	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinitrophenol	b	ND	ND	ND	ND	ND
p-Chloroaniline	100	ND	ND	ND	ND	ND
Chlorobenzilate	b	ND	ND	ND	ND	ND
p-Chloro-m-cresol	10	ND	ND	ND	ND	ND
2-Chloronaphthalene	10	ND	ND	ND	ND	ND
2-Chlorophenol	10	ND	ND	ND	ND	ND
3-Chloropropionitrile	b	ND	ND	ND	ND	ND
Chrysene	10	ND	ND	ND	ND	ND
Ortho-Cresol	10	ND	ND	ND	ND	ND
Para-Cresol	10	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	10	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	10	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	10	ND	ND	ND	ND	ND
m-Dichlorobenzene	10	ND	ND	ND	ND	ND
o-Dichlorobenzene	10	ND	ND	ND	ND	ND
p-Dichlorobenzene	10	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	20	ND	ND	ND	ND	ND
2,4-Dichlorophenol	10	ND	ND	ND	ND	ND
2,6-Dichlorophenol	10	ND	ND	ND	ND	ND
Diethylphthalate	10	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	10,000	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	200	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	10,000	ND	ND	ND	ND	ND
2,4-Dimethylphenol	10	ND	ND	ND	ND	ND
Dimethylphthalate	10	ND	ND	ND	ND	ND
Di-n-butylphthalate	10	ND	ND	ND	ND	ND
1,4-Dinitrobenzene	100	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	50	ND	ND	ND	ND	ND
2,4-Dinitrophenol	50	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	10	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	10	ND	ND	ND	ND	ND
Di-n-octylphthalate	10	ND	ND	ND	ND	ND
Di-n-propylnitrosamine	d	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	10	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	10	ND	ND	ND	ND	ND
Fluoranthene	10	ND	ND	ND	ND	ND
Fluorene	10	ND	ND	ND	ND	ND

(continued)

TABLE 18 (continued)

Analyte	Practical quantitation limits	Leachate blank	Reagent blank	CKO1P-1-B1	CKO1P-2-B1	CKO1P-3-B1
Hexachlorobenzene	10	ND	ND	ND	ND	ND
Hexachlorobutadiene	10	ND	ND	ND	ND	ND
Hezachlorocyclopentadiene	10	ND	ND	ND	ND	ND
Hexachloroethane	10	ND	ND	ND	ND	ND
Hexachlorophene	10	ND	ND	ND	ND	ND
Hexachloropropene	10	ND	ND	ND	ND	ND
Ideno(1,2,3-cd)pyrene	10	ND	ND	ND	ND	ND
Isosafrole	100	ND	ND	ND	ND	ND
Malononitrile	10,000	ND	ND	ND	ND	ND
Methapyrilene	a	ND	ND	ND	ND	ND
3-Methylcholanthrene	100	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloro-aniline)	200	ND	ND	ND	ND	ND
Naphthalene	10	ND	ND	ND	ND	ND
1,4-Naphthoquinone	100	ND	ND	ND	ND	ND
1-Naphthylamine	100	ND	ND	ND	ND	ND
2-Naphthylamine	100	ND	ND	ND	ND	ND
p-Nitroaniline	50	ND	ND	ND	ND	ND
Nitrobenzene	10	ND	ND	ND	ND	ND
4-Nitrophenol	50	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	100	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	100	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	100	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	100	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	100	ND	ND	ND	ND	ND
N-Nitrosomorpholine	200	ND	ND	ND	ND	ND
N-Nitrosopiperidine	200	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	200	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	200	ND	ND	ND	ND	ND
Pentachlorobenzene	10	ND	ND	ND	ND	ND
Pentachloroethane	10	ND	ND	ND	ND	ND
Pentachloronitrobenzene	100	ND	ND	ND	ND	ND
Pentachlorophenol	50	ND	ND	ND	ND	ND
Phenacetin	100	ND	ND	ND	ND	ND
Phenanthrene	10	ND	ND	ND	ND	ND
Phenol	10	ND	ND	ND	ND	ND
2-Picoline	100	ND	ND	ND	ND	ND
Pronamide	100	ND	ND	ND	ND	ND
Pyrene	10	ND	ND	ND	ND	ND
Pyridine	100	ND	ND	ND	ND	ND
Resorcinol	10	ND	ND	ND	ND	ND
Safrole	100	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	100	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	100	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	10	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	50	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	10	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	a	ND	ND	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Detection limit not given, standard unavailable.

[c] Less than quantitation limit (5 times the detection limit).

[d] Not detected by reverse search. PQL not determined.

TABLE 19. METALS ANALYSIS FOR K001-PCP TCLP EXTRACTS OF ASH SAMPLES (μg/ml)

Analyte	Analysis type	Quantitation limit	Extraction blank	CK01P-1-B1	CK01P-2-B1	CK01P-3-B1
Silver	ICPES	0.045	ND[a]	ND	ND	ND
Arsenic	AA	0.015	0.004[b]	0.007[b]	0.01[b]	0.008[b]
Barium	ICPES	0.045	0.013[b]	0.32	0.19	0.25
Beryllium	ICPES	0.005	ND	ND	ND	ND
Cadmium	ICPES	0.015	ND	ND	ND	ND
Chromium	ICPES	0.045	ND	ND	ND	ND
Copper	ICPES	0.05	ND	ND	ND	ND
Mercury	C. Vapor	0.001	ND	ND	ND	ND
Nickel	ICPES	0.1	ND	ND	ND	ND
Lead	AA	0.01	ND	0.021	ND	ND
Antimony	ICPES	0.3	ND	ND	ND	ND
Selenium	AA	0.025	ND	ND	ND	ND
Thallium	AA	0.05	ND	ND	ND	ND
Vanadium	ICPES	0.1	ND	ND	ND	ND
Zinc	ICPES	0.03	0.019[b]	0.009[b]	0.019[b]	0.03

[a] ND = Not detected above the detection limit.

[b] Less than quantitation limit (5 times the detection limit).

TABLE 20. VOLATILE ORGANIC RESULTS FOR K001-PCP SCRUBBER WATER
(μg/liter)

Analyte	Quantitation limits	Makeup CK01P-1-C1	Effluent CK01P-1-D1	Effluent CK01P-2-D1	Effluent CK01P-3-D1
Acetonitrile	50	ND[a]	ND	5.3[b]	ND
Acrolein	10	ND	ND	ND	ND
Acrylonitrile	10	ND	ND	ND	ND
Benzene	10	ND	ND	ND	ND
Bromodichloromethane	10	ND	ND	ND	ND
Bromomethane	10	ND	ND	ND	ND
Carbon tetrachloride	10	ND	ND	ND	ND
Carbon disulfide	10	ND	ND	ND	ND
Chlorobenzene	10	ND	ND	ND	ND
2-Chloro-1,3-butadiene	0.25	ND	ND	ND	ND
Chlorodibromomethane	10	ND	ND	ND	ND
Chloroethane	10	ND	ND	ND	ND
2-Chloroethyl vinyl ether	1	ND	ND	ND	ND
Chloroform	10	ND	ND	ND	ND
Chloromethane	10	ND	ND	ND	ND
3-Chloropropene	10	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	10	ND	ND	ND	ND
1,2-Dibromoethane	10	ND	ND	ND	ND
Dibromomethane	10	ND	ND	ND	ND
Trans-1,4-dichloro-2-butene	0.25	ND	ND	ND	ND
Dichlorodifluoromethane	10	ND	ND	ND	ND
1,1-Dichloroethane	10	ND	ND	ND	ND
1,2-Dichloroethane	10	ND	ND	ND	ND
1,1-Dichloroethylene	10	ND	ND	ND	ND
Trans-1,2-dichloroethene	10	ND	ND	ND	ND
1,2-Dichloropropane	25	ND	ND	ND	ND
Trans-1,3-dichloropropene	25	ND	ND	ND	ND
Cis-1,3-dichloropropene	25	ND	ND	ND	ND
1,4 Dioxane	250	ND	ND	ND	ND
Ethyl cyanide	0.5	ND	ND	ND	ND
Ethyl methacrylate	10	ND	ND	ND	ND
Iodomethane	10	ND	ND	ND	ND
Isobutyl alcohol	1	ND[b]	ND[b]	ND	ND[b]
Methyl ethyl ketone	50	43[b]	22[b]	ND	19[b]
Methyl methacrylate	10	ND	ND	ND	ND
Methyl methane sulfonate	25	ND	ND	ND	ND
Methylacrylonitrile	1	ND	ND	ND	ND
Methylene chloride	50	ND	ND	ND	ND
Pyridine	25	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	10	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	10	ND	ND	ND	ND

(continued)

TABLE 20 (continued)

Analyte	Quantitation limits	Makeup CKO1P-1-C1	Effluent CKO1P-1-D1	Effluent CKO1P-2-D1	Effluent CKO1P-3-D1
Tetrachloroethene	10	ND	ND	ND	ND
Toluene	10	ND	ND	ND	ND
Tribromomethane	10	ND	ND	ND	ND
1,1,1-Trichloroethane	10	ND	ND	ND	ND
1,1,2-Trichloroethane	10	ND	ND	ND	ND
Trichloroethene	10	ND	ND	ND	ND
Trichlorofluoromethane	10	ND	ND	ND	ND
1,2,3-Trichloropropane	250	ND	ND	ND	ND
Vinyl chloride	10	ND	ND	ND	ND
1,4-Dioxane	NA[c]	ND	ND	ND	ND
Non-BDAT Parameters					
2-Chloroethyl vinyl ether	50	ND	ND	ND	ND
Ethylene oxide	250	ND	ND	ND	ND
Acetonitrile	250	ND	ND	ND	ND
Acrolein	250	ND	ND	ND	ND
Ethylbenzene	10	ND	ND	ND	ND
Xylenes	10	ND	ND	ND	ND
Styrene	10	ND	ND	ND	ND
Ethyl ether	250	ND	ND	ND	ND
Ethyl acetate	10	ND	ND	ND	ND
Epichlorohydrin	10	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND
Methyl isobutyl ketone	50	ND	ND	ND	ND
Methylacrylonitrile	NA	ND	ND	ND	ND

[a] ND = The compound was not detected above the detection limit.

[b] Less than the quantitation limit.

[c] NA = The standard is not available; the compound was searched by using a NBS data base of 42,000 compounds.

TABLE 21. SEMIVOLATILE ORGANIC RESULTS FOR KOO1-PCP SCRUBBER WATER (µg/liter)

Analyte	Quantitation limits	Blank	CKO1P-1-C1	CKO1P-1-D1	Blank	CKO1P-2-D1	CKO1P-3-D1
Acenaphthalene	50	ND[a]	ND	ND	ND	ND	ND
Acenaphthene	50	ND	ND	ND	ND	ND	ND
Acetophenone	50	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	5,000	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	1,000	ND	ND	ND	ND	ND	ND
Aniline	100	ND	ND	ND	ND	ND	ND
Anthracene	50	ND	ND	ND	ND	ND	ND
Aramite	b	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	10	ND	ND	ND	ND	ND	ND
Benzenethiol	b	ND	ND	ND	ND	ND	ND
Benzidine	5,000	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	50	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthrene	50	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	50	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthrene	50	ND	ND	ND	ND	ND	ND
p-Benzoquinone	5,000	ND	ND	ND	ND	ND	ND
Bis(2-Chloroethoxy)ethane	50	ND	ND	ND	ND	ND	ND
Bis(2-Chloroethyl)ether	50	ND	ND	ND	ND	ND	ND
Bis(2-Chloroisopropyl)ether	50	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	50	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	50	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	50	ND	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinitrophenol	b	ND	ND	ND	ND	ND	ND
p-Chloroaniline	500	ND	ND	ND	ND	ND	ND
Chlorobenzilate	b	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	50	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	50	ND	ND	ND	ND	ND	ND
2-Chlorophenol	50	ND	ND	ND	ND	ND	ND
3-Chloropropionitrile	b	ND	ND	ND	ND	ND	ND
Chrysene	50	ND	ND	ND	ND	ND	ND
Ortho-Cresol	50	ND	ND	ND	ND	ND	ND
Para-Cresol	50	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	50	ND	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	50	ND	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	50	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	50	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	50	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	50	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	100	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	50	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	50	ND	ND	ND	ND	ND	ND
Diethylphthalate	50	ND	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	50,000	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	1,000	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	50,000	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	50	ND	ND	ND	ND	ND	ND
Dimethylphthalate	50	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	50	ND	ND	ND	ND	ND	ND
1,4-Dinitrobenzene	500	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	250	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	250	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	50	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	50	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	50	ND	ND	ND	ND	ND	ND
Di-n-propylnitrosamine	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	50	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	50	ND	ND	ND	ND	ND	ND
Fluoranthene	50	ND	ND	ND	ND	ND	ND
Fluorene	50	ND	ND	ND	ND	ND	ND

(continued)

TABLE 21 (continued)

Analyte	Quantitation limits	Blank	CK01P-1-C1	CK01P-1-D1	Blank	CK01P-2-D1	CK01P-3-D1
Hexachlorobenzene	50	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	50	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	50	ND	ND	ND	ND	ND	ND
Hexachloroethane	50	ND	ND	ND	ND	ND	ND
Hexachlorophene	b	ND	ND	ND	ND	ND	ND
Hexachloropropene	50	ND	ND	ND	ND	ND	ND
Idenc(1,2,3-cd)pyrene	50	ND	ND	ND	ND	ND	ND
Isosafrole	500	ND	ND	ND	ND	ND	ND
Malononitrile	50,000	ND	ND	ND	ND	ND	ND
Methapyrilene	b	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	500	ND	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	1,000	ND	ND	ND	ND	ND	ND
Naphthalene	50	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	500	ND	ND	ND	ND	ND	ND
1-Naphthylamine	500	ND	ND	ND	ND	ND	ND
2-Naphthylamine	500	ND	ND	ND	ND	ND	ND
p-Nitroaniline	250	ND	ND	ND	ND	ND	ND
Nitrobenzene	50	ND	ND	ND	ND	ND	ND
4-Nitrophenol	250	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	500	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	500	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	500	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	500	ND	ND	ND	ND	ND	ND
N-Nitrosomethylamine	500	ND	ND	ND	ND	ND	ND
N-Nitrosomorpholine	1,000	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	1,000	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	1,000	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	1,000	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	50	ND	ND	ND	ND	ND	ND
Pentachloroethane	50	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	500	ND	ND	ND	ND	ND	ND
Pentachlorophenol	250	ND	ND	ND	ND	ND	ND
Phenacetin	500	ND	ND	ND	ND	ND	ND
Phenanthrene	50	ND	ND	ND	ND	ND	ND
Phenol	50	ND	ND	ND	ND	ND	ND
2-Picoline	500	ND	ND	ND	ND	ND	ND
Pronamide	500	ND	ND	ND	ND	ND	ND
Pyrene	50	ND	ND	ND	ND	ND	ND
Resorcinol	50	ND	ND	ND	ND	ND	ND
Safrole	500	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	500	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	500	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	50	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	250	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	50	ND	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	b	ND	ND	ND	ND	ND	ND

[a] ND = Not detected above detection limit.

[b] Detection limit not given, standard not available.

TABLE 22. METALS ANALYSIS FOR KOO1-PCP SCRUBBER WATER SAMPLES (μg/ml)

Analyte	Analysis type	Quantitation limit	CKO1P-1-C1	CKO1P-1-D1	CKO1P-2-D1	CKO1P-3-D1
Silver	ICPES	0.045	ND[a]	ND	ND	ND
Arsenic	AA	0.01	ND	0.12	0.11	0.16
Barium	ICPES	0.045	0.12	0.24	0.39	0.31
Beryllium	ICPES	0.005	ND	ND	ND	ND
Cadmium	ICPES	0.015	ND	0.008[b]	0.009[b]	0.008[b]
Chromium	ICPES	0.045	ND	0.019[b]	0.023[b]	0.020[b]
Copper	ICPES	0.05	0.15	0.09	0.07	0.08
Mercury	C. Vapor	0.001	ND	ND	0.003	ND
Nickel	ICPES	0.1	ND	0.03[b]	0.03[b]	ND
Lead	AA	0.01	0.021	0.18	0.20	0.18
Antimony	ICPES	0.3	ND	ND	ND	ND
Selenium	AA	0.025	ND	0.007[b]	0.007[b]	0.017[b]
Thallium	AA	0.015	ND	0.01[b]	0.006[b]	0.008[b]
Vanadium	ICPES	0.1	ND	ND	0.04[b]	ND
Zinc	ICPES	0.03	1.1	0.61	0.88	0.94

[a] ND = Not detected above the detection limit.

[b] Less than quantitation limit (5 times the detection limit).

TABLE 23. PURGEABLE/NONPURGEABLE ORGANIC CARBON DATA FOR K001-PCP SCRUBBER WATER SAMPLES (mg/liter)

	CK01P-1-C1	CK01P-1-D1	CK01P-2-D1	CK01P-3-D1
NPOC	6	1[a]	ND[b]	ND
POC	ND	3[a]	ND	ND

[a] Less than the quantitation limit (5 times the detection limit).

[b] ND = Not detected above the detection limit of 1 mg/liter.

TABLE 24. K001-PCP SCRUBBER DIOXIN/FURAN RESULTS (ng/liter)

Analyte	Reagent blank,	CK01P-1-C1,	CK01P-1-D1,	CK01P-2-D1,	CK01P-3-D1
Total TCDD	<1.8	<1.8	<2.0	<1.9	<2.2
Total TCDF	<1.2	<1.3	<1.3	<1.3	<1.5
Total PCDD	<1.8	<2.1	<2.0	<1.9	<2.1
Total PCDF	<1.6	<1.9	<1.7	<1.3	<1.9
Total HxCDD	<3.4	<4.4	<4.0	<3.6	<4.7
Total HxCDF	<2.6	<3.7	<3.7	<3.4	<5.0

The original data tables as received from the laboratory are presented in Appendix D.

K001-Creosote

The time and dates of sample collection for the K001-creosote test burns at John Zink are presented in Table 25. The following is a listing of tables that show the sample types and the results for each parameter class:

Sample type	Analytical results table
K001-creosote feed composition	
Volatile organics	26
Semivolatile organics	27
Metals	28
Total organic carbon	29
Proximate and ultimate	30
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Organochlorine pesticide	32
Chlorinated herbicides	33
Dioxins/furans	34
Ash composition	
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Semivolatile organics	36
Metals	37
Total organic carbon	38
Organophosphorous pesticide	39
Organochlorine pesticide	40
Chlorinated herbicides	41
Dioxins/furans	42
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Organophosphorous pesticide	50
Organochlorine pesticide	51
Chlorinated herbicides	52
Dioxins/furans	53

The original data tables as received from the laboratory are presented in Appendix E.

TABLE 25. K001-CREOSOTE SAMPLE INFORMATION

Test No.	Sample No.	Date collected	Time (24-h) collected
	K001-Creosote Feed Samples		
1	ZK01C-1-A1	10/2/87	a
1	ZK01C-1-A2	10/2/87	a
2	ZK01C-2-A1	10/5/87	a
2	ZK01C-2-A2	10/5/87	a
3	ZK01C-3-A1	10/6/87	a
3	ZK01C-3-A2	10/6/87	a
	Ash Samples		
1	ZK01C-1-B1	10/6/87	1340
1	ZK01C-1-B2	10/6/87	1525
2	ZK01C-2-B1	10/6/87	1840
2	ZK01C-2-B2	10/6/87	2015
3	ZK01C-3-B1	10/7/87	1230
3	ZK01C-3-B2	10/7/87	1445
All	Fly ash	10/8/87	b
	Pretest Scrubber Water Sample		
1	ZK01C-1-D1	10/5/87	1400
	Scrubber Water Samples		
1	ZK01C-1-E1	10/6/87	1340
1	ZK01C-1-E2	10/6/87	1525
2	ZK01C-2-E1	10/6/87	1840
2	ZK01C-2-E2	10/6/87	2000
3	ZK01C-3-E1	10/7/87	1230
3	ZK01C-3-E2	10/7/87	1445

[a] The feed samples were collected while the fiber packs were being packed.

[b] The fly ash sample was collected from the solids separator after the tests were complete.

TABLE 26. GC/MS VOLATILE ORGANIC RESULTS FOR K001-CREOSOTE FEED
(mg/g)

Compound	Quantitation limit	ZK01C-1-A1	ZK01C-1-A2	ZK01C-2-A1	ZK01C-2-A2	ZK01C-3-A1	ZK01C-3-A2	Reagent Blank
Volatiles (Method 8240)								
Acetonitrile	1000	ND[a]	ND	ND	ND	ND	ND	ND
Acrolein	2500	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND
Benzene	50	56	60	61	51	58	83	ND
Bromodichloromethane	50	ND	ND	ND	ND	ND	ND	ND
Bromomethane	50	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	50	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	50	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	50	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Chloroethane	50	ND	ND	ND	ND	ND	ND	ND
Chloroform	50	ND	ND	ND	ND	ND	ND	ND
Chloromethane	50[b]	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-butadiene	NA	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	500	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	50	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	50	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	50	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	50	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	50	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	50	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl cyanide	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND
Iodomethane	100	ND	ND	ND	ND	ND	ND	ND
Isobutyl Alcohol	NA	ND	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	250	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	NA	ND	ND	ND	ND	ND	ND	ND
Methylacrylonitrile	NA	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	250	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 26 (continued)

Compound	Quantitation limit	ZK01C-1-A1	ZK01C-1-A2	ZK01C-2-A1	ZK01C-2-A2	ZK01C-3-A1	ZK01C-3-A2	Reagent Blank
Tetrachloroethene	50	ND	ND	ND	ND	ND	ND	ND
Toluene	50	110	120	100	110	110	170	ND
Tribromomethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	50	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	50	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	50	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	50	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	50	57	56	55	72	71	87	ND
Xylenes	50	120	130	120	130	130	170	ND
Styrene	50	69	71	64	66	71	98	ND
Ethyl Ether	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl Acetate	50	ND	ND	ND	ND	ND	ND	ND
Epichlorohydrin	NA	ND	ND	ND	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND	ND	ND	ND
Methyl isobutyl ketone	500	ND	ND	ND	ND	ND	ND	ND
Di-n-propylnitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane	NA	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	NA	ND	ND	ND	ND	ND	ND	ND
Hexachloropentadiene	NA	ND	ND	ND	ND	ND	ND	ND
Cumene	NA	ND	ND	ND	ND	ND	ND	ND
Benzyl Chloride	NA	ND	ND	ND	ND	ND	ND	ND
Acetaldehyde	NA	ND	ND	ND	ND	ND	ND	ND
Cyclohexanone	NA	ND	ND	ND	ND	ND	ND	ND
Dimethyl Nitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND
Methyl Acetate	NA	ND	ND	ND	ND	ND	ND	ND
Propylene Oxide	NA	ND	ND	ND	ND	ND	ND	ND
Phthalic Anhydride	NA	ND	ND	ND	ND	ND	ND	ND

[a] ND = not detected above the detection limit.

[b] NA = standard not available. Compound searched by using an NBS data base of 42,000 compounds.

TABLE 27. SEMIVOLATILE ORGANIC RESULTS FOR KO01-CREOSOTE WASTE FEED SAMPLES (μg/g)

Compound	Quantitation limit	ZK01C-1-A1 x=1[a]	ZK01C-1-A2 x=0.94	ZK01C-2-A1 x=1	ZK01C-2-A2 x=0.98	ZK01C-3-A1 x=0.97	ZK01C-3-A2 x=1.11	Reagent blank x=0.76
Acenaphthalene	4,600	ND[b]	1000	ND	ND	ND	ND	ND
Acenaphthene	2,500	21,000	15,000	19,000	16,000	19,000	17,000	ND
Acetophenone	3,700	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	8,500	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	3,950	ND	ND	ND	ND	ND	ND	ND
Aniline	13,000	ND	ND	ND	ND	ND	ND	ND
Anthracene	2,500	15,000	7,300	12,000	8,500	7,400	9,100	ND
Aramite	NA[c]	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	10,500	4,500[d]	4,000[d]	4,600[d]	4,000[d]	4,200	4,000	ND
Benzenethiol	NA	ND	ND	ND	ND	ND	ND	ND
Benzidine	10,000	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	3,300	1,700[d]	1,800[d]	1,900[d]	1,700[d]	1,600[d]	1,700[d]	ND
Benzo(b and/or K)fluoranthrene	6,500	4,900[d]	4,700[d]	3,900[d]	4,100[d]	3,000[d]	3,100[d]	ND
Benzo(g,h,i)perylene	5,500	ND	ND	ND	ND	ND	ND	ND
p-Benzoquinone	NA	ND	ND	ND	ND	ND	ND	ND
Bis(2-Chloroethoxy)methane	7,000	ND	ND	ND	ND	ND	ND	ND
Bis(2-Chloroethyl)ether	7,500	ND	ND	ND	ND	ND	ND	ND
Bis(2-Chloroisopropyl)ether	7,500	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	3,300	ND	ND	ND	92[d]	ND	ND	ND
4-Bromophenyl phenyl ether	2,500	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	3,300	ND	ND	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinitrophenol	NA	ND	ND	ND	ND	ND	ND	ND
p-Chloroaniline	13,000	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	5,500	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	NA	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	2,500	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	4,350	ND	ND	ND	ND	ND	ND	ND
3-Chloropropionitrile	NA	ND	ND	ND	ND	ND	ND	ND
Chrysene	3,300	4,800	4,200	4,800	4,100	4,200	4,300	ND
ortho-Cresol	13,000	ND	ND	ND	ND	ND	ND	ND
para-Cresol	13,000	ND	3,400[d]	3,300[d]	3,600[d]	ND	3,100[d]	ND
Dibenz(a,h)anthracene	3,300	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	NA	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	NA	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	2,500	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	2,500	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	6,000	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	22,000	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	3,550	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	900	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	2,500	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	NA	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	4,500	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	4,000	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	3,500	870[d]	1,200[d]	1,100[d]	1,200[d]	910[d]	1,200[d]	ND

(continued)

TABLE 27 (continued)

Compound	Quantitation limit	ZK01C-1-A1 x=1[a]	ZK01C-1-A2 x=0.94	ZK01C-2-A1 x=1	ZK01C-2-A2 x=0.98	ZK01C-3-A1 x=0.97	ZK01C-3-A2 x=1.11	Reagent blank x=0.76
Dimethylphthalate	2,100	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	33,000	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	3,450	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-creosol	31,500	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	55,000	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	7,500	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	2,500	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	3,300	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	2,650	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenlhydrazine	NA	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	29,000	26,000[d]	22,000[d]	25,000[d]	21,000[d]	23,000[d]	23,000[d]	ND
Fluorene	2,500	18,000	12,000	16,000	14,000	16,000	14,000	ND
Hexachlorobenzene	2,500	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	1,200	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	8,000	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	2,100	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	NA	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	7,500	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	4,900	ND	ND	ND	ND	ND	ND	ND
Isosafrole	2,000	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	16,000	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	4,600	ND	ND	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	NA	ND	ND	ND	ND	ND	ND	ND
Naphthalene	2,100	42,000	40,000	40,000	32,000	29,000	43,000	ND
1,4-Naphthoquinone	1,600	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	7,500	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	17,000	ND	ND	ND	ND	ND	ND	ND
p-Nitroaniline	65,000	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	2,500	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	3,150	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	4,100	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	3,550	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	13,000	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	16,000	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	4,600	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomorpholine	4,500	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	3,850	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	55,000	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	3,450	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	2,000	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	2,500	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	3,450	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	4,750	ND	ND	ND	ND	ND	ND	ND
Phenacetin	NA	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	7,000	41,000	32,000	37,000	29,000	32,000	36,000	ND
Phenol	2,000	2,400	3,700	3,600	3,900	2,400	3,300	ND

(continued)

TABLE 27 (continued)

Compound	Quantitation limit	ZK01C-1-A1 x=1[d]	ZK01C-1-A2 x=0.94	ZK01C-2-A1 x=1	ZK01C-2-A2 x=0.98	ZK01C-3-A1 x=0.97	ZK01C-3-A2 x=1.11	Reagent blank x=0.76
2-Picoline	3,150	ND	ND	ND	ND	ND	ND	ND
Pronamide	2,400	ND	ND	ND	ND	ND	ND	ND
Pyrene	2,500	17,000	13,000	16,000	12,000	15,000	13,000	ND
Resorcinol	NA	ND	ND	ND	ND	ND	ND	ND
Safrole	3,300	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	2,000	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	9,000	ND	ND	ND	ND	ND	ND	ND
1,2,4,-Trichlorobenzene	2,500	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	13,000	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	3,650	ND	ND	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	NA	ND	ND	ND	ND	ND	ND	ND

[a] Variable dilutions performed for each sample. Quantitation limit times x (listed under sample number) is the quantitation limit (5 times the detection limit) for that sample.

[b] ND = not detected above the detection limit.

[c] NA = standard not available. Compound searched by using NBS data base of 42,000 compounds.

[d] Less than quantitation limit (5 times detection limit).

TABLE 28. METALS ANALYSIS RESULTS FOR K001-CREOSOTE FEED SAMPLES
(μg/g)

Parameter	Analysis type	Quantitation limit	ZK01C-1-A1	ZK01C-1-A2	ZK01C-2-A1	ZK01C-2-A2	ZK01C-3-A1	Reagent blank	ZK01C-3-A2	Reagent blank
Silver	ICPES	3.5	ND[a]	ND	ND	ND	ND[b]	ND	ND	ND
Arsenic	AA	2.0	2.6	ND	2.1	2.5	0.7[b]	ND	2.6	ND
Barium	ICPES	1.0	63	58	70	59	12	ND	150	ND
Beryllium	ICPES	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ICPES	2.0	3.4	3.4	3.1	2.4	0.79[b]	ND	3.5	ND
Chromium	ICPES	3.5	5.0	4.8	6.4	7.0	1.6[b]	ND	8.6	ND
Copper	ICPES	3.0	35	32	39	39	12	ND	38	ND
Mercury	C.Vapor	1.25	0.36[b]	0.35[b]	ND[b]	0.40[b]	0.79[b]	ND	0.66[b]	ND
Nickel	ICPES	7.5	2.1[b]	ND	2.1[b]	2.8[b]	1.8[b]	ND	4.5[b]	ND
Lead	AA	21	170	160	150	110	37	ND	190	ND
Antimony	ICPES	17	ND[b]	ND[b]	ND[b]	ND[b]	ND[b]	ND	ND[b]	ND
Selenium	AA	2.0	1.5[b]	1.4[b]	1.2[b]	1.1[b]	0.3[b]	ND	1.1[b]	ND
Thallium	AA	2.5	7.7	8.0	6.8	5.3	2.2	ND	3.3[b]	ND
Vanadium	ICPES	4.0	ND	ND	ND	0.82[b]	ND	ND	1.9[b]	ND
Zinc	ICPES	1.0	170	170	160	120	40	ND	200	ND

[a] ND = not detected above the detection limit.

[b] Less than quantitation limit (5 times detection limit).

TABLE 29. K001-CREOSOTE FEED TOTAL ORGANIC CARBON RESULTS (µg/g)

Parameter	Quantitation limit	ZK01C-3-A2
TOC	0.5	61

TABLE 30. K001-CREOSOTE FEED SAMPLE ZK01C-1-A1 ULTIMATE AND PROXIMATE ANALYSES RESULTS

Parameter	ZK01G-1-A1, %
Drying loss	9.19
Carbon	66.2
Hydrogen	5.26
Oxygen	14.0
Nitrogen	0.09
Sulfur	0.51
Ash	12.7
Volatile matter	58.0
Fixed carbon	20.1

TABLE 31. K001-CREOSOTE FEED SAMPLE ORGANOPHOSPHOROUS PESTICIDE RESULTS
(μg/g)

Compound	Quantitation limit	Reagent blank	ZK01C-1
Phorate	0.10	ND[a]	ND
Sulfatepp	0.10	ND	ND
Disulfoton	0.20	ND	ND
Methyl parathion	0.20	ND	ND
Ethyl parathion	0.15	ND	ND
Famphur	0.50	ND	ND

[a] Not detected above the detection limit.

TABLE 32. K001-CREOSOTE WASTE FEED ORGANOCHLORINE PESTICIDE RESULTS (μg/g)

Compound	Quantitation limit	Reagent blank	ZK01C-1-A1
Aldrin	7.5	ND[a]	ND
(Alpha)-BHC	4.0	ND	ND
(Beta)-BHC	7.5	ND	ND
(Delta)BHC	7.5	ND	ND
(Gamma)-BHC	5.0	ND	ND
Chlordane	100	ND	ND
p,p'-DDD	15	ND	ND
p,p'-DDE	7.5	ND	ND
p,p'-DDT	15	ND	ND
Dieldrin	7.5	ND	ND
Endosulfan I	7.5	ND	ND
Endosulfan II	7.5	ND	ND
Endrin	7.5	ND	ND
Endrin aldehyde	15	ND	ND
Heptachlor	5.0	ND	ND[b]
Heptachlor epoxide	7.5	ND	5.1[b]
Isodrin	7.5	ND	ND
Kepone	40	ND	ND
Methoxychlor	25	ND	ND
Toxaphene	1000	ND	ND
Aroclor 1016	1000	ND	ND
Aroclor 1221	1000	ND	ND
Aroclor 1232	1000	ND	ND
Aroclor 1242	1000	ND	ND
Aroclor 1248	1000	ND	ND
Aroclor 1254	300	ND	ND
Aroclor 1260	400	ND	ND

[a] Not detected above the detection limit.

[b] Less than quantitation limit (5 times detection limit).

TABLE 33. KOO1-CREOSOTE WASTE FEED SAMPLES CHLORINATED HERBICIDES RESULTS
(µg/g)

Compound	Quantitation limit	ZKO1C-1-A	Reagent blank
2,4-D	1.25	ND[a]	ND
Silvex	0.375	ND	ND
2,4,5-T	0.375	ND	ND
Dinoseb	0.375	ND	ND

[a] Not detected above the detection limit.

TABLE 34. KOO1-CREOSOTE FEED SAMPLES DIOXIN/FURAN RESULTS
(ng/g)

Compound	Reagent blank	ZKO1C-1-A1[a]
Total TCDD	<0.2	<52
Total TCDF	<0.2	<39
Total PCDD	<0.2	<48
Total PCDF	<0.2	<41
Total HxCDD	<0.5	<129
Total HxCDF	<0.4	<87

[a] The complex matrix required a 1000:1 dilution to obtain suitable chromatography. The detection limits have been affected by this dilution.

TABLE 35. GC/MS VOLATILE ORGANIC RESULTS FOR K001-CREOSOTE ASH
(μg/g)

Compound	Quantitation limit (PQL)	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B2	ZK01C-2-B1	ZK01C-3-B1	Fly Ash	ZK01C-3-B2	Reagent Blank
Volatiles (Method 8240)									
Acetonitrile	1000	ND[a]	ND	ND	ND	ND	ND	ND	ND
Acrolein	2500	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	50	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	50	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	50	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	50	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	50	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	50	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-butadiene	NA[b]	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	500	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	50	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-dichloroethene	50	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,4-dichloro-2-butene	50	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	NA	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl cyanide	NA	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND	ND
Iodomethane	100	ND	ND	ND	ND	ND	ND	ND	ND
Isobutyl Alcohol	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	250	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methylacrylonitrile	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	250	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	100	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	100	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 35 (continued)

Compound	Quantitation limit (PQL)	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B2	ZK01C-2-B1	ZK01C-3-B1	Fly Ash	ZK01C-3-R2	Reagent Blank
Tetrachloroethene	50	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	50	ND	ND	ND	ND	ND	ND	ND	ND
Tribromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	50	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	50	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	50	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	50	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	50	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	50	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Ether	NA	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Acetate	50	ND	ND	ND	ND	ND	ND	ND	ND
Epichlorohydrin	NA	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND	ND	ND	ND	ND
Methyl isobutyl ketone	500	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-propylnitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	NA	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropentadiene	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cumene	NA	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl Chloride	NA	ND	ND	ND	ND	ND	ND	ND	ND
Acetaldehyde	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexanone	NA	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl Nitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Acetate	NA	ND	ND	ND	ND	ND	ND	ND	ND
Propylene Oxide	NA	ND	ND	ND	ND	ND	ND	ND	ND
Phthalic Anhydride	NA	ND	ND	ND	ND	ND	ND	ND	ND

[a] ND = Not detected above the detection limit.

[b] NA = Standard not available. Compound searched by using an NBS data base of 42,000 compounds.

TABLE 36. SEMIVOLATILE ORGANIC RESULTS FOR K001-CREOSOTE ASH SAMPLES
(μg/g)

Compound	Quantitation limit (PQL)	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B2	ZK01C-2-B1	ZK01C-3-B1	ZK01C-3-B2	Fly ash	Reagent blank	Reagent blank
Acenaphthalene	1.15	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	0.95	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	2.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	100	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aramite	NA[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	2.60	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzenethiol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	14.5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b &/or K)fluoranthrene	1.60	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	1.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Benzoquinone	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	1.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	0.85	0.18[c]	ND	ND	ND	ND	0.2[c]	ND	0.2[c]	ND
4-Bromophenyl phenyl ether	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Sec-butyl-4,6-dinitrophenol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloroaniline	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	1.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	1.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropionitrile	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ortho-cresol	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
Para-cresol	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	1.45	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	5.5	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	0.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	2.30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	1.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	2.75	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	0.90	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 36 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-B1	ZKO1C-1-B2	ZKO1C-2-B2	ZKO1C-2-B1	ZKO1C-3-B1	ZKO1C-3-B2	Fly ash	Reagent blank	Reagent blank
Dimethylphthalate	0.55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	0.85	0.83[c]	0.70[c]	0.93	0.53[c]	0.53[c]	0.77[c]	ND	ND	ND
1,3-Dinitrobenzene	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-creosol	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	14.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenlhydrazine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	0.30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	0.55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	1.25	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	1.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	0.55	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	0.40	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	4.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Nitroaniline	17.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	0.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	1.05	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	0.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	1.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomorpholine	1.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	0.95	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	1.40	ND	ND	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	1.20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	1.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 36 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-B1	ZKO1C-1-B2	ZKO1C-2-B2	ZKO1C-2-B1	ZKO1C-3-B1	ZKO1C-3-B2	Fly ash	Reagent blank	Reagent blank
2-Picoline	0.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	0.60	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
Resorcinol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	0.85	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	2.30	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,-Trichlorobenzene	0.65	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	3.35	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	0.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a] ND = Not detected above the detection limit.

[b] NA = Standard not available; quantitation limit not determined.

[c] Less than quantitation limit (5 times detection limit).

TABLE 37. METALS ANALYSIS RESULTS FOR K001-CREOSOTE ASH SAMPLES (μg/g)

Parameter	Analysis type	Quantitation limit (PQL)	ZK01G-1-B1	ZK01G-1-B2	Reagent blank	ZK01G-2-B1	ZK01G-2-B2	ZK01G-3-B1	Reagent blank	ZK01C-3-B2	Reagent blank	Fly ash	Reagent blank
Silver	ICPES	3.5	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	AA	2.0	5.3	5.3	ND	9.0	10	13	ND	11	ND	17	ND
Barium	ICPES	1.0	81	74	ND	61	48	56	ND	72	ND	90	ND
Beryllium	ICPES	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.35	ND
Cadmium	ICPES	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	54	ND
Chromium	ICPES	3.5	6.1	5.3	ND	5.8	8.7	10	ND	7.7	ND	120	ND
Copper	ICPES	3.0	86	100	ND	98	110	130	ND	86	ND	77	ND
Mercury	C.Vapor	1.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	ICPES	7.5	3.6[b]	4.6[b]	ND	5.0[b]	5.2[b]	6.8[b]	ND	3.9[b]	ND	26	ND
Lead	AA	21	ND	ND	ND	ND	ND	ND	ND	ND	ND	110	ND
Antimony	ICPES	17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	AA	2.0	2.3	1.9[b]	ND	1.8[b]	2.5	2.6	ND	2.8	ND	ND	ND
Thallium	AA	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	ICPES	4.0	4.4	4.1	ND	4.1	4.2	5.2	ND	4.8	ND	21	ND
Zinc	ICPES	1.0	1.9	1.8	ND	3.2	2.8	3.0	ND	2.5	ND	290	ND

[a] ND = not detected above the detection limit.

[b] Less than quantitation limit (5 times detection limit).

TABLE 38. K001-CREOSOTE ASH SAMPLES TOTAL ORGANIC CARBON RESULTS
(μg/g)

Parameter	Quantitation limit	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B1	ZK01C-2-B2	ZK01C-3-B1	ZK01C-3-2
TOC	0.5	27	41	58	29	32	38

TABLE 39. K001-CREOSOTE ASH SAMPLES ORGANOPHOSPHOROUS PESTICIDE RESULTS
(µg/g)

Compound	Quantitation limit	Reagent blank	ZK01C-3-B2
Phorate	0.05	ND[a]	ND
Sulfotepp	0.05	ND	ND
Disulfoton	0.10	ND	ND
Methyl parathion	0.10	ND	ND
Ethyl parathion	0.65	ND	ND
Famphur	0.25	ND	ND

[a] Not detected above detection limit.

TABLE 40. K001-CREOSOTE ASH SAMPLE ORGANOCHLORINE PESTICIDE RESULTS
(µg/kg)

Compound	Quantitation limit	Reagent blank	ZK01C-3-B2
Aldrin	5.0	ND[a]	ND
(Alpha)-BHC	2.5	ND	ND
(Beta)-BHC	5.0	ND	ND
(Delta)BHC	5.0	ND	ND
(Gamma)-BHC	5.0	ND	ND
Chlordane	65	ND	ND
p,p'-DDD	10	ND	ND
p,p'-DDE	5.0	ND	ND
p,p'-DDT	10	ND	ND
Dieldrin	5.0	ND	ND
Endosulfan I	5.0	ND	ND
Endosulfan II	5.0	ND	ND
Endrin	5.0	ND	ND
Endrin aldehyde	10	ND	ND
Heptachlor	5.0	ND	ND
Heptachlor epoxide	5.0	ND	ND
Isodrin	5.0	ND	ND
Kepone	30	ND	ND
Methoxychlor	15	ND	ND
Toxaphene	500	ND	ND
Aroclor 1016	500	ND	ND
Aroclor 1221	500	ND	ND
Aroclor 1232	500	ND	ND
Aroclor 1242	500	ND	ND
Aroclor 1248	500	ND	ND
Aroclor 1254	250	ND	ND
Aroclor 1260	250	ND	ND

[a] Not detected above the detection limit.

TABLE 41. K001-CREOSOTE ASH SAMPLES CHLORINATED HERBICIDES RESULTS
(µg/g)

Compound	Quantitation limit	ZK01C-3-B2	Reagent blank
2,4-D	2.5	ND[a]	ND
Silvex	0.10	ND	ND
2,4,5-T	0.10	ND	ND
Dinoseb	0.10	ND	ND

[a] Not detected above the detection limit.

TABLE 42. K001-CREOSOTE ASH SAMPLES DIOXIN/FURAN RESULTS
(ng/g)

Compound	Reagent blank	ZK01C-3-B2	ZK01C-3-B2
Total TCDD	<0.2	<0.3	<0.4
Total TCDF	<0.2	<0.2	<0.3
Total PCDD	<0.2	<0.3	<0.3
Total PCDF	<0.2	<0.2	<0.3
Total HxCDD	<0.5	<0.5	<0.7
Total HxCDF	<0.4	<0.5	<0.6

TABLE 43. VOLATILE ORGANIC RESULTS FOR K001-CREOSOTE ASH SUBJECTED TO TCLP
(μg/g)

Compound	Quantitation limit (PQL)	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B1	ZK01C-2-B2	ZK01C-3-B1	TCLP Blank	ZK01C-3-B2	TCLP Blank	Reagent blank	Fly ash
Acetonitrile	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-butadiene	NA[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-dichloroethene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,4-dichloro-2-butene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl cyanide	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iodomethane	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isobutyl Alcohol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylacrylonitrile	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tribromomethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 43 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-B1	ZKO1C-1-B2	ZKO1C-2-B1	ZKO1C-2-B2	ZKO1C-3-B1	TCLP Blank	ZKO1C-3-B2	TCLP Blank	Reagent blank	Fly ash
Trichloroethene	50	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl ether	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl acetate	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Epichlorohydrin	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl isobutyl ketone	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-propylnitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropentadiene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cumene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl chloride	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetaldehyde	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexanone	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl nitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Propylene oxide	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phthalic anhydride	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a] ND = not detected above the detection limit.

[b] NA = standard not available. Compound searched by using NBS data base of 42,000 compounds.

TABLE 44. TCLP SEMIVOLATILE ORGANIC RESULTS FOR K001-CREOSOTE ASH SAMPLES
(μg/liter)

Compound	Quantitation limit (PQL)	ZK01C-1-B1	ZK01C-1-B2	ZK01C-2-B1	ZK01C-2-B2	ZK01C-3-B1	ZK01C-3-B2	Fly ash	TCLP blank[a]	Reagent blank	Reagent blank	Reagent blank
Acenaphthalene	20	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aramite	NA[b]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzenethiol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b &/or K)fluoranthrene	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Benzoquinone	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Sec-butyl-4,6-dinitrophenol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloroaniline	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropionitrile	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ortho-cresol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Para-cresol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 44 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-B1	ZKO1C-1-B2	ZKO1C-2-B1	ZKO1C-2-B2	ZKO1C-3-B1	ZKO1C-3-B2	Fly ash	TCLP blank[a]	Reagent blank	Reagent blank	Reagent blank
Dimethylphthalate	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-creosol	125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	220	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenlhydrazine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Nitroaniline	260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomorpholine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 44 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-B1	ZKO1C-1-B2	ZKO1C-2-B1	ZKO1C-2-B2	ZKO1C-3-B1	ZKO1C-3-B2	Fly ash	TCLP blank[a]	Reagent blank	Reagent blank	Reagent blank
2-Picoline	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Resorcinol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,-Trichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a] ND = not detected above detection limit.

[b] NA = standard not available. Detection limit not determined.

TABLE 45. METALS RESULTS FOR K001-CREOSOTE ASH TCLP EXTRACTION SAMPLES (mg/liter)

Parameter	Analysis type	Quantitation limit (PQL)	ZK01G-1-B1	ZK01G-1-B2	ZK01G-2-B1	ZK01G-2-B2	ZK01G-3-B1	TCLP blank	Reagent blank	ZK01C-3-B2	Fly ash	TCLP blank	Reagent blank
Silver	ICPES	0.035	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	AA	0.020	ND	ND	ND	ND	0.025	ND	ND	ND	0.12	ND	ND
Barium	ICPES	0.010	0.38	0.57	0.53	0.31	0.22	0.020	ND	0.41	0.080	0.008	ND
Beryllium	ICPES	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ICPES	0.020	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND
Chromium	ICPES	0.035	ND	ND	ND	ND	ND	ND	ND	ND	2.8	ND	ND
Copper	ICPES	0.030	0.020	0.030	0.030	ND	0.008	0.030	ND	0.070	0.009	0.15	ND
Mercury	C. Vapor	0.0025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	ICPES	0.075	ND	ND	0.020	ND	ND	ND	ND	0.020	0.030	ND	ND
Lead	AA	0.210	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Antimony	ICPES	0.170	0.035	ND	0.040	0.040	0.040	ND	ND	0.040	0.060	ND	ND
Selenium	AA	0.020	ND	ND	ND	ND	0.004	ND	ND	ND	0.004	ND	ND
Thallium	AA	0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	ICPES	0.040	ND	ND	ND	ND	0.020	ND	ND	ND	0.12	ND	ND
Zinc	ICPES	0.010	0.020	0.050	0.080	0.010	0.030	0.003	ND	0.002	0.11	0.010	ND

[a] Not detected above detection limit.

TABLE 46. GC/MS VOLATILE ORGANIC RESULTS FOR K001-CREOSOTE WATER SAMPLES
(μg/liter)

Compound	Quantitation limit (PQL)	ZK01C-1-D1	ZK01C-1-E1	ZK01C-1-E2	ZK01C-2-E1	ZK01C-2-E2	ZK01C-03-E1	ZK01C-03-E2
Volatiles (Method 8240)								
Acetonitrile	1000	ND[a]	ND	ND	ND	ND	ND	ND
Acrolein	2500	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	50	ND	ND	ND	ND	ND	ND	ND
Benzene	50	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	50	ND	ND	ND	ND	ND	ND	ND
Bromomethane	50	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	50	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	50	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	50	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Chloroethane	50	ND	ND	ND	ND	ND	ND	ND
Chloroform	50	ND	ND	ND	ND	ND	ND	ND
Chloromethane	50[b]	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-butadiene	NA	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	500	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	50	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	50	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	50	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-dichloroethene	50	ND	ND	ND	ND	ND	ND	ND
Trans-1,4-dichloro-2-butene	50	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	50	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-dichloropropene	50	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl cyanide	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND
Iodomethane	100	ND	ND	ND	ND	ND	ND	ND
Isobutyl Alcohol	NA	ND	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	250	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	250	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	NA	ND	ND	ND	ND	ND	ND	ND
Methylacrylonitrile	NA	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	250	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	50	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 46 (continued)

Compound	Quantitation limit (PQL)	ZKO1C-1-D1	ZKO1C-1-E1	ZKO1C-1-E2	ZKO1C-2-E1	ZKO1C-2-E2	ZKO1C-03-E1	ZKO1C-03-E2
Tetrachloroethene	50	ND	ND	ND	ND	ND	ND	ND
Toluene	50	ND	ND	ND	ND	ND	ND	ND
Tribromomethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	50	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	50	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	50	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	50	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	50	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	50	ND	ND	ND	ND	ND	ND	ND
Xylenes	50	ND	ND	ND	ND	ND	ND	ND
Styrene	50	ND	ND	ND	ND	ND	ND	ND
Ethyl ether	NA	ND	ND	ND	ND	ND	ND	ND
Ethyl acetate	50	ND	ND	ND	ND	ND	ND	ND
Epichlorohydrin	NA	ND	ND	ND	ND	ND	ND	ND
Acetone	250	ND	ND	ND	ND	ND	ND	ND
Methyl isobutyl ketone	500	ND	ND	ND	ND	ND	ND	ND
Di-n-propylnitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane	NA	ND	ND	ND	ND	ND	ND	ND
1,3-Butadiene	NA	ND	ND	ND	ND	ND	ND	ND
Hexachloropentadiene	NA	ND	ND	ND	ND	ND	ND	ND
Cumene	NA	ND	ND	ND	ND	ND	ND	ND
Benzyl chloride	NA	ND	ND	ND	ND	ND	ND	ND
Acetaldehyde	NA	ND	ND	ND	ND	ND	ND	ND
Cyclohexanone	NA	ND	ND	ND	ND	ND	ND	ND
Dimethyl nitrosoamine	NA	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	NA	ND	ND	ND	ND	ND	ND	ND
Propylene oxide	NA	ND	ND	ND	ND	ND	ND	ND
Phthalic anhydride	NA	ND	ND	ND	ND	ND	ND	ND

[a] ND = not detected above detection limit.

[b] NA = standard not available. Compound searched using an NBS data base of 42,000 compounds.

TABLE 47. SEMIVOLATILE ORGANIC RESULTS FOR K001-CREOSOTE SCRUBBER WATER (μg/liter)

Compound	Quantitation limit	ZK01C-1-D1 x=1[a]	ZK01C-1-E1 x=1	ZK01C-1-E2 x=3.5	ZK01C-2-E1 x=1	ZK01C-2-E2 x=1	ZK01C-3-E1 x=1.5[b]	ZK01C-3-E2 x=1	Reagent blank	Reagent blank
Acenaphthalene	20	ND[c]	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Acetylaminofluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aramite	NA[c]	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	40	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzenethiol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	250	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b and/or K)fluoranthrene	25	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Benzoquinone	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Sec-butyl-4,6-dinitrophenol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloroaniline	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropionitrile	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ortho-cresol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Para-cresol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,e)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,i)pyrene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Dichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Dichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dichlorobenzene	25	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	85	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	35	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethoxybenzidine	40	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND

(continued)

TABLE 47 (continued)

Compound	Quantitation limit	ZK01C-1-D1 x=1[a]	ZK01C-1-E1 x=1	ZK01C-1-E2 x=3.5	ZK01C-2-E1 x=1	ZK01C-2-E2 x=1	ZK01C-3-E1 x=1.5[c]	ZK01C-3-E2 x=1	Reagent blank	Reagent blank
Dimethylphthalate	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-creosol	125	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	220	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine/diphenylnitrosamine	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenlhydrazine	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloropropene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isosafrole	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	60	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-Methylenebis(2-chloroaniline)	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinone	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	65	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Nitroaniline	260	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-butylamine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	65	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomorpholine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopyrrolidine	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
5-Nitro-o-toluidine	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloroethane	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	10	2[d]	ND	ND	ND	ND	ND	ND	5.5[d]	ND

(continued)

TABLE 47 (continued)

Compound	Quantitation limit	ZK01C-1-D1 x=1[a]	ZK01C-1-E1 x=1	ZK01C-1-E2 x=3.5	ZK01C-2-E1 x=1	ZK01C-2-E2 x=1	ZK01C-3-E1 x=1.5[c]	ZK01C-3-E2 x=1	Reagent blank	Reagent blank
2-Picoline	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Resorcinol	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	35	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,-Trichlorobenzene	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	55	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tris(2,3-dibromopropyl)phosphate	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a] Variable dilutions performed for each sample. Reported times x (listed under sample number) is the PQL for that sample.

[b] ND = not detected above detection limit.

[c] NA = standard not available, PQL not determined.

[d] Less than quantitation limit (5 times detection limit).

TABLE 48. METALS ANALYSIS RESULTS FOR K001-CREOSOTE SCRUBBER WATER
(mg/liter)

Parameter	Analysis type	Quantitation limit	ZK01C-1-D1	ZK01C-1-E1	Reagent blank	ZK01C-1-E2	ZK01C-2-E1	ZK01C-2-E2	Reagent blank	ZK01C-03-E1	ZK01C-3-E2	Reagent blank
Silver	ICPES	0.035	ND[a]	ND	ND	0.010[b]	0.010[b]	0.020[b]	ND	0.010[b]	0.0202[b]	ND
Arsenic	AA	0.020	0.010[b]	0.041	ND	0.15	0.16	0.28	ND	0.25	1.6	ND
Barium	ICPES	0.010	0.12	0.76	ND	0.80	0.56	1.0	ND	0.90	1.1	ND
Beryllium	ICPES	0.005	ND	0.002[b]	ND	ND	0.001[b]	0.001[b]	ND	0.002[b]	0.001[b]	ND
Cadmium	ICPES	0.020	0.64	0.87	ND	0.99	0.95	1.2	ND	0.45	0.46	ND
Chromium	ICPES	0.035	0.09	0.35	ND	0.74	0.60	1.0	ND	0.65	0.89	ND
Copper	ICPES	0.030	0.18	0.42	ND	0.50	0.43	0.51	ND	0.45	0.35	ND
Mercury	C.Vapor	0.0025	ND	0.016	ND	0.060	0.008	0.29	ND	0.19	0.54	ND
Nickel	ICPES	0.075	0.12	0.48	ND	0.51	0.56	0.60	ND	0.70	0.54	ND
Lead	AA	0.210	0.47	2.5	ND	4.5	3.5	5.4	ND	3.3	3.9	ND
Antimony	ICPES	0.170	ND	ND	ND	ND	ND	0.040[b]	ND	ND	0.040[b]	ND
Selenium	AA	0.020	ND	0.057	ND	0.11	0.090	0.12	ND	0.038	0.021	ND
Thallium	AA	0.025	ND	0.028	ND	2.4	2.8	3.4	ND	3.8	4.0	ND
Vanadium	ICPES	0.040	0.010[b]	0.040	ND	0.060	0.040	0.080	ND	0.050	0.060	ND
Zinc	ICPES	0.010	0.14	5.0	ND	7.1	9.1	11	ND	8.2	8.2	ND

[a] ND = not detected above detection limit.

[b] Less than quantitation limit (5 times detection limit).

TABLE 49. K001-CREOSOTE AQUEOUS SAMPLES WATER QUALITY PARAMETER RESULTS
(mg/liter)

Parameter	Quantitation limit	ZK01C-1-D1	ZK01C-1-E1	ZK01C-1-E2	ZK01C-2-E1	ZK01C-2-E2	ZK01C-3-E1	ZK01C-3-E2
Chloride	5	260	590	560	770	920	920	830
Total cyanide	0.25	NDS[a]	ND[b]	NDS	NDS	NDS	NDS	NDS
Chemical oxygen demand	25	10	25	80	40	120	75	80
Fluoride, SIE	0.05	NDS	36	NDS	NDS	NDS	NDS	NDS
Hydrogen sulfide	5	NDS	1	NDS	NDS	NDS	NDS	NDS
Nonpurgeable organic carbon	5	3	6	6	8	9	11	11
Purgeable organic carbon	5	1	2	2	ND	2	2	3
Total dissolved solids	5	860	2400	2200	3000	3600	3700	3400
Total organic halides	0.05	0.15	0.24	0.25	0.5	0.19	0.44	0.23
pH (pH units)	NA[c]	6.8	3.3	3.3	3.2	3.1	3.4	3.2

[a] Not determined in this sample.

[b] Not detected above detection limit.

[c] Not applicable.

TABLE 50. K001-CREOSOTE WATER SAMPLES ORGANOPHOSPHOROUS PESTICIDE RESULTS
(µg/liter)

Compound	Quantitation limit	Reagent blank	ZK01C-3-E2
Phorate	0.50	ND[a]	ND
Sulfotepp	0.50	ND	ND
Disulfoton	1.0	ND	ND
Methyl parathion	1.0	ND	ND
Ethyl parathion	0.75	ND	ND
Famphur	2.5	ND	ND

[a] Not detected above detection limit.

TABLE 51. K001-CREOSOTE WATER SAMPLE ORGANOCHLORINE PESTICIDE RESULTS
(µg/liter)

Compound	Quantitation limit	Reagent blank	ZK01C-3-2
Aldrin	0.15	ND[a]	ND
(Alpha)-BHC	0.10	ND	ND
(Beta)-BHC	0.15	ND	ND
(Delta)BHC	0.15	ND	ND
(Gamma)-BHC	0.10	ND	ND
Chlordane	1.0	ND	ND
p,p'-DDD	0.30	ND	ND
p,p'-DDE	0.15	ND	ND
p,p'-DDT	0.30	ND	ND
Dieldrin	0.15	ND	ND
Endosulfan I	0.15	ND	ND
Endosulfan II	0.15	ND	ND
Endrin	0.15	ND	ND
Endrin aldehyde	0.30	ND	ND
Heptachlor	0.10	ND	ND
Heptachlor epoxide	0.15	ND	ND
Isodrin	0.15	ND	ND
Kepone	0.80	ND	ND
Methoxychlor	0.50	ND	ND
Toxaphene	10	ND	ND
Aroclor 1016	10	ND	ND
Aroclor 1221	10	ND	ND
Aroclor 1232	10	ND	ND
Aroclor 1242	10	ND	ND
Aroclor 1248	10	ND	ND
Aroclor 1254	3.0	ND	ND
Aroclor 1260	4.0	ND	ND

[a] Not detected above detection limit.

TABLE 52. K001-CREOSOTE WATER SAMPLES CHLORINATED HERBICIDES RESULTS (µg/liter)

Compound	Quantitation limit	ZK01C-3-E2	Reagent blank
2,4-D	0.25	ND[a]	ND
Silvex	0.75	ND	ND
2,4,5-T	0.75	ND	ND
Dinoseb	0.75	ND	ND

[a] Not detected above detection limit.

TABLE 53. K001-CREOSOTE WATER SAMPLES DIOXIN/FURAN RESULTS (ng/liter)

Compound	Reagent blank	ZK01C-3-E2
Total TCDD	<2	<2
Total TCDF	<1	<2
Total PCDD	<2	<2
Total PCDF	<1	<2
Total HxCDD	<3	<5
Total HxCDF	<3	<5

EFFECTIVENESS OF TREATMENT

K001-PCP

The CRF rotary kiln incinerator appeared to operate normally during the K001-PCP test. The K001-PCP waste used for the CRF test contained the expected levels of various analytes typically found in bottom sediment sludges of wastewaters from wood-preserving processes in which PCP is used. The PCP concentrations in the feed samples ranged from 920 to 3000 ppm. The feed samples also contained fairly high levels (ranging up to 50,000 ppm) of PNA's. No BDAT-list volatiles or semivolatiles were detected above the quantitation limit in the ash, ash TCLP, and scrubber water samples. Also, no BDAT-list dioxins or furans were detected above the method detection limit in any of the K001-PCP samples.

Arsenic (up to 0.8 ppm), barium (up to 74 ppm), chromium (up to 8.2 ppm), copper (up to 6.8 ppm), lead (up to 5.2 ppm), and zinc (up to 11 ppm) were the BDAT-list metals found above the quantitation limit in the ash. Only lead (0.021 µg/ml in one sample) and zinc (0.03 µg/ml in one sample) were detected above the quantitation limit in the TCLP extracts. In the scrubber water samples, arsenic, barium, copper, lead, and zinc were detected above the quantitation limit.

The methods and results of the atmospheric emission tests are presented in Section 6. A brief summary is presented here to add perspective to the preceding analytical results. Atmospheric emission test results during the K001-PCP test burn suggest that this waste can be incinerated in compliance with the incinerator regulations governing the destruction and removal efficiency (DRE) of POHC's.[6] Eleven POHC's were designated for the waste--PCP and 10 PNA compounds. For both tests DRE's were greater than 99.99 percent for 10 of the 11 POHC's. DRE's for the eleventh POHC (naphthalene for one test and acenaphthylene for the other) were 99.984 percent.[6]

K001-Creosote

The John Zink rotary kiln incineration system appeared to operate normally during the K001-creosote test. The K001-creosote (K001-C) waste used for the test contained the expected levels of various analytes typically found in bottom sediment sludges of wastewaters from wood-preserving processes in which creosote is used. BDAT-list volatiles detected in the K001-C feed above the quantitation limits were benzene (up to 83 µg/g) and toluene (up to 170 µg/g). The BDAT-list semivolatiles analyses for the feed samples showed several polynuclear aromatic hydrocarbons and phenols typical of creosote waste. Naphthalene, for example, was present in concentrations up to 43,000 µg/g, and anthracene, fluoranthene, fluorene, phenanthrene, and pyrene were all present in concentrations exceeding 10,000 µg/g. With one exception, no BDAT-list volatiles or semivolatiles were detected above 5 times the quantitation limit in the ash, ash TCLP, or scrubber water samples. One ash sample contained 0.93 µg/g of di-n-butylphthalate.

Barium (up to 150 ppm), copper (up to 39 ppm), lead (up to 190 ppm), and zinc (up to 200 ppm) were the major BDAT-list metals found in the feed samples. The ash contained arsenic, barium, chromium, copper, selenium, vanadium, and zinc above the quantitation limit, but the TCLP extracts contained only barium and zinc above the quantitation limit (both were less than 1 mg/liter). In the scrubber water samples, lead (up to 5.4 mg/liter), thallium (up to 4.0 mg/liter), and zinc (up to 11 mg/liter) were the major metals present.

No BDAT-list organophosphorous pesticides, organochlorine pesticides, PCB's, organochlorine herbicides, dioxins, or furans were detected above the method detection limit in any of the K001-C samples.

Atmospheric emission test results during the K001-C test burn suggest that this waste can be incinerated in compliance with the incinerator regulations governing POHC DRE. Anthracene, acenaphthene, naphthalene, phenanthrene, and fluroanthene were designated as POHCs during the test. For all three emission tests, DRE's were greater than 99.99 percent for the five POHC's.

SECTION 5

SAMPLING AND ANALYTICAL PROBLEMS AND CORRECTIVE ACTIONS

GENERAL QUALITY ASSURANCE CONCERNS

Site-specific QAPP's were developed for the K001-PCP test burn at the U.S. EPA CRF and the K001-creosote test burn at the John Zink facility. The QAPP for the K001-PCP burn was entitled "Site Test Plan and Quality Assurance Project Plan for the Combustion Research Facility Test Burn of K001." A two-part QAPP was prepared prior to the K001-creosote test burns. This QAPP was entitled "Site Test Plan and Quality Assurance Project Plan - Part A: Incineration Tests of K001 and K015 at the John Zink Company Test Facility" and "Part B: Emission Testing." These QAPP's were approved by the HWERL Quality Assurance Officer before the tests. Each Site Test Plan (STP) was prepared in accordance with HWERL QAPP requirements and OSW protocols as documented in the "Generic Quality Assurance Project Plan for Land Disposal Restrictions Program" (EPA/530-SW-87-011). Except for the deviations summarized in Table 54, the test burns were conducted as defined in the STP's. None of the deviations materially affect the validity of the test results. The specific results of the analytical quality assurance procedures are provided in the K001-PCP and K001-creosote OER's.

SPECIFIC SAMPLING PROBLEMS

No significant problems were encountered in the sampling of untreated K001-PCP, K001-creosote, ash, or scrubber water. Differences did occur, however, between both the number of samples taken and the analyses conducted during the K001-PCP test burns and the K001-creosote and other subsequent HWERL BDAT tests involving treatment of other RCRA wastes. These differences are summarized in the following paragraphs.

A total of four samples of untreated K001-PCP were taken, one for each of the three tests plus one sample from a drum of K001-PCP that was not incinerated during the test burn. Three samples of ash were taken, one during each test. Three samples of scrubber water also were taken, again one during each test. One sample of scrubber makeup water also was taken. Subsequent to the K001-PCP test burns, OSW required that a minimum of six samples of each residue be collected. These six samples of treatment residues must be temporally related with samples of untreated waste fed to the treatment unit. This procedure was followed for the K001-creosote test burn.

TABLE 54. DEVIATIONS FROM THE SITE TEST PLAN/QUALITY ASSURANCE PROJECT PLAN

Activity	STP[a] specifications	Deviations from the STP
K001-PCP		
Collection of samples for metals analysis	The STP/QAPP did not specify collection of aliquots for metals analysis.	After the test burn, it was decided that metals in K001-PCP feed, ash, and scrubber water would be analyzed. These analyses were conducted on sample aliquots that had not been preserved (acidified) in the field.
Sample analysis	The STP/QAPP specified that SW-846, 3rd edition, would be followed and methanol would be used to extract volatile organics.	The volatile organic determinations were made using both tetraglyme and methanol.
K001-creosote		
Scrubber water samples	The STP/QAPP specified that a length of Teflon tubing would be used for the sample cooling coil.	Stainless steel tubing was used in place of Teflon. This material provided better heat transfer and was easier to work with.
K001-C feed rate	The STP/QAPP specified 500 lb/h as a feed rate.	A feed rate of 180 lb/h K001-C feed was used during the test periods to comply with John Zink's 3 million Btu/h permit limitation. The K001-C feed used had a significantly higher heat content (10,000 to 11,000 Btu/lb instead of 2000 to 4000 Btu/lb) than was anticipated when the STP/QAPP was written.

[a] "Site Test Plan and Quality Assurance Project Plan for the Combustion Research Facility Test Burn on K001" and "Site Test Plan/Quality Assurance Project Plan for Incineration of K001-C at the John Zink Test Facility."

K001-PCP

The untreated K001-PCP, ash, and scrubber water were analyzed for the constituents indicated in Table 4 and as specified in the STP/QAPP. Subsequent to the K001-PCP test burns, OSW required that at least one sample of each untreated waste and treatment residue(s) be analyzed for each compound on the BDAT list. The analysis of the remaining five samples of each material could be limited to those classes of compounds reasonably expected to be present.

Flue gas emissions were measured during two of the three CRF incineration tests. Elevated levels of several phthalate compounds were found in the scrubber discharge flue gas during both tests. The most common phthalate found was bis(2-ethylhexyl)phthalate, which was measured in the scrubber discharge flue gas at levels up to 540 µg/dscm. Butyl benzyl phthalate was also measured in the scrubber discharge flue gas for both tests at levels up to 14 µg/dscm. Dimethyl phthalate was present in the scrubber discharge flue gas at levels up to 18 µg/dscm, and di-n-octylphthalate was measured in the Test 2 scrubber discharge flue gas at 19 µg/dscm. Because these compounds were not present in any of the feed samples at the detection limit of 100 µg/g, their presence as an undestroyed feed organic is not likely.

The most logical explanation for the high concentrations of phthalates found in the flue gas samples is that the packed-tower scrubber and much of the ductwork between the scrubber and the scrubber-discharge flue gas sampling location were replaced before the K001-PCP tests. The new scrubber and ductwork are made of fiber-reinforced plastic, which contains phthalate plasticizers in the binder resin. The levels measured in flue gas samples for these tests were likely the result of the new scrubber and ductwork installed.

No particulate data were obtained for the second emission test. Upon recovery of the individual sample fractions, rupture of the filter support was noted, which allowed particulate matter to get into the back half of the sampling train, particularly the resin trap. Because an undeterminable amount of particulate was lost, no attempt was made to analyze this sample; however, semivolatile organic and HCl emissions data were collected during this run.

K001-Creosote

No unusual sampling problems were encountered during the K001-creosote tests at the John Zink test facility.

RESULTS OF QUALITY ASSURANCE ANALYSES

K001-PCP

Volatile Organic Analyses--

All volatile organic compounds in the untreated K001-PCP, ash, and scrubber water samples were analyzed in accordance with the procedures specified in Method 8240 of SW-846, 3rd edition, with one exception--tetraglyme

was used instead of methanol.[19] When this discrepancy became known, methanol extracts of K001-PCP feed samples were conducted, and the results compared favorably. The results of these two tests are presented in the data in Tables 7 and 8 in Section 4.

Recoveries of surrogate compounds were within acceptable QA/QC limits with the exception of toluene-d_8 in Sample CK01P-3-B1 (118% vs. 117%), and 1,2-dischloroethane-d_4 in Sample CK01P-3-D1 (118% vs. 114%). The results of the matrix spike/matrix spike duplicate (MS/MSD) were within QA/QC limits and the analysis of laboratory blanks showed no significant contamination.

Semivolatile Extracts--

All semivolatiles extracts were analyzed in accordance with the QA/QC procedures outlined in Method 8270 SW-846, 3rd edition, without significant modification. Recoveries of surrogates and the results of the MS/MSD analysis were within acceptable QA/QC limits. The analysis of the laboratory blanks showed no significant contamination.

Metals and Water Quality Parameters

All samples were analyzed in accordance with the procedures outlined in the QA/QC plan. The relative percent difference between the matrix spike and the matrix spike duplicate was less than 20 percent for all elements except arsenic and zinc. The recoveries for arsenic were 73 and 42 percent, respectively; whereas the respective zinc recoveries were 46 and 9 percent. Other parameters (instrument checks, calibration check samples) were within range for these analyses, which indicates a matrix effect to be the cause of these low anomalies. No contamination was observed in the laboratory blanks.

Dioxin/Furan Samples

The dioxin/furan samples were analyzed in accordance with the QA/QC procedures outlined in SW-846 Method 8280, 3rd edition. Extraction efficiencies of surrogates were within acceptable limits, and no contamination was observed in the reagent blanks.

K001-Creosote

Volatile Organic Analyses--

The volatile samples were analyzed in accordance with the QA/QC procedures outlined in Method 8240 SW-846, 3rd edition. Recoveries of the surrogate compounds were all within acceptable limits with the exception of toluene-d_8 in three out of six of the feed samples. All MS/MSD compounds were within Method 8240 recovery limits, and no significant contamination was observed in system blanks.

Semivolatile Extracts--

All semivolatile extracts were analyzed in accordance with the QA/QC procedures outlined in Method 8270 SW-846, 3rd edition, without significant modification. All surrogate recovery values for K001-creosote waste feed samples were within acceptable limits. The surrogate recovery values for several ash and scrubber water samples were outside acceptable limits (see QA Section of the original analysis results in Appendix E, Radian K001-creosote

analytical report). For those samples that had recovery values outside these limits, the reported concentrations for the analytes should be considered estimates. The MS/MSD's were performed for one ash (ZK01C-3-B2) and one scrubber water (ZK01C-3-E2) sample. Several matrix-spike relative percent differences (RPD's) and recoveries were not within acceptance limits (Appendix E). For those samples that had recovery values outside these limits, the reported concentrations for the analytes should be considered estimates. At least one extraction blank was generated for each sample set. A leachate and reagent blank were generated for TCLP samples. Phthalates and phenol were the only target analytes observed in the blanks.

All samples were analyzed in accordance with the QA/QC procedures (Appendix E). Duplicate matrix spike analyses data on ash and scrubber water samples showed many of the analytes were outside of the recovery acceptance criteria, which could be indicative of matrix interferences. In some instances, the recoveries were not determined because of a low-level spike into a sample containing much greater amounts of that analyte. The small amount spiked was within the variability of the analysis and could not be reproducibly determined. Distilled water blanks and reagent blanks showed no levels detected at a concentration greater than 5 times the instrument detection limits.

Instrument Calibration and Tuning

The extracted samples were analyzed in accordance with the QA/QC procedures outlined in Method 8140 SW-846, 3rd edition. All surrogate recoveries were within acceptable QA/QC limits, with the exception of the feed samples. A low surrogate recovery for the water sample was due to a loss during sample concentration. Duplicate matrix spike analyses for feed, ash, and scrubber water samples showed several compound recoveries outside the limits in the QAPP.

The extracted samples were analyzed in accordance with the QA/QC procedures outlined in Method 8080 SW-846, 3rd edition. Even though some variation was noted in the surrogate recoveries, all were above 50 percent and most were within acceptable limits. A feed surrogate recovery of 121 percent indicates a matrix interference. Matrix spike recoveries were within acceptable limits, and no significant contamination was observed in the reagent and extraction blanks.

The extracted samples were analyzed in accordance with the QA/QC procedures outlined in Method 8150 SW-846, 3rd edition. The surrogate recovery was outside acceptable limits on the ash sample, but within the QAPP limits on the feed and water samples. Duplicate matrix spike analysis was performed on a sample from the water and the ash matrix. Low recoveries and large RPD's were observed in the ash samples because of the polarity of the matrix. No significant contamination was noted in the analysis of the reagent and extraction blanks.

The dioxin/furan samples were analyzed in accordance with the QA/QC procedures outlined in SW-846 Method 8280, 3rd edition. Extraction efficiencies

were monitored by spiking each sample with ^{13}C-labeled surrogates prior to extraction. Surrogate compounds were not recovered from the feed samples because of the large dilution necessary to obtain adequate peak shape and resolution.

ATMOSPHERIC EMISSION TESTS

K001-PCP (U.S. Combustion Research Facility)

Sampling--

All of the sampling quality assurance objectives were met with one exception--the desired total number of samples was not achieved because of time constraints. Only two particulate and POHC determination tests were run (instead of three). No HCl tests were performed. Historically, the CRF has been in compliance with the HCl emission requirements for incinerators.

Quality assurance procedures were followed to assess the data quality of the volatile and semivolatile hazardous constituents in the flue gas samples. The data quality objectives (DQO's) for volatiles matrix spike recoveries were met. In addition to matrix spike sample analyses, all volatile organic sampling train (VOST) Tenax traps were spiked with the surrogates isooctane and octane prior to analysis, and the surrogate recovery was measured. The recovery DQO of 50 to 200 percent was met for 10 of 14 measurements for isooctane (or 71 percent) and for all octane measurements (or 100 percent). The completeness DQO was 90 percent; therefore, this DQO was met for octane recovery for this data set, but not for isooctane recovery.

For semivolatiles QA, all modified Method 5 (MM5) train samples subjected to extraction were spiked with 20 µg of each of the surrogate compounds octaflurobiphenyl and 9-phenylanthracene. Surrogate recoveries were measured in all extract analyses. The recovery DQO for this measurement is 50 to 200 percent recovery. All octafluorobiphenyl recoveries were within this range; no 9-phenylanthracene recovery was within this range. Measurement completeness was, thus, 50 percent compared to a completeness DQO of 90 percent.

A more complete QA discussion of the K001-PCP is included as Section 7 of Reference 6 (Appendix D of this report).

K001-Creosote (John Zink Test Facility)

Sampling--

All of the sampling quality assurance objectives were met with one exception--no particulate data were obtained for the second emission test because a ruptured filter support allowed particulate matter into the back half of the sampling train, which caused an undeterminable amount of particulate to be lost.

Analysis--

Emission tests were run for particulate, HCl, semivolatile organics (POHC's), and metals. For particulate and HCl, all QA objectives were met

except for a low matrix spike recovery (45 percent) for HCl. This low recovery indicates a possible matrix effect on the samples. The replicate analysis and standard reference sample (SRS) data were within expected ranges. The surrogate recovery data for semivolatiles were within the acceptable recovery limits specified by the method. One set of independent reference standards data was generated in duplicate to verify the calibration for analyzing these samples. These values were all within ± 20 percent, which is acceptable according to Method 8270. The blank train data showed that no sample contamination problems were encountered. Quality assurance for metals included matrix spike recoveries, duplicate analyses, and filter/reagent blank data.

A more complete QA discussion of the K001-creosote test burn is included as Section 3 of Reference 16 (Appendix E of this report).

SECTION 6

OTHER RESULTS

ATMOSPHERIC EMISSION TESTS

As part of the waste-destruction-technology evaluation, selected atmospheric emissions were measured. These measurements would typically be made as part of a trial burn test under the Resource Conservation and Recovery Act (RCRA) requirements. During the K001-PCP test burn at the CRF, emission tests were performed for total particulate and selected volatile and semivolatile organic hazardous constituents. During the K001-creosote test burn at John Zink, emission tests were performed for total particulate, HCl, and selected semivolatile hazardous constituents (POHC's).

The complete atmospheric emission test results for K001-PCP are presented in the Acurex Corporation report entitled "Pilot-Scale Incineration Tests of Wastewater Treatment Sludge From Pentachlorophenol Wood Preserving Processes (K001)." This report is presented in Appendix B.

The complete atmospheric emission test results for K001-creosote are presented in the PEI Associates, Inc., report entitled "Emission Test Report - Incineration Tests of K001 (Creosote) at the John Zink Company Test Facility." This report is presented in Appendix F.

SUMMARY OF RESULTS

K001-PCP

Tables 55 and 56 present the results of the two atmospheric emissions tests for volatile organic constituents and semivolatile organic hazardous constituents, respectively. Table 57 summarizes the operating conditions of the scrubber air-pollution-control system. Particulate emissions were not measured at the scrubber discharge; instead, they were measured in the stack downstream of the carbon bed and HEPA filter for compliance with State permit requirements.

The VOST sampling was performed to determine the concentrations of volatile organic compounds in the scrubber discharge flue gas. The samples were analyzed by GC/FID for the 23 compounds listed in Table 58. As shown in Table 55, chloroform, 1,2-dichloroethane, and benzene were present in one or

TABLE 55. VOLATILE ORGANIC CONSTITUENTS IN THE SCRUBBER DISCHARGE FLUE GAS

Compound	Concentration, µg/dscm						
	Test 1 (6-26-87)			Test 2 (7-1-87)			
	1st trap pair	2nd trap pair	Average[a]	1st trap pair	2nd trap pair	3rd trap pair	Average[a]
Methylene chloride	480	1,100	790	220	330	770	440
Chloroform	<9.4	22	16	<9.4	<8.9	17	12
1,2-Dichloroethane	<6.7	22	14	48	34	37	40
Benzene	17	40	29	12	31	37	27
All others	<3.9 to <21	<4.8 to <23	<23	<4.1 to <22	<3.7 to <20	<4.0 to <22	<22

[a] Average assumes "<" values present at the corresponding detection limit.

TABLE 56. SEMIVOLATILE ORGANIC HAZARDOUS CONSTITUENTS IN FLUE GAS SAMPLES

Compound	Concentration, µg/dscm			
	Scrubber discharge flue gas		Stack gas	
	Test 1 (6-26-87)	Test 2 (7-1-87)	Test 1 (6-26-87)	Test 2 (7-1-87)
POHCs				
Acenaphthene	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	<1.0	<4.0	<1.0	<1.0
Anthracene	<1.0	1.9	<1.0	<1.0
Benzo(a)anthracene	<1.0	4.0	<1.0	<1.0
Chrysene	<1.0	4.8	<1.0	<1.0
Fluoranthene	3.4	10	<1.0	<1.0
Fluorene	<1.0	<1.0	<1.0	<1.0
Naphthalene	74	5.9	16	16
Phenanthrene	31	<1.0	0.74	<1.0
Pyrene	14	8.1	<1.0	<1.0
Pentachlorophenol	<1.0	<1.0	<1.0	<1.0
Other semivolatile organic hazardous constituents				
2,4-Dimethylphenol	15	<1.0	<1.0	<1.0
Phthalates:				
Bis(2-ethylhexyl)phthalate	300	540	110	59
Butyl benzyl phthalate	14	4.4	2.2	3.8
Dimethyl phthalate	18	9.4	<1.0	<1.0
Di-n-octylphthalate	<1.0	19	<1.0	<1.0
All other 8270 constituents	<1.0	<1.0	<1.0	<1.0

TABLE 57. K001-PCP TEST OPERATING CONDITIONS: AIR-POLLUTION-CONTROL SYSTEM

Parameter	Test 1 (6-26-87)	Test 2 (7-1-87)
Test start time	1620	0930
Test stop time	2020	1430
Test duration, h	4.0	5.0
Venturi scrubber liquor flow rate, liters/min (gal/min)	64 (17)	64 (17)
Venturi scrubber pressure drop, kPa (in.WC)	-- --	6.2 (25)
Packed tower scrubber liquor flow rate, liters/min (gal/min)	114 (30)	114 (30)
Average makeup rate, liters/min (gal/min)	17 (4.4)	16 (4.3)
Average blowdown rate, liters/min (gal/min)	5.7 (1.5)	5.7 (1.5)
Stack gas O_2, %		
Range	8.0-11.0	10.5-14.5
Average	9.0	12.0
Stack gas CO_2, %		
Range	5.0-7.2	5.4-8.0
Average	6.0	6.2

TABLE 58. VOLATILE ORGANIC COMPOUNDS SOUGHT IN THE K001-PCP TEST SAMPLE ANALYSES

Compound	Compound
Methylene chloride	Benzene
1,1-Dichloroethene	1,1,2-Trichloroethane
1,1-Dichloroethane	Hexane
t-1,2-Dichloroethane	Bromoform
Chloroform	Tetrachloroethene + tetrachloroethane
1,2-Dichloroethane	Toluene
1,1,1-Trichloroethane	Chlorobenzene
Carbon tetrachloride	Ethylbenzene
Bromodichloromethane	1,3-Dichlorobenzene
1,2-Dichloropropane	1,2-Dichlorobenzene
t-1,3-Dichloropropane	1,4-Dichlorobenzene
Trichloroethylene	

more scrubber-discharge flue gas samples at levels generally in the 10- to 40-µg/dscm range. These compounds are measured products of incomplete combustion (PIC's) routinely detected in combustion source flue gas in a range of 1 to several tens of µg/dscm, as found in these tests.

The MM5 sampling was performed to determine the concentrations of semivolatile organic hazardous constituents in the scrubber discharge flue gas. The samples were analyzed for the semivolatile organic hazardous constituents listed in Table 59 by GC/MS, in accordance with EPA Method 8270.

As shown in Table 56, several of the PNA POHC's were present in the scrubber-discharge flue gas during both tests, at levels up to several tens of µg/dscm. The POHC concentrations in the scrubber discharge flue gas were roughly comparable during both tests. Naphthalene and phenanthrene levels were somewhat higher during Test 1. In contrast, acenaphthylene, anthracene, benzo(a)anthracene, chrysene, and fluoranthene levels were higher during Test 2.

In addition to the PNA POHC's, several phthalate compounds were present in the scrubber-discharge flue gas. The most commonly found phthalate was bis(2-ethylhexyl)phthalate, which was measured in the scrubber discharge flue gas at levels up to 540 µg/dscm. Butyl benzyl phthalate was also measured in the scrubber-discharge flue gas during both tests, at levels up to 14 µg/dscm. Dimethyl phthalate was present in the scrubber-discharge flue gas at levels up to 18 µg/dscm, and di-n-octylphthalate was measured in the Test 2 scrubber discharge flue gas at 19 µg/dscm.

Phthalates are universal laboratory contaminants routinely found in Method 8270 sample extracts; however, the levels shown in Table 56 are higher than those usually ascribed to laboratory contamination. This indicates that these compounds were probably present in the flue gas at the elevated levels measured in these tests. Because the compounds were not present in any of the feed samples at a detection limit of 100 µg/g, their presence as an undestroyed feed organic is not likely. The most logical explanation for the high concentrations of phthalates found in the flue gas samples is that the packed-tower scrubber and much of the ductwork between the scrubber and the scrubber-discharge flue gas sampling location were replaced before the K001-PCP tests. The new scrubber and ductwork are made of fiber-reinforced plastic, which contains phthalate plasticizers in the binder resin. The levels measured in flue gas samples for these tests might well have resulted from the new scrubber and ductwork.

K001-Creosote

Table 61 summarizes the critical emission parameters for the K001-creosote test burns at the John Zink facility. Briefly, these data show the following:

> Particulate concentrations corrected to 7 percent O_2 were below the RCRA allowable limit of 0.08 grain per dry standard cubic foot (gr/dscf).

TABLE 59. SEMIVOLATILE ORGANIC COMPOUNDS SOUGHT IN THE K001-PCP TEST SAMPLE ANALYSES

Compound	Compound
N-Nitrosodimethylamine	Fluorene
Phenol	4,5-Dinitro-2-methylphenol
2-Chlorophenol	Diphenylamine
1,3-Dichlorobenzene	N-Nitrosodiphenylamine
1,4-Dichlorobenzene	Azobenzene
1,2-Dichlorobenzene	1,2-Diphenyl hydrazine
Bis(2-chloroisopropyl)ethyl	4-Bromophenyl phenyl ether
N-Nitroso-di-n-propylamine	Hexachlorobenzene
Isophorone	Pentachlorophenol
2-Nitrophenol	Phenanthrene
2,4-Dimethylphenol	Anthracene
Bis(2-chloroethoxy)methane	Disulfoton
2,4-Dichlorophenol	Di-n-butyl phthalate
1,2,4-Trichlorobenzene	Fluoranthene
Hexachlorobutadiene	Benzidine
4-Chloro-3-methyl phenol	Pyrene
1,4,6-Trichlorophenol	Butyl benzyl phthalate
2-Chloronapththalene	Bis(2-ethylhexyl)phthalate
Dimethyl phthalate	Di-n-octyl phthalate
Acenaphthene	Benzo(b)fluoranthene
2,4-Dinitrophenol	Benzo(k)fluoranthene
4-Nitrophenol	Benzo(a)pyrene
2,4-Dinitrotoluene	Indeno(1,2,3-cd)pyrene
2,6-Dinitrotoluene	Benzo(g,h,i)perylene
Diethyl phthalate	

- Measured HCl emission rates in pounds per hour were considerably less than the RCRA allowable of 4.0 lb/h.

- The average secondary combustion chamber concentration of CO was less than 30 ppm during each test.

- The DRE performance standard of 99.99 percent was achieved for the designated semivolatile analytes.

Table 62 summarizes the sampling and analytical methods used in this test program. Samples were collected after the venturi scrubbing system to determine the concentrations and mass emission rates of the pollutants listed in Table 61. Stack samples for determining semivolatile organics were collected on XAD-2 sorbent. The XAD-2, filter, and probe rinse residues were solvent-extracted, and the concentrated extracts were analyzed by gas GC/MS (M8270-SW-846).

TABLE 60. POHC DRE's FOR THE K001-PCP TEST BURN

Compound	DRE, percent			
	Scrubber discharge flue gas		Stack gas	
	Test 1 (6-26-87)	Test 2 (7-1-87)	Test 1 (6-26-87)	Test 2 (7-1-87)
Acenaphthene	>99.99967	>99.99979	>99.99958	>99.99975
Acenaphthylene	>99.9935	99.9844	>99.9918	>99.9954
Anthracene	>99.99969	99.99945	>99.99961	>99.99966
Benzo(a)anthracene	>99.9986	99.9931	>99.9982	>99.9980
Chrysene	>99.9972	99.9955	>99.9964	>99.9989
Fluoranthene	99.9989	99.9973	>99.99958	>99.99968
Fluorene	>99.99961	>99.99974	>99.99951	>99.99970
Naphthalene	99.984	99.9981	99.9957	99.9937
Phenanthrene	99.9958	>99.99991	99.99987	>99.99989
Pyrene	99.9915	99.9965	>99.99923	>99.99949
Pentachlorophenol	>99.99989	>99.99994	>99.99986	>99.99994

TABLE 61. RESULTS FOR CRITICAL EMISSION PARAMETERS FOR THE K001-CREOSOTE TEST BURN

Parameter	Test No. 1	Test No. 2	Test No. 3	Average
Test date (1987)	10/6	10/6	10/7	
Test time (24-h)	1210-1526	1713-2024	1155-1458	
Feed rate, lb/h	180	180	180	180
Analyte feed rate, lb/h				
Anthracene	2.0	1.8	1.4	1.7
Acenaphthene	3.2	3.2	3.2	3.2
Naphthalene	7.4	6.5	6.5	6.8
Phenanthrene	6.6	5.9	6.1	6.2
Fluoranthene	4.3	4.1	4.1	4.2
Exhaust data data				
Volumetric flow, dscfm	1596	1637	1555	1596
O_2, %[a]	8.95	8.95	8.35	8.75
CO_2, %[a]	8.10	8.10	8.95	8.38
CO, ppm (dry)[b]	31	38	18	29
Particulate concentration, gr/dscf at 7% O_2	0.027	-	0.029	0.028
Emission rate, lb/h				
Particulate	0.32	-	0.34	0.33
HCl	0.11	0.12	0.05	0.09
Anthracene	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	-
Acenaphthene	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	-
Naphthalene	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	-
Phenanthrene	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	-
Fluoranthene	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	$<3.7 \times 10^{-5}$	-
DRE, %[c]				
Anthracene	>99.99	>99.99	>99.99	-
Acenaphthene	>99.99	>99.99	>99.99	-
Naphthalene	>99.99	>99.99	>99.99	-
Phenanthrene	>99.99	>99.99	>99.99	-
Fluoranthene	>99.99	>99.99	>99.99	-

[a] Values determined from Orsat analysis of integrated bag samples.

[b] CO values determined from CEM located at outlet of secondary combustion chamber.

[c] $\text{DRE} = \frac{\text{lb/h (in)} - \text{lb/h (out)}}{\text{lb/h (in)}} \times 100$

TABLE 62. SUMMARY OF SAMPLE AND ANALYTICAL PROCEDURES FOR K001-CREOSOTE TEST BURN

Sample identification	Parameter	Sample method	Analytical method	Number of samples
Stack gas (after venturi scrubber system)	POHC's (phenanthrene, anthracene, naphthalene, acenaphthene, fluoranthene)	MM5[a]	SW 846-8270[b] (GC/MS)	3
	Particulate	EPA 5	EPA 5 (gravimetric)	2
	HCl	EPA 5	EPA 300.0[c] (ion chromatography)	3
	BDAT-list metals	EPA 12	SW 846[b] (ICP/AA)	3
	Volumetric gas flow, temperature, moisture content, composition (O_2, CO_2)	EPA 1-4	-	-
Secondary combustion chamber (outlet)	CO	EPA 10	NDIR	Continuous
	O_2	EPA 3A	Zirconium cell	Continuous
	CO_2	EPA 3A	NDIR	Continuous
	Gas temperature	Thermocouple/ digital readout	-	Continuous

[a] Sampling and Analysis Methods for Hazardous Waste Combustion, Method S008, EPA-600/8-84-02, February 1984; and Laboratory and Field Evaluation of the Semi-VOST Method, EPA-600/4-85-075.

[b] Test Methods for Evaluating Solid Wastes. Physical/Chemical Methods, EPA SW 846, 3rd Edition. November 1986.

[c] Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, 1979.

Tables 63 and 64 summarize the particulate and HCl emissions data from this test program. Concentrations are expressed in grains per dry standard cubic foot and mass emission rate data, in pounds per hour. Test times for these runs were 180 minutes.

TABLE 63. SUMMARY OF PARTICULATE EMISSION DATA FROM K001-CREOSOTE TEST BURN

Run No.	Concentration		Mass emission rate, lb/h
	gr/dscf	gr/dscf at 7% O_2	
KO-SV-1	0.023	0.027	0.32
KO-SV-2[a]	-	-	-
KO-SV-3	0.026	0.029	0.34

[a] Particulate not determined.

TABLE 64. SUMMARY OF HCl EMISSION DATA FROM K001-CREOSOTE TEST BURN

Run No.	Concentration, gr/dscf	Mass emission rate, lb/h
KO-SV-1	0.008	0.11
KO-SV-2	0.008	0.12
KO-SV-3	0.004	0.05

As noted in Table 63, no particulate data were obtained for Run KO-SV-2. Upon recovery of the individual sample fractions, it was found that the filter frit support had ruptured and allowed particulate matter to enter the back half of the sample train. Because an undeterminable amount of particulate was lost, no attempt was made to analyze this sample. Data on semivolatile organics and HCl emissions were collected during this run, however. Particulate concentration corrected to 7 percent O_2 averaged 0.028 gr/dscf for the two available sample runs, and corresponding mass emission rates averaged 0.33 lb/h. The HCl concentrations averaged 0.007 gr/dscf, with a corresponding mass emission rate of 0.09 lb/h.

Prior to the organics analysis, probe rinse and filter samples were analyzed gravimetrically for particulate determination in accordance with EPA Method 5 procedures. An aliquot from the 1N sodium hydroxide (NaOH) impinger of each MM5 sampling train was also analyzed for chloride content (as HCl) by ion chromatography in accordance with EPA Method 300.

Samples for metals analyses were collected by an EPA Method 12 sampling train. This train is identical to an EPA Method 5 (particulate) sampling train except that 0.1N nitric acid (HNO_3) is added to the impingers and used as the sample nozzle and probe rinse reagent.

During each test, the flow rate, temperature, moisture content, and composition (O_2 and CO_2) of the flue gas were measured by EPA Methods 1 through 4 procedures. Also, continuous emission monitors were used for monitoring and continuous recording of O_2, CO_2, and CO concentrations at the outlet of the secondary combustion chamber during each test period. Procedures outlined in EPA Method 3A (O_2 and CO_2) and Method 10 (CO) were followed.

Tables 65 through 67 summarize the semivolatile organic feed, mass emission data, and the DRE's for each compound, respectively. Also included are the method detection limits (MDL's) for the feed and stack samples. As shown in Table 66, nondetectable levels of each analyte were observed in all stack emission samples. A minimum detection limit of 20 micrograms per sample was established for this set of samples. This value was used in calculating the sample concentrations and mass emission rates for generating DRE data. Calculations produced DRE's of greater than 99.99 percent for each compound, which indicates that these compounds were effectively destroyed by the incineration process. Method 8270 (GC/MS) quality control measures were applied with acceptable results. Because all sample surrogate recoveries were within accepted criteria of the method, no corrections were made to the sample results. Analysis of the Modified Method 5 stack samples also included analysis for dibenzo furan and 2-methylnaphthalene, and both were below the method detection limit (20 µg/sample). The feed composition analysis does not indicate positive identification of these compounds; therefore, no DRE data were developed.

Table 68 summarizes the concentration and mass emission rate data for the BDAT-list metals. Concentrations are expressed in micrograms per dry normal cubic meter (µg/dNm³) and mass emission rates in pounds per hour. Cadmium, lead, and zinc were present in these samples at higher concentrations (700 to 995 µg/dNm³) than were the other listed metals. Because of probe-heat electrical problems, the three tests were run for 103, 60, and 80 minutes, respectively, to minimize condensation of water vapor on the filter media. In two of the three tests, the filter media was observed to be wet upon recovery. This should have a minimal effect on sample analysis because the fractions are combined and digested prior to analysis.

STATISTICAL EVALUATION OF TEST BURN DATA

The statistical methods for establishing BDAT outlined in the Federal Register (Vol. 51, No. 172, September 5, 1986) were used to determine data outliers and 99 percent confidence limits. Data outside the range of a Z-score of $\pm 2.00_i$ are rated as outliers.

Based on this criterion, the Z-score test outlined in the Federal Register indicated that none of the data values can be rated as outliers. The

TABLE 65. SUMMARY OF SEMIVOLATILE ORGANIC FEED RATE DATA FROM K001-CREOSOTE TEST BURN

	Test Nos. and total feed rates					
	1		2		3	
	180 lb/h		180 lb/h		180 lb/h	
Analyte[a]	Concentration, % by weight	Feed rate,[b] lb/h	Concentration, % by weight	Feed rate, lb/h	Concentration, % by weight	Feed rate, lb/h
Anthracene	1.1	2.0	1.0	1.8	0.8	1.4
Acenaphthene	1.8	3.2	1.0	3.2	1.8	3.2
Naphthalene	4.1	7.4	3.6	6.5	3.6	6.5
Phenanthrene	3.6	6.6	3.3	5.9	3.4	6.1
Fluoranthene	2.4	4.3	2.3	4.1	2.3	4.1

[a] Minimum detection limit, ppm

Anthracene	-	500
Acenaphthene	-	500
Naphthalene	-	420
Phenanthrene	-	1400
Fluoranthene	-	5800

[b] Analyte feed rate (lb/h) = concentration (%) x feed rate (lb/h).

TABLE 66. SUMMARY OF DATA ON SEMIVOLATILE ORGANIC CONCENTRATIONS AND MASS EMISSION RATES

Analyte[a]	Test Nos. and sample volumes					
	1		2		3	
	3.19 dNm^3		3.31 dNm^3		3.14 dNm^3	
	Concentration, $\mu g/m^3$	Mass emission rate, 10^{-5} lb/h	Concentration, $\mu g/m^3$	Mass emission rate, 10^{-5} lb/h	Concentration, $\mu g/m^3$	Mass emission rate, 10^{-5} lb/h
Anthracene	<6.3	<3.7	<6.0	<3.7	<6.4	<3.7
Acenaphthene	<6.3	<3.7	<6.0	<3.7	<6.4	<3.7
Naphthalene	<6.3	<3.7	<6.0	<3.7	<6.4	<3.7
Phenanthrene	<6.3	<3.7	<6.0	<3.7	<6.4	<3.7
Fluoranthene	<6.3	<3.7	<6.0	<3.7	<6.4	<3.7

[a] Analyte detection limit: 20-µg/sample. All analytical values were less than the analyte detection limit.

TABLE 67. SUMMARY OF SEMIVOLATILE ORGANIC DRE DATA

Analyte[a]	Test Nos.								
	1			2			3		
	Feed rate, lb/h	Mass emission rate, 10^{-5} lb/h	DRE,[a] %	Feed rate, lb/h	Mass emission rate, 10^{-5} lb/h	DRE,[a] %	Feed rate, lb/h	Mass emission rate, 10^{-5} lb/h	DRE,[a] %
Anthracene	2.0	<3.7	>99.998	1.85	<3.7	>99.998	1.4	<3.7	>99.997
Acenaphthene	3.2	<3.7	>99.999	3.15	<3.7	>99.999	3.2	<3.7	>99.999
Naphthalene	7.4	<3.7	>99.999	6.5	<3.7	>99.999	6.5	<3.7	>99.999
Phenanthrene	6.6	<3.7	>99.999	5.9	<3.7	>99.999	6.1	<3.7	>99.999
Fluoranthene	4.3	<3.7	>99.999	4.1	<3.7	>99.999	4.1	<3.7	>99.999

[a] $\%\ DRE = \frac{lb/h\ (in) - lb/h\ (out)}{lb/h\ (in)} \times 100$

TABLE 68. SUMMARY OF BDAT-LIST METALS EMISSION DATA FROM K001-CREOSOTE TEST BURN

	Run Nos.					
	1		2		3	
Metals	µg/dNm³	lb/h	µg/dNm³	lb/h	µg/dNm³	lb/h
Arsenic	25.2	0.00015	34.0	0.0002	23.6	0.00014
Antimony	14.2	0.00009	25.1	0.00015	18.6	0.00011
Barium	36.2	0.00022	58.7	0.00035	41.3	0.00025
Beryllium	0.1	4.9×10^{-7}	0.2	9.7×10^{-7}	0.1	6.4×10^{-7}
Cadmium	769.3	0.005	481.2	0.003	91.4	0.0006
Chromium	73.5	0.0004	146.5	0.0009	42.2	0.0003
Copper	74.6	0.004	179.6	0.001	104.1	0.0006
Lead	992.5	0.006	1208.3	0.007	672.9	0.004
Mercury	0.006	3.3×10^{-8}	0.009	5.7×10^{-8}	0.02	1.1×10^{-7}
Nickel	29.0	0.0002	90.5	0.0005	25.8	0.0002
Selenium	1.1	6.6×10^{-6}	1.8	0.00001	1.4	8.3×10^{-6}
Silver	3.8	0.00002	2.6	0.00002	1.1	6.9×10^{-6}
Thallium	14.8	0.00009	11.5	0.00007	135.7	0.0008
Vanadium	36.7	0.002	80.4	0.005	8.1	0.00005
Zinc	836.2	0.005	1058.9	0.006	1073.7	0.007

compounds detected in the K001-PCP and K001-creosote samples are summarized in Tables 69 and 70; the 99 percent upper confidence limits are also specified.

NON-BDAT PARAMETERS

In addition to determining the compounds included on the BDAT list, EPA's Hazardous Waste Engineering Research Laboratory completed analysis of several other compounds in samples of both K001-PCP and K001-creosote feed, ash, and scrubber water. These additional data were collected for EPA's Office of Air Quality Planning and Standards (OAQPS) to assist them in their development of air emissions regulations for TSDF's (treatment, storage, and disposal facilities), including waste-treatment processes. Specifically, OAQPS needed data on waste characteristics and waste handling prior to incineration. Most of the OAQPS compounds are included on the BDAT list of compounds; those that are not are identified separately as non-BDAT parameters on the data tables in Section 4.

TABLE 69. CONCENTRATION AND 99 PERCENT UPPER CONFIDENCE LIMITS FOR COMPOUNDS DETECTED IN K001-PCP SAMPLES

Compounds	Samples 1	2	3	99% Upper confidence limit
K001-PCP Untreated Waste				
Volatiles, ppb				
Toluene	16	10	39	92
Semivolatiles, ppm				
Acenaphthene	13,000	18,000	14,000	22,092
Anthracene	9,300	13,000	8,500	17,003
Benz(a)anthracene		3,400	2,500	a
Benzo(a)pyrene		940	620	a
Benzo(b and/or k)fluoranthene	940	2,300	1,600	4,316
Chrysene		3,600		
Fluorene	8,200	12,000	9,000	15,250
Fluoranthene	13,000	21,000	15,000	28,393
Naphthalene	26,000	43,000	37,000	63,127
Pentachlorophenol	970	3,000	920	6,579
Phenanthrene	28,000	42,000	32,000	54,235
Pyrene	9,200	15,000	11,000	20,451
Metals, ppm				
Arsenic	2.9	2.3	1.1	6.32
Barium	30.0	19.0	17.0	42.99
Cadmium	0.5	0.6	0.4	0.79
Chromium (total)	1.5	2.7	2.1	4.06
Copper	6.7	11.0	10.0	16.67
Lead	7.8	11.0	6.3	15.69
Mercury	0.11	0.16	0.064	0.30
Zinc	64.0	58.0	30.0	125.64

(continued)

TABLE 69 (continued)

Compounds	Samples 1	2	3	99% Upper confidence limit
K001-PCP Incinerator Ash				
Metals, ppm				
Arsenic	0.8	0.6	0.4	1.30
Barium	74	21	21	174
Chromium (total)	8.2	1.1	1.2	31
Copper	6.8	3	2	15
Lead	5.2	1.2	0.96	15
Zinc	11	2.1	2.1	34
K001-PCP Ash TCLP				
Metals, mg/liter				
Barium	0.32	0.19	0.25	0.45
Lead	0.021			
K001-PCP Scrubber Water				
Metals, mg/liter				
Arsenic		0.12	0.11	a
Barium	0.12	0.24	0.39	0.89
Chromium (total)			0.045	
Copper	0.15	0.09	0.07	0.24
Lead	0.021	0.18	0.2	1.76
Mercury			0.003	
Zinc	1.1	0.61	0.88	1.68

[a] It is not appropriate to calculate 99 percent confidence limits for residuals when less than three data points are available.

TABLE 70. CONCENTRATIONS AND 99 PERCENT UPPER CONFIDENCE LIMITS FOR COMPOUNDS DETECTED IN K001-CREOSOTE SAMPLES

Compounds	Samples						99% upper confidence limit
	1	2	3	4	5	6	
K001-Creosote Untreated Waste							
Volatiles, ppb							
Benzene	56	60	61	51	58	83	89
Toluene	110	120	100	110	110	170	183
Ethyl benzene	57	56	55	72	71	87	101
Xylenes	120	130	120	130	130	170	179
Semivolatiles, ppm							
Acenaphthalene		1,000					
Acenaphthene	21,000	15,000	19,000	16,000	19,000	17,000	23,723
Anthracene	15,000	7,300	12,000	8,500	7,400	9,100	18,571
Chrysene	4,800	4,200	4,800	4,100	4,200	4,300	5,176
Fluorene	18,000	12,000	16,000	14,000	16,000	14,000	20,698
Naphthalene	42,000	40,000	40,000	32,000	29,000	43,000	54,342
Phenanthrene	41,000	32,000	37,000	29,000	32,000	36,000	45,831
Phenol	2,400	3,700	3,600	3,900	2,400	3,300	5,254
Pyrene	17,000	13,000	16,000	12,000	15,000	13,000	19,560
Metals, ppm							
Arsenic	2.6		2.1	2.5	0.7	2.6	7.10
Barium	63.0	58.0	70.0	59.0	12.0	150.0	375
Cadmium	3.4	3.4	3.1	2.4	0.8	3.5	10
Chromium (total)	5.0	4.8	6.4	7.0	1.6	8.6	20
Copper	35.0	32.0	39.0	39.0	12.0	38.0	89
Lead	170.0	160.0	150.0	110.0	37.0	190.0	501

(continued)

TABLE 70 (continued)

Compounds	Samples						99% upper confidence limit
	1	2	3	4	5	6	
Metals, ppm (cont'd)							
Mercury	0.4	0.4		0.4	0.8	0.6	1.14
Nickel	2.1		2.1	2.8	1.8	4.5	5.85
Selenium	1.5	1.4	1.2	1.1	37.0	1.1	56
Thallium	7.7	8.0	6.8	5.3	2.2	3.3	17
Vanadium						1.9	
Zinc	170.0	170.0	160.0	120.0	40.0	200.0	512
K001-Creosote Ash							
Metals, ppm							
Arsenic	5.3	5.3	9	10	13	11	20
Barium	81	74	61	48	56	72	102
Chromium (total)	6.1	5.3	5.8	8.7	10	7.7	13
Copper	86	100	98	110	130	86	145
Nickel	3.6	4.6	5	5.2	6.8	3.9	8.04
Selenium	2.3	1.9	1.8	2.5	2.6	2.8	3.46
Vanadium	4.4	4.1	4.1	4.2	5.2	4.8	5.57
Zinc	1.9	1.8	3.2	2.8	3	2.5	4.34
K001-Creosote Ash TCLP							
Metals, mg/liter							
Arsenic					0.025		
Barium	0.38	0.57	0.53	0.31	0.22	0.41	0.87

(continued)

TABLE 70 (continued)

Compounds	Samples						99% upper confidence limit
	1	2	3	4	5	6	
Metals, mg/liter (cont'd)							
Cadmium	0.02						
Copper	0.02	0.03	0.03		0.008	0.07	0.16
Nickel			0.02			0.02	
Selenium					0.004		
Vanadium					0.02		
Zinc	0.02	0.05	0.08	0.01	0.03	0.002	0.41
K001-Creosote Scrubber Water							
Metals, mg/liter							
Arsenic	0.041	0.15	0.16	0.28	0.25	1.6	3.50
Barium	0.76	0.8	0.56	1	0.9	1.1	1.45
Cadmium	0.87		0.95	1.2	0.45	0.46	2.06
Chromium (total)	0.35	0.74	0.6	1	0.65	0.89	1.59
Copper	0.42	0.5	0.43	0.51	0.45	0.35	0.61
Lead	2.5	4.5	3.5	5.4	3.3	3.9	6.95
Mercury	0.016	0.06	0.008	0.29	0.19	0.54	3.87
Nickel	0.48	0.51	0.56	0.6	0.7	0.54	0.76
Selenium	0.057	0.11	0.09	0.12	0.038	0.021	0.30
Thallium		2.4	2.8	3.4	3.8	4	5.31
Vanadium	0.04	0.06	0.04	0.08	0.05	0.06	0.10
Zinc	5	7.1	9.1	11	8.2	8.2	14.63

[a] It is not appropriate to calculate 99 percent confidence limits for residuals when less than three data points are available.

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16. ABSTRACT

This report describes the treatment of creosote and pentachlorophenol wood preserving wastewater treatment sludges by rotary kiln incineration (RCRA Code K001.)

17. KEY WORDS AND DOCUMENT ANALYSIS

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