BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT FOR

K009 AND K010

Robert April, Chief
Treatment Technology Section

Jose Labiosa
Project Manager

U.S. Environmental Protection Agency
Office of Solid Waste
401 M Street, S.W.
Washington, D.C. 20460

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This background document provides the Agency's technical support for selecting and developing treatment standards for the only regulated constituent (i.e., chloroform) for the K009 and K010 wastes. Section 2 presents waste-specific information; Section 3 discusses the applicable and demonstrated technologies used to treat the waste; Section 4 summarizes the available performance data; Section 5 explains EPA's determination of BDAt; while Section 6 discusses the selection of the regulated constiuent and deletion of some K009 and K010 constituents originally selected in the proposed rule. Finally, Section 7 presents the determination of the treatment standards.

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Versar personnel involved in the preparation of this document included Mr. Jerome Strauss, Program Manager; Mr. Stephen Schwartz, Task Manager; Mr. Stanley Moore, Staff Scientist; Ms. Martha Martin, Technical Editor; and Ms. Sally Gravely, Project Secretary. Mr. Alan Corson of Jacobs Engineering Group and Mr. Mark Hereth of Radian Corporation assisted in the review of the document.

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1. INTRODUCTION

Pursuant to section 3004(m), enacted by the Hazardous and Solid Waste Amendments (HSWA) on November 8, 1984, the Environmental Protection Agency (EPA) is establishing best demonstrated available technology (BDAT) treatment standards for wastes from acetaldehyde production. These wastes are identified in 40 Code of Federal Regulations (CFR) Part 261.32 as K009 and K010. Compliance with these BDAT treatment standards is a prerequisite for the placement of these wastes in facilities designated as land disposal units according to 40 CFR Part 268. The effective date of these treatment standards is June 8, 1989.

This background document provides the Agency's technical support for selecting and developing treatment standards for the only regulated constituent (i.e., chloroform) for the K009 and K010 wastes. Section 2 presents waste-specific information, the number and location of facilities affected by the land disposal restrictions, manufacturing processes generating the wastes, and waste characterization data. Section 3 discusses the applicable and demonstrated technologies used to treat the waste (or similar wastes), and Section 4 summarizes the available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of the regulated constituent and deletion of some K009 and K010 constituents originally selected in the proposed rule. Determination of the treatment standards is presented in Section 7.

The BDAT program and promulgated methodology are more thoroughly described in two additional documents: Methodology for Developing Best Demonstrated Available (BDAT) Treatment Standards (USEPA 1989c) and Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT") (USEPA 1987c). The petition process to be followed in requesting a variance from the BDAT treatment standards is also provided in the Document entitled Methodology for Developing Best Demonstrated Available (BDAT) Treatment Standards (USEPA 1989c).

EPA has identified two companies that produce acetaldehyde. The Agency is promulgating regulations for chloroform in K009 and K010 nonwastewaters and wastewaters. For the purpose of determining the applicability of the treatment standard, wastewaters are defined as wastes containing less than 1 percent (weight basis) total suspended solids* (TSS) and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition must comply with the treatment standard for nonwastewaters.

The performance standards for chloroform in K009 and K010 nonwastewaters have been established based on a transfer of the chloroform treatment standard established for K019 wastes and are based on the total concentration analysis of the ash residuals for chloroform generated during incineration of K019 waste.

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*The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by Method 209C, Total Suspended Solids Dried at 103 to 105°C, in Standard Methods for the Examination of Water and Wastewaters, 16th Edition (APHA, AWWA, and WPCF 1985).

The BDAT level of performance standards for K009 and K010 wastewaters are promulgated based on a transfer of treatment performance data from EPA's Office of Water for wastewaters that are believed to be similar to and/or to contain constituents present in K009 and K010 wastewaters. These data were used to establish the Effluent Limitations Guidelines and Standards for the Organic Chemicals Plastics and Synthetic Fibers Industries (USEPA 1987a, 1987b).

If the concentrations of the regulated constituent, as generated or treated, are lower than or equal to the promulgated BDAT treatment standard (presented in Table 1-1), then the wastes are not prohibited from being placed in land disposal units.

Table 1-1 BDAT Treatment Standards for K009 and K010

Nonwastewaters

Constituent	Maximum for any single grab sample	
	Total composition (mg/kg)	TCLP (mg/l)
Chloroform	6.0	Not Applicable

Wastewaters

Constituent	Based on composite samples
	Total composition (mg/l)
Chloroform	0.10

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industries affected by the land disposal restrictions for K009 and K010 and presents available characterization data for these wastes.

40 CFR Part 261.32 lists two wastes generated in the production of acetaldehyde from ethylene as hazardous wastes under Subtitle C of the Resource Conservation and Recovery Act (RCRA). The 40 CFR Part 261.32 listing criteria are as follows:

K009: Distillation bottoms from the production of acetaldehyde from ethylene.

K010: Distillation side cuts from the production of acetaldehyde from ethylene.

The Agency has determined that the listed wastes K009 and K010 represent two separate waste treatability groups based on their different physical and chemical characteristics. Although these wastes are generated by similar processes, EPA has data showing that K009 wastes typically contain less than 1 percent TOC and less than 1 percent TSS and, as originally generated, are thus classified as wastewaters for the purpose of establishing BDAT. Conversely, the Agency has data showing that K010 wastes are typically over 1 percent TOC and therefore, as originally generated, are classified as nonwastewaters. Residuals generated from the treatment of either K009 or K010 could be classified as wastewaters or nonwastewaters depending on their characteristics (TOC and TSS). As described later in this section, EPA examined the available

waste characterization data for the manufacturing process generating these listed wastes, as well as the applicable and demonstrated treatment technologies for these wastes.

2.1 Industry Affected and Process Description

The four-digit Standard Industrial Classification (SIC) code associated with the production of industrial organic chemicals, including acetaldehyde, is 2869. A flow diagram of the production process is presented in Figure 2-1. This flow diagram represents a simplified "crude distillation column." The acetaldehyde process of Texas Eastman Company (a generator of K009 and K010) produces at least two side cut streams (K010) from a "finishing column"; in addition, a second distillation column is also involved in the production train, and it yields a bottom stream (K009). The Agency estimates that only two companies produce acetaldehyde and may generate K009 and K010 wastes: (1) Texas Eastman Company (two plants located in Longview, Texas) and (2) Celanese Company (one plant located in Bay City, Texas).

Commercial processes for the production of acetaldehyde include (1) the oxidation or dehydrogenation of ethanol, (2) the addition of water to acetylene, (3) the partial oxidation of hydrocarbons, and (4) the direct oxidation of ethylene. Today's promulgated standards, however, apply only to those listed wastes (i.e., K009 and K010) resulting from the manufacturing of acetaldehyde from direct oxidation of ethylene.

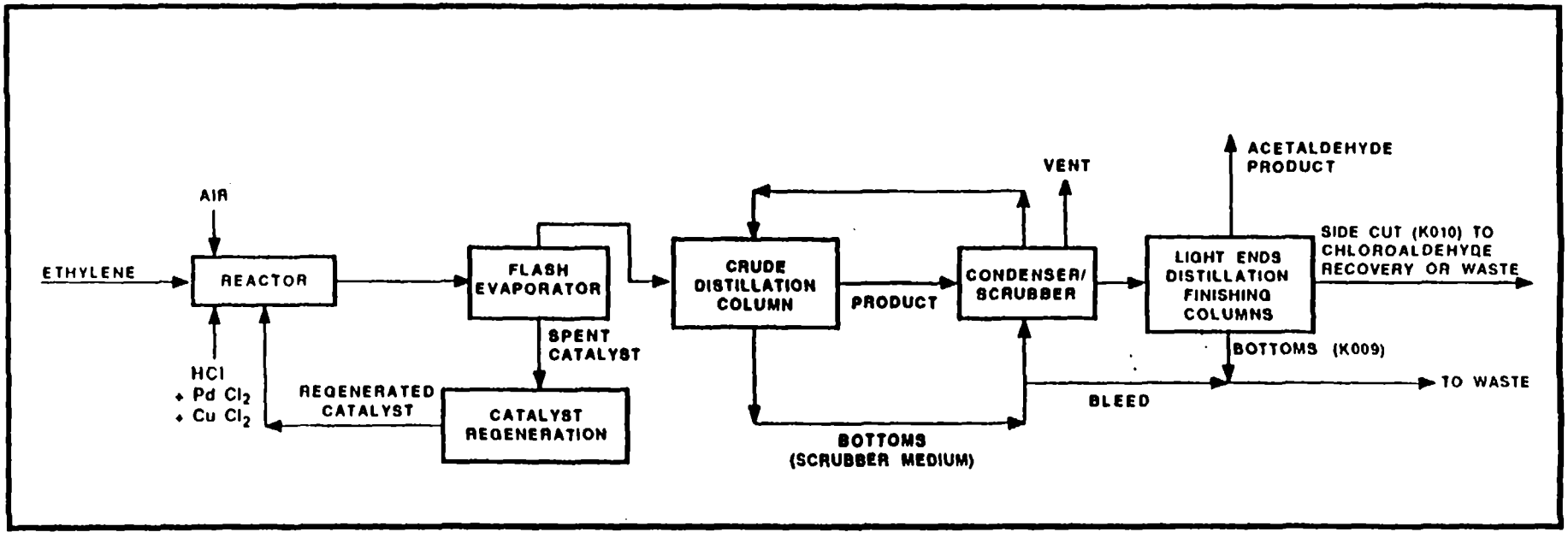

FIGURE 2-1 SIMPLIFIED SCHEMATIC PROCESS FOR THE GENERATION OF K009 AND K010 WASTES FROM ACETALDEHYDE PRODUCTION (LIQUID-PHASE OXIDATION OF ETHYLENE)

The direct liquid-phase oxidation of ethylene is the most widely used method for the manufacture of acetaldehyde.* Ethylene is catalytically oxidized with air in a dilute hydrochloric acid solution containing the chlorides of palladium and copper in a tubular reactor. The reaction products are flash evaporated, and the product acetaldehyde passes overhead to the crude distillation column. The aqueous bottoms from the flash evaporator go to a regeneration reactor, where the palladium catalyst is regenerated and recycled to the acetaldehyde reactor. The product from the crude distillation column is condensed and scrubbed; unreacted ethylene and light hydrocarbons (including a small amount of acetaldehyde) are vented. The crude acetaldehyde from the scrubber then goes to final distillation. In the final distillation column, the purified acetaldehyde product is obtained from the distillation overhead cut. K010 waste is obtained from the final distillation side cuts (these K010 side cuts may then be sent for recovery of the chloroaldehydes if not disposed of as a hazardous waste), and K009 waste is obtained from the final distillation bottoms. The reaction chemistry is explained below.

The process involves the oxidation of ethylene by palladium chloride to form the product acetaldehyde, palladium metal, and hydrogen chloride:

$$C_2H_4 + PdCl_2 + H_2O \rightarrow CH_3CHO + Pd + 2HCl$$

ethylene	palladium chloride		acetaldehyde	metallic palladium	hydrochloric acid

*Three facilities produce acetaldehyde from ethylene and are subject to the treatment standards promulgated for K009/K010 wastes. Two facilities report using 100 percent pure ethylene, and the other uses a mixture of 90 percent ethylene and 10 percent ethyl alcohol.

Cupric chloride is used as the second component of the catalyst system to reoxidize the palladium metal to palladium chloride:

$$2CuCl_2 + Pd \rightarrow PdCl_2 + 2CuCl$$

cupric chloride	palladium chloride	cuprous chloride

The cuprous chloride thus formed is, in turn, reoxidized to cupric chloride in the second-stage regeneration unit:

$$4CuCl + O_2 + 4HCl \rightarrow 4CuCl_2 + 2H_2O$$

cuprous chloride	cupric chloride

Two hazardous waste streams are generated from the production of acetaldehyde: (1) distillation bottoms (K009) which contain treatable concentrations of the BDAT list organics, chloroform and methylene chloride, and (2) distillation side cuts (K010), which contain slightly higher concentrations of the BDAT list organics chloroform and methylene chloride.

2.2 Waste Characterization

This section presents waste characterization data currently available to the Agency for K009 and K010 wastes. The approximate concentrations of major waste constituents are included in Table 2-1 at the end of this section. Tables 2-2 and 2-3 present the BDAT list constituents and non-BDAT list constituents in K009 and K010 wastes.

According to available characterization data, K009 waste contains about 97 percent water and about 3 percent total BDAT list and non-BDAT list organics. Total organic carbon (TOC) ranges from 0.3 to 0.6 percent.

EPA has data showing that K010 waste contains about 50 percent water and 50 percent total BDAT list and non-BDAT list organics. Texas Eastman Company indicated in their comments on the proposed rule that K010 waste contains as much as 150 ppm total concentration of chlorinated organic compounds. Also, data indicate that the heat content of K010 waste is less than 1,660 British thermal units per pound (Btu/lb).

2.3 Determination of Waste Treatability Group

Fundamental to waste treatment is the concept that the type of treatment technology used and the level of treatment achieved depend on the physical and chemical characteristics of the waste.

Based on review of the generation of K009 and K010 wastes and all available data characterizing these wastes, the Agency has determined that these wastes represent two separate treatability groups. Characterization data show that K009 wastes typically contain less than 1 percent total organic carbon (TOC) and less than 1 percent total suspended solids (TSS) and therefore, as originally generated, are classified as wastewaters for the purpose of establishing BDAT. In contrast, EPA has data showing that K010 wastes are typically over 1 percent TOC and therefore, as originally generated, are classified as nonwastewaters.

Table 2-1 Major Constituent Composition

for K009 and K010 Wastes

Constituent	Concentration (wt percent)	
	K009 waste	K010 waste
Water[a]	96.8-96.9	46.7-51.2
Total BDAT list and non-BDAT list organics[a]	3.1-3.16	48.8-53.3
Total organic content[b]	0.27-0.63	3.6-3.8

References:
[a] Data from Characterization of Waste Streams (for K009/K010) Listed in 40 CFR Part 261 Waste Profiles by Environ Corporation (USEPA 1985a).
[b] Texas Eastman Company waste characterization data submitted to EPA-OSW on November 10, 1988.

Table 2-2 Constituent Analysis in K009 Waste

BDAT ref. no.	Constituent	Waste characterization (mg/kg) for untreated K009 wastes (a)	(b)	(c)	(d)
	BDAT list constituents:				
2	Acrolein	-	ND	CBI	CBI
3	Acrylonitrile	-	ND	CBI	CBI
4	Benzene	-	ND	CBI	CBI
14	Chloroform	*	1.4-2.8	CBI	CBI
22	1,1-dichloroethane	-	ND	CBI	CBI
101	2,4-dinitrophenol	-	ND	CBI	CBI
225	Ethyl acetate	-	2.2	CBI	CBI
31	Ethyl methacrylate	-	2.0	CBI	CBI
15	Methyl chloride	*	ND	CBI	CBI
38	Methylene chloride	*	ND	CBI	CBI
43	Toluene	-	ND	CBI	CBI
	BDAT list metals:				
159	Chromium (total)	-	<0.05	CBI	CBI
161	Lead	-	<0.05	CBI	CBI
162	Mercury	-	0.0004-<0.0007	CBI	CBI
	Non-BDAT list organics:				
	Acetic acid	13,900	-	CBI	CBI
	Acetyl chloride	4,200	-	CBI	CBI
	Chloral	2,100	150-1,900	CBI	CBI
	Chloroacetaldehyde	-	15.0-92.0	CBI	CBI
	Crotonaldehyde	-	<10.0-60.0	CBI	CBI
	Dichloroacetaldehyde	-	500-3,100	CBI	CBI
	Formaldehyde	*	<10.0	CBI	CBI
	Formic acid	-	-	CBI	CBI
	Paraldehyde	1,600	<10.0	CBI	CBI
	Non-BDAT list metal:				
	Copper	-	0.51-0.65	CBI	CBI

- = No data provided.
ND = Not detected.
* = The combined value of methylene chloride, methyl chloride, chloroform, and formaldehyde is 2,000 mg/kg in the untreated waste.
CBI = Confidential Business Information.

References:

a. Data from Characterization of Waste Streams Listed in 40 CFR Part 261 Waste Profiles (K009/K010) by Environ Corporation prepared for EPA in 1985.
b. Texas Eastman Company waste characterization data submitted to EPA-OSW on November 10, 1988.
c. Texas Eastman Company data presenting hydrolysis as BDAT submitted to EPA on May 31, 1988. These data are claimed as Confidential Business Information. This information is available in the confidential portion of the Administrative Record for this rulemaking.
d. K009 and K010 waste characterization data from EPA Office of Water's Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) data base is claimed as Confidential Business Information. This information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-3 Constituent Analysis in K010 Waste

BOAT ref. no.	Constituent	Waste characterization (mg/kg) for untreated K010 waste (a)	(b)	(c)	(d)
	BOAT list constituents:				
2	Acrolein	-	ND	CBI	CBI
3	Acrylonitrile	-	ND	CBI	CBI
4	Benzene	-	ND	CBI	CBI
14	Chloroform	*	120-3800	CBI	CBI
22	1,1-dichloroethane	-	ND	CBI	CBI
101	2,4-dinitrophenol	-	ND	CBI	CBI
225	Ethyl acrylate	-	ND	CBI	CBI
31	Ethyl methacrylate	-	ND	CBI	CBI
15	Methyl chloride	*	ND	CBI	CBI
38	Methylene chloride	*	520-730	CBI	CBI
43	Toluene	-	ND	CBI	CBI
	BOAT list metals:				
159	Chromium (total)	-	<0.02-0.2	CBI	CBI
161	Lead	-	<0.05	CBI	CBI
162	Mercury	-	<0.0002-0.0004	CBI	CBI
	Non-BOAT list organics:				
	Acetaldehyde	7,800	-	CBI	CBI
	Acetic acid	600	-	CBI	CBI
	Acetyl chloride	5,000	-	CBI	CBI
	Chloral	3,400	0.83-4.2	CBI	CBI
	Chloroacetaldehyde	5,500	4.5-8.5	CBI	CBI
	Crotonaldehyde	-	<0.05-0.80	CBI	CBI
	Dichloroacetaldehyde	-	2.3-8.6	CBI	CBI
	Formaldehyde	*	<10.0	CBI	CBI
	Formic acid	-	-	CBI	CBI
	Paraldehyde	-	<0.05-0.11	CBI	CBI
	Non-BOAT list metal:				
	Copper	-	<0.05-0.2	CBI	CBI

- = No data provided.
ND = Not detected.
* = The combined value of chloroform, methylene chloride, methyl chloride, and formaldehyde is 4,000 mg/kg in the untreated waste.
CBI = Confidential Business Information

References:

a. Data from Characterization of Waste Streams Listed in 40 CFR Part 261 Waste Profiles (K009/K010) by Environ Corporation prepared for EPA in 1985.
b. Texas Eastman Company waste characterization data submitted to EPA-OSW on November 10, 1988.
c. Texas Eastman Company data presenting hydrolysis as BOAT submitted to EPA on May 31, 1988. These data are claimed as Confidential Business Information. This information is available in the confidential portion of the Administrative Record for this rulemaking.
d. K009 and K010 waste characterization data from EPA Office of Water's OCPSF data base is claimed as Confidential Business Information. This information is available in the confidential portion of the Administrative Record for this rulemaking.

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

Section 2 established two treatability groups for the management of K009 and K010 wastes. This section identifies the treatment technologies that are applicable to these groups and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must be demonstrated to treat the waste in question or to treat a waste that is similar in terms of the parameters that affect treatment selection. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

Initial data gathering on the treatment of K009 and K010 wastes included review of the following: (1) the National Survey of Treatment, Storage, Disposal, and Recycling Facilities data base for K009 and K010 (USEPA 1986); (2) CBI data submitted to the Agency by Texas Eastman Company, presenting hydrolysis treatment data for K009 and K010 wastes; (3) data from Characterization of Waste Streams Listed in 40 CFR Part 261 Waste Profiles (K009/K010) prepared for EPA in 1985 (USEPA 1985); (4) technical literature sources; and (5) review of the Office of Water's Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemicals Plastics and Synthetic Fibers Point Source Category.

Since K009 and K010 wastes contain organics, as shown in Section 2.3, the Agency believes that the technologies applicable to the untreated listed wastes should include those that destroy or reduce the total amount of the organic compounds in the wastes. Additionally, treatment of residuals (wastewaters and nonwastewaters) generated from the treatment of BDAT list organics should also be considered.

For the K009 and K010 nonwastewaters, either as generated or as residuals from treatment of K009 and K010 wastes, the Agency has identified the following technologies as potentially applicable: (1) incineration, (2) fuel substitution, (3) solvent extraction followed by recovery or incineration of the contaminated solvent, and (4) recycle or reuse.

For K009 and K010 wastewaters, the Agency has identified the following potentially applicable treatment technologies: (1) hydrolysis followed by biological treatment, followed by incineration of biomass (The Agency received one comment on the proposed rule from Texas Eastman Company (TEC) (a generator of K009 and K010 waste) stating that TEC does not routinely use a rotary kiln to incinerate the biomass from their hydrolysis/biological treatment of K009 and K010 wastewaters.); (2) hydrolysis followed by either carbon adsorption or steam stripping; (3) biological treatment in combination with steam stripping and/or carbon adsorption, followed by incineration of spent carbon and biomass; (4) steam stripping followed by carbon adsorption; and (5) wet air oxidation followed by biological treatment, followed by incineration.

(Detailed information on the above-mentioned technologies may be found in the BDAT Treatment Technology Background Document (USEPA 1988d).)

EPA has not identified facilities that specifically use steam stripping followed by carbon adsorption, wet air oxidation followed by biological treatment, or hydrolysis followed by carbon adsorption or steam stripping on K009 and K010 wastes. However, based on waste parameters that affect treatment selection for these technologies, the Agency feels that K009 and K010 would be no more difficult to treat than any wastes for which these technologies are applicable.

3.1.1 Nonwastewaters

Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste in order to volatilize organic constituents and to destabilize chemical bonds, eventually destroying the hazardous constituents by converting them to carbon dioxide, water, and/or other oxidized waste constituents. In general, two residuals are generated by incineration processes: ash and scrubber water (when wet scrubbers are used). The incineration of K009 and K010 nonwastewaters will result in scrubber waters that must be managed as K009 and K010 wastewaters by virtue of the derived-from rule. The scrubber water is expected to contain only very low levels of organic constituents, if any, since most of the organics are expected to be destroyed in the incinerator.

Fuel substitution, like incineration, destroys the organic constituents of a waste, but it also derives a fuel value from the waste. The fuel substitution of nonwastewaters is expected to generate

combustion gas scrubber water, which must be managed as K009 and K010 wastewaters by virtue of the derived-from rule.

Solvent extraction of hazardous wastes is a process whereby a contaminant dissolved in a liquid is transferred from the waste to an extracting solvent that preferentially dissolves that substance. For solvent extraction to be effective, the extracting solvent must be immiscible in the waste to be treated and must differ in density so that phase separation is possible.

Recycling is the use, reuse, or reclaiming of a material (40 CFR Part 261.1). A material is "used or reused" if it is either employed as an ingredient (including its use as an intermediate) to make a product or employed in a particular function as an effective substitute for a commercial product. A material is "reclaimed" if it is processed to recover a useful product or if it is regenerated.

3.1.2 Wastewaters

Hydrolysis is a technology that causes decomposition of a chemical compound. Typically, during hydrolysis a chemical reaction occurs in which water reacts with another substance to form two or more new substances. Elevated temperatures and/or pressures usually enhance rates of hydrolysis. Hydrolysis replaces one or more of the substitute halogens with hydroxyl groups. The resulting compound is generally more oxidizable or biodegradable.

Carbon adsorption is a separation technology used to remove and/or recover dissolved organics and certain inorganics from aqueous streams.

Powdered or granular activated carbon particles are used as the adsorbing medium in this technology.

Steam stripping is a technology that can separate more volatile materials from less volatile materials by vaporizing the more volatile materials and then condensing them. As such, it is a type of distillation process.

Biological treatment is a technology that uses living microorganisms to decompose organic constituents. Biological treatment can occur either in the presence of oxygen, known as aerobic treatment, or in the absence of oxygen, referred to as anaerobic treatment. In aerobic treatment the organic constituents are broken down into water, carbon dioxide, and other lower molecular weight organic components by the microorganisms. In contrast, in anaerobic treatment the organic constituents are broken down into water, methane, and other organic components.

Wet air oxidation converts hazardous waste to less toxic substances by the aqueous phase oxidation of dissolved or suspended organic or inorganic substances at elevated temperature and pressure. Elevated pressure is used to keep the aqueous products of oxidation in the liquid state, allowing organic destruction to proceed at lower temperatures than would otherwise be necessary for thermal destruction. Water moderates the oxidation rate, removing excess heat of reaction. Oxygen is incorporated as the oxidizing agent. It is important to point out that sometimes wet air oxidation does not achieve complete oxidation and typically leaves behind constituents with lower molecular weights (such as aldehydes) that need to undergo additional treatment prior to disposal.

3.2 Demonstrated Treatment Technologies

3.2.1 Nonwastewaters

Of the aforementioned applicable technologies for BDAT list organic constituents, the Agency believes that incineration is demonstrated to treat K009 and K010 nonwastewaters (either as generated or as treatment residuals).

The Agency has not identified any facilities that incinerate K009 and K010 nonwastewaters. However, EPA has data from incineration of K019 wastes (chlorinated organics) that have chlorinated organic hazardous constituents similar to those present in K009 and K010 nonwastewaters. The Agency believes that K019 is more difficult to treat than K009 and K010 nonwastewaters because K019 contains organic constituents that have higher bond dissociation energies and higher boiling points than those of any of the organic constituents present in K009 and K010 nonwastewaters (see Appendix A).

The Agency has determined that recycling is demonstrated for K010 wastes because one facility submitted CBI data showing treatment of K010 waste through recycling. However, the Agency's data show that the residuals of these recycling practices result in wastewaters that need further treatment prior to disposal and are currently treated along with K009 waste prior to disposal. As of January 11, 1989, these wastes were treated by a proprietary hydrolysis process followed by biological treatment.

3.2.2 Wastewaters

One facility is currently using hydrolysis followed by biological treatment to treat K009 and K010 wastewaters. As a result, the Agency has determined that hydrolysis followed by biological treatment is a demonstrated technology for K009 and K010 wastewaters. This facility, however, informed the Agency of its intention to treat effluents from the hydrolysis unit by steam stripping prior to biological treatment.

EPA's Office of Water has performance data showing that biological treatment, steam stripping, carbon adsorption, or any combination of these technologies is being used to treat wastewaters believed to be similar to, or containing constituents also present in, K009 and K010 wastewaters. The Agency lacks data to support the fact that any of the other applicable technologies are demonstrated for K009 and K010 wastewaters or similar wastes. The Agency has wet air oxidation data from the treatment of acrylonitrile but determined that these data were pilot-scale data (to determine applicability of treatment) and that the operating conditions of the wet air oxidation treatment system were insufficient to optimize treatment. The Agency therefore did not consider these data in establishing BDAT.

4. PERFORMANCE DATA BASE

This section presents the data available on the performance of demonstrated technologies in treating the listed wastes. These data are used elsewhere in this document for determining which technologies represent BDAT (Section 5), for selecting constituents to be regulated (Section 6), and for developing treatment standards (Section 7). In addition to full-scale demonstration data, eligible data may include data developed at research facilities or obtained through other applications at less than full-scale operation, as long as the technology is demonstrated in full-scale operation for a similar waste as defined in Section 3.

Performance data, to the extent that they are available to EPA, include the untreated and treated waste concentrations for a given constituent, the values of operating parameters that were measured at the time the waste was being treated, the values of relevant design parameters for the treatment technology, and data on waste characteristics that affect performance of the treatment technology.

Where data are not available on the treatment of the specific wastes of concern, the Agency may elect to transfer data on the treatment of a similar waste or wastes using the demonstrated technology. To transfer data from another waste category, EPA must find that the untested wastes (those covered by this background document) are no more difficult to treat (based on the waste characteristics or the parameters that affect performance of the demonstrated treatment technology) than the treated wastes from which performance data are being transferred.

4.1 Nonwastewaters

The Agency does not have performance data available to characterize treatment of K009 and K010 nonwastewaters by incineration; however, it does have data for incineration of a similar waste, K019. (The source of these data is the U.S. EPA Onsite Engineering Report of Treatment Technology Performance and Operation for Rollins Environmental Services (TX) Inc., Deer Park, Texas, March 11, 1988.) According to 40 CFR Part 261.32, K019 is listed as "heavy ends from the distillation of ethylene dichloride in ethylene dichloride production." The similarity of K019 to K009 and K010 is based on the waste compositions, the waste characteristics affecting performance, and the fact that K009 and K010 wastes are also produced from distillation column residuals from producing chlorinated aliphatic hydrocarbons. (See Appendix A for a summary of the waste characteristics affecting performance for constituents of concern in K009 and K010 wastes.)

Consequently, the Agency is transferring performance data from the treatment of K019 to K009 and K010 nonwastewaters. (Nonwastewaters may be K009 and K010 as generated or the residuals from treatment of K009 and K010 wastes, e.g., spent activated carbon from wastewater treatment or biomass from biological treatment.) Performance data were transferred for the treatment of chloroform (the only regulated organic constituent in K009/K010 nonwastewaters). These performance data are presented in Table 4-1 at the end of this section and in Appendix C (Tables C-1 through C-6). Also included from K019 data are (1) matrix spike recovery data for kiln ash residue (Table C-7), (2) accuracy corrected data (Table C-8),

and (3) calculation of Treatment Standards for K019 nonwastewaters (Table C-9). These data were excerpted from the Best Demonstrated Available Technology (BDAT) Background Document for Chlorinated Organics Treatability Group (K016, K018, K019, K020, K030) (USEPA 1988a). Tables C-1 through C-6 present the six data sets of the BDAT list constituents detected in the untreated wastes (K019 and RCRA blend, a combination of oily, solvent water and other industrial organic waste residuals not necessarily a hazardous waste regulated under Subtitle C of RCRA) and treated wastes (rotary kiln ash) from the rotary kiln incineration treatment system. These tables also present design and operating data for each sample set. The testing procedures used to analyze these constituents are specifically identified in the analytical quality assurance/quality control discussion of the BDAT Background Document for Chlorinated Organics Treatability Group (K016, K018, K019, K020, K030).

As mentioned in Section 3, the Agency has determined that recycling is demonstrated for K010 nonwastewaters because one facility currently treats K010 nonwastewater by recycling. The Agency did not propose recycling as BDAT because the facility currently recycling K010 nonwastewater uses a proprietary treatment process.

The levels of chromium (total), mercury, and lead in untreated K009 and K010 wastes were determined to be below treatable levels. As a result, the Agency is not regulating these BDAT list metals. However, the Agency did find copper at treatable concentrations in K009 and K010 wastes. The Agency is not regulating copper in K009 and K010 wastes

because (1) copper is not listed in Appendix VIII of 40 CFR Part 261 as an elemental constituent but rather as a specific compound (i.e., copper cyanide), (2) no other constituent in the K009/K010 hazardous waste of concern in the matrices was associated with copper, and (3) copper cannot serve as an indicator constituent for the treatment of other metal constituents.

4.2 Wastewaters

The Agency has CBI performance data on hydrolysis only, from a facility using hydrolysis followed by biological treatment of K009 and K010 wastewaters. As a result, the Agency is unable to determine the performance of biological treatment on hydrolyzed K009 and K010 wastewater. EPA also has performance data from the Office of Water's (OW's) data base supporting the development of Effluent Limitations Guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) Industries.

The Office of Solid Waste reviewed eight sets* of performance data (for chloroform) from the OW's OCPSF data base for the Best Available Technology (BAT) Option II Toxics (Subcategory One--plants that have or will install biological treatment to comply with the Best Practicable Control Technology (BPT) currently available) for end-of-pipe biological treatment plus in-plant control technologies that treat the constituents prior to discharge to end-of-pipe treatment. The wastewater treatment

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*A data set refers to the data available from individual plants, and each "set" of data has paired influent and effluent data points.

technologies for chloroform for which these data were collected include biological treatment and steam stripping. This is the technology basis that the Office of Water used for establishing the effluent limitations for chloroform for BAT Subcategory One.

These data do not all represent treatment of K009 and K010 wastewaters, but rather treatment of wastewaters that contain constituents that are also present in K009 and K010 wastewaters. The Agency may use data from wastes believed to be similar or wastes that contain the same or similar constituents as a waste of concern in order to develop treatment standards.

The transfer of treatment data is supported by the determination that K009 and K010 wastes generated by the Organic Chemicals Plastics and Synthetic Fibers Industry are applicable to the Chemical Organic Commodity Industry because the constituents present in the wastes treated by the Office of Water are similar to those in K009 and K010 wastes. Also, the Agency concluded that none of the constituents present in K009 and K010 wastes are likely to interfere with or reduce the level of performance achieved for the wastes tested by OW. Therefore, the Agency is transferring performance data from the OW's OCPSF BAT Option II Toxics (Subcategory One) Limitations data base to chloroform, the regulated constituent in K009 and K010 wastewaters.

Table 4-1 Treatment Performance Data (Ash) from the Incineration of K019 Waste

Constituent	Untreated (ppm)	Treated (ppm)
Chloroform	4,600	<2.0
Chloroform	5,800	<2.0
Chloroform	5,000	<2.0
Chloroform	5,300	<2.0
Chloroform	6,000	<2.0
Chloroform	5,600	<2.0
Average concentration	5,383	<2.0

Table 4-2 Treatment Performance Data for Treatment Train Consisting of Steam Stripping Followed by Biological Treatment (Biological Treatment Data Only)

Constituent	Untreated (ppm)	Treated (ppm)
Plant 2631F		
Chloroform	2.71	0.018
Chloroform	3.23	0.015
Chloroform	1.17	0.022
Chloroform	4.24	0.031
Chloroform	4.22	0.042
Chloroform	5.25	0.048
Chloroform	4.69	0.068
Chloroform	1.79	0.014
Chloroform	2.43	0.014
Chloroform	2.07	0.016
Chloroform	2.18	0.015
Chloroform	1.48	<0.010
Average concentration	3.0	0.026

Source: USEPA 1987d.

5. IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for determining best demonstrated available technology (BDAT) for K009 and K010 nonwastewaters and wastewaters.

To determine BDAT, the Agency examines all applicable performance data to determine whether the technologies are demonstrated. Next, EPA determines by using statistical techniques whether one or more of the technologies perform significantly better than the others. All performance data used for determination of best technology must first be adjusted for analytical precision and accuracy, as discussed in EPA's publication Best Demonstrated Available Technology (BDAT) Background Document for Methodology. (An accuracy adjustment assesses the ability of an analytical technique to recover a particular constituent from the waste in a particular test. It is usually done by spiking a sample with a known amount of a target constituent and then comparing the amount recovered with results from unspiked samples.) BDAT must be specifically defined for all streams associated with the management of the listed waste or wastes; this pertains to the original waste as well as any residual waste stream created by the treatment process.

The technology that performs best on a particular waste or waste treatability group is then evaluated to determine whether it is "available." To be available, the technology must (1) be commercially available to any generator and (2) provide "substantial" treatment of the waste as determined through evaluation of adjusted data. In determining

whether treatment is substantial, a demonstrated treatment technology must "substantially diminish the toxicity" of the waste or "substantially reduce the likelihood of migration of hazardous constituents" from the waste in accordance with section 3004(m) of HSWA. Treatment will always be deemed substantial if it results in nondetectable levels of the hazardous constituents of concern in the TCLP extract. EPA will evaluate whether a treatment technology provides substantial treatment on a case-by-case basis when the treatment technology does not achieve nondetectable constituent concentrations in the residual. This approach is necessary because of the difficulty in establishing a meaningful guideline that can be applied broadly to the many wastes and technologies that will be considered. EPA will consider the following factors in an effort to evaluate whether a technology provides substantial treatment on a case-by-case basis:

1. Number and types of constituents treated;
2. Performance (concentration of the constituents in the treatment residuals); and
3. Percent of constituents removed.

If none of the demonstrated treatment technologies achieve substantial treatment of a waste, the Agency cannot establish treatment standards for the constituents of concern in that waste. If the best technology is determined to be not available, then the next best technology is evaluated, and so on.

Nonwastewater forms of K009 and K010 contain more than 1 percent (weight basis) filterable solids and more than 1 percent (weight basis)

total organic carbon. Wastewater forms of K009 and K010 contain less than 1 percent (weight basis) filterable solids and less than 1 percent (weight basis) total organic carbon. BDAT will be defined for all K009 and K010 nonwastewater and wastewater streams for BDAT list organics.

Nonwastewater streams from K009 and K010 include but are not limited to (1) the as-generated waste streams (K010 as generated is typically a nonwastewater), (2) the ash produced by incineration, (3) the scrubber water sludges generated by treatment of the scrubber wastewater, and (4) the nonwastewater generated as biomass by the biological treatment process.

Wastewater streams from K009 and K010 include but are not limited to (1) the as-generated K009 waste stream, (2) the scrubber water from incineration of nonwastewaters, and (3) the wastewater from steam stripping.

5.1 Nonwastewaters

In Section 3 of this document, the Agency identified incineration as a demonstrated technology to be considered BDAT for K009 and K010 nonwastewaters. Consistent with EPA's methodology for determining BDAT, the Agency evaluated the incineration performance data for a similar waste (K019, which the Agency believes is more difficult to treat than K009 and K010) to determine whether this technology would provide statistically significant treatment for BDAT list organic constituents in K009 and K010 wastes. Based on the evaluation of the design and operating parameters of the similar treatment system, the analytical

testing, and the quality of the data, EPA determined that statistically significant treatment occurs. This determination is based on the reduction of BDAT list organic constituents to nondetectable levels in the treatment residuals. In addition to providing substantial reduction, incineration is a widely available commercial technology.

As stated in Section 4, the Agency has performance data for only incineration of K019 waste, which is believed to be similar to K009 and K010 wastes because K019 wastes (chlorinated organics) contain constituents similar to those present in K009 and K010 nonwastewaters. The Agency concludes that incineration is BDAT for K009 and K010 nonwastewaters because it has been demonstrated on a similar waste, K019. Further, the Agency believes that K019 is harder to treat than K009 and K010 wastes because all constituents in K009 and K010 have lower bond energies and lower boiling points than phenanthrene (2900 kcal/mole bond dissociation energy and 340°C boiling point; see Appendix A), a constituent of K019. Phenanthrene was treated to nondetectable levels in K019. (Phenanthrene's concentration in the untreated K019 wastes ranged from 11 to 21 ppm.) Additionally, the Agency believes that none of the constituents in K009 and K010 nonwastewaters are likely to interfere with the treatment provided by incineration of chloroform in K019.

5.2 Wastewaters

In Section 3 of this document, the Agency identified biological treatment in combination with steam stripping and/or carbon adsorption to be demonstrated and available treatment trains because these are the technology treatment trains upon which the Office of Water bases its

Effluent Limitations Guidelines and Standards for wastes similar to K009 and K010 wastes. The treatment train that the Office of Water used to establish the Effluent Limitations Guidelines for chloroform is based on Steam Stripping followed by biological treatment.

The Agency determined that some of the OW performance data used to establish the proposed wastewater treatment standards were not adjusted for analytical spiked recoveries. (These performance data represented the following four separate studies: (1) the OCPSF Verification Study (V) which emphasized data collection that described raw process wastewater and effluents from the principal treatment configurations (i.e., preliminary in-plant treatment and biological treatment for combined plant wastewaters); (2) the Five-Plant Study (F) conducted by EPA with cooperation of the Chemical Manufacturers Association and participating OCPSF plants to assess the effectiveness of biological treatment in removing certain organic priority pollutants; (3) the Twelve-Plant Study (T) conducted by EPA that was designed to provide additional data on certain nonbiological treatment technologies such as steam stripping and activated carbon adsorption; and (4) Public Comment Plants (P) which represent data submitted to EPA from industry comments (USEPAe).) Recovery data were not available for the data set from plant 2631F (Five-Plant Study) used to develop the standard for chloroform in K009 and K010 wastewaters. However, recovery data were available for the treated effluents resulting from the biological treatment at this same plant (i.e., 2631V) in the Verification Study. The Agency therefore borrowed the recovery data for chloroform from plant 2631V and adjusted

the data from plant 2631F that were used to establish the final K009 and K010 standard for chloroform in K009 and K010 wastewaters. Performance data for the data set used for determining the BDAT treatment standards for K009 and K010 wastewaters are presented in Table 4-2 and Appendix B of this Final K009 and K010 background document. The Agency then proceeded to edit the available performance data according to the criteria specified in the Best Demonstrated Available Technology (BDAT) Background Document for Methodology (USEPA 1988c).

Data sets were deleted if the influent concentrations in the OW data were less than the lowest concentration for the constituent's untreated waste concentration in K009 and K010 wastes. Data points in OW's data base with effluent concentrations greater than the corresponding influent concentrations were deleted because the protocols established in the methodology document state that the data used for establishing performance standards must show substantial treatment. The Agency's rationale for consideration and/or deletion of data used for calculation of the BDAT treatment standard for K009 and K010 wastewaters is presented below.

Eight data sets were available from the OW's OCPSF BAT Option II Toxics (Subcategory One) Limitations data base for treatment of chloroform. EPA deleted the data set from plant 2693P because analytical data were not available to adjust the data for analytical precision and accuracy. Influent concentrations from plants 725T, 1609V, and 2631V were below the lowest concentration level (1.4 ppm) for chloroform detected in K009 and K010 untreated waste. Only data sets from plant

725V and 2631F had influent concentrations equal to or above the concentration for chloroform in K009 and K010 untreated waste.

The data set from plant 725V was deleted because it had only two data points with concentrations equal to or above the lowest concentration for chloroform in K009 and K010 untreated wastes as presented in the characterization data for K009 and K010 waste in Tables 2-2 and 2-3 in this final background document. The Agency selected the data set from plant 2631F (with 11 data points above the lowest concentration for chloroform in K009 and K010 untreated waste and 1 data point with an approximate value to the lowest concentration for chloroform in K009 and K010 untreated wastes). The data set from Plant 2631F was therefore selected because the Agency believes that a standard derived from a larger data set is more likely to be statistically correct. The Agency concluded that it was therefore more conservative to use the data set from plant 2631F for calculating the performance standard.

As mentioned in Section 3, EPA identified hydrolysis followed by biological treatment to be a demonstrated and available technology because one facility uses this proprietary technology to treat K009 and K010 wastes. No data were submitted on the biological treatment portion of the facility's treatment system. However, the Agency concluded that hydrolysis alone is not a candidate for BDAT because the effluent wastewaters from hydrolysis have a significant concentration of chloroform as presented in the November 27, 1985, Federal Register, p. 48938, Table 1 (USEPA 1985b). The Agency also has CBI data from Texas Eastman Company

showing the presence of other BDAT list hazardous constituents in K009/K010 wastewaters resulting from hydrolysis treatment of those wastewaters, but Texas Eastman Company claimed that such constituents were a direct result of impurities in the materials used to adjust the pH levels of the untreated K009/K010 wastewaters. The Agency asked the facility treating K009 and K010 waste by hydrolysis to submit treatment data on the use of its hydrolysis process in combination with the other treatment processes at the facility, but the facility did not submit these data. Because these new data were not submitted, EPA was unable to perform a statistical analysis of variance (ANOVA) of the facility's treatment train, comparing it to steam stripping followed by biological treatment. Should these data become available and show statistically better treatment (based on the ANOVA method), the Agency may amend the standard. The Agency is not precluded from amending a promulgated standard after better information is received.

Based on the available information, EPA has determined that treatment of K009 and K010 wastewaters in well-designed and well-operated steam stripping units followed by biological treatment represents BDAT for K009 and K010 wastewaters. The Agency also noted that some data for steam stripping alone support the achievability of the performance level for steam stripping followed by biological treatment (see Table B-3 in Appendix B).

6. SELECTION OF REGULATED CONSTITUENTS

This section presents the rationale for the selection of regulated constituents for the treatment of K009 and K010 wastes.

Constituents selected for regulation must satisfy the following criteria:

1. They must be on the BDAT list of hazardous regulated constituents. This is a growing list of hazardous constituents that does not preclude the addition of new constituents as additional key parameters are identified. The list is divided into the following categories: volatile organics, semivolatile organics, metals, inorganics, organochlorine pesticides, PCBs, and dioxins and furans. The constituents in each category have similar chemical properties and are expected to behave similarly during treatment with the exception of the organics. (Presence on the BDAT list implies the existence of approved techniques for analyzing the constituent in treated waste matrices.)

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

3. Where performance data are transferred from another waste, the selected constituents must be as difficult to treat as the waste constituent(s) for which performance data are transferred. Factors for assessing ease of treatment will vary according to the technology of concern. For example, for incineration the factors include bond dissociation energy, thermal conductivity, and boiling point.

From the group of constituents that are eligible to be regulated, EPA may select a subset of constituents as representative of the broader group. For example, out of a group of constituents that react similarly to treatment, the Agency might name only those that are the most difficult to treat as regulated constituents for the purpose of setting a standard.

6.1 Identification of BDAT List Constituents

As discussed in Sections 2 and 4, the Agency has characterization data for K009 and K010 wastes, as well as the following performance data from the treatment of similar wastes: K019 performance data for the nonwastewater organics and performance data from the Office of Water's data base from the OCPSF industries. Constituents that were not expected to be in the untreated wastes or that could be regulated by regulation of other BDAT list constituents were not considered for regulation.

6.2 Constituents Selected for Regulation

The regulated constituents are selected from among those BDAT list constituents expected to be in the untreated K009 and K010 wastes and for which available data suggest that substantial treatment is provided by incineration for nonwastewaters and by steam stripping followed by biological treatment for wastewaters. These constituents serve as performance indicators that effective treatment is provided to the other BDAT list constituents present in the waste. As a general rule, any BDAT constituent expected to be present in the waste at a concentration above treatable levels would be eligible for selection.

At proposal, the Agency identified methylene chloride and chloroform as candidates for regulation. These two constituents were determined to be present in the untreated waste at treatable concentrations. For instance, chloroform concentrations ranged from 120 to 3,800 ppm in K010 nonwastewater and from 1.4 to 2.8 ppm in K009 wastewaters. Similarly, methylene chloride was detected at CBI ranges in K009 and at CBI ranges in K010 wastes.

Today's rule promulgates concentration based standards for K009 and K010 wastes by regulating chloroform. This is because the Agency determined that regulation of chloroform should ensure that effective treatment is provided to methylene chloride. Because methylene chloride has a lower boiling point and higher vapor pressure than chloroform, the Agency believes that methylene chloride is less difficult to treat than chloroform. As a result, the Agency withdrew the methylene chloride standard.

6.3 Non-BDAT List Constituents

Non-BDAT list (40 CFR Part 261) organic constituents that are expected to be present in K009 and K010 waste at treatable concentrations include acetic acid, acetyl chloride, chloral, chloroacetaldehyde, crotonaldehyde, formaldehyde, formic acid, and paraldehyde. Because currently available EPA methods cannot adequately analyze these constituents at low concentration levels in complex hazardous waste matrices, the constituents are not currently on the BDAT list. However, the Agency considered the following as surrogates or indicators for these non-BDAT list constituents: biological oxygen demand (BOD), chemical oxygen demand (COD), total organic content, total volatile solids, and total organic chlorine content. Because of time constraints, however, the Agency was unable to determine the validity of such gross parameters as surrogates or indicators of the non-BDAT list constituents in K009 and K010 wastes.

The Agency solicited comments on the need for setting additional treatment requirements for the non-BDAT list constituents. The Agency

specifically requested comments on whether the presence of the non-BDAT list constituents would interfere with the efficiency of the treatment of the BDAT list constituents. The Agency received one comment in support of its assumption that the available data do not suggest that these non-BDAT list constituents are likely to interfere with the treatment of the regulated constituents. The Agency does not expect these non-BDAT list constituents to behave differently or to interfere with the treatment of the BDAT list constituents. The Agency has not concluded its studies for identifying analytical methods or alternative gross parameters, but the Agency believes that by regulating the BDAT list constituents, it will have also regulated the non-BDAT list constituents, as explained below.

6.3.1 Nonwastewaters

The treatment standard for K009 and K010 nonwastewaters is based on a transfer of performance data from the incineration of chloroform in K019 nonwastewaters. The Agency expects that the same treatment of these non-BDAT list constituents will be provided by treatment of the BDAT list constituent. Further, EPA does not expect the non-BDAT list constituents to interfere with the treatment of the BDAT list constituents.

6.3.2 Wastewaters

The Agency also believes that, based on their chemical structure and physical properties, and the fact that these wastes are generated from the same production process as the BDAT list constituents, these non-BDAT list constituents are likely to be amenable to the same types of

treatment technologies as those utilized for the BDAT list constituents in K009 and K010 wastewaters (i.e., steam stripping followed by biological treatment). In addition, the Agency expects that these non-BDAT list constituents will be treated as effectively as were the BDAT list constituents. Also, EPA does not expect these non-BDAT list constituents to interfere with the treatment of the BDAT list constituents.

The actual reduction of non-BDAT list hazardous constituents cannot be assessed because the necessary analytical methods are not available. Therefore, EPA intends to maximize the reduction of chloroform, which is a BDAT list constituent for which validated analytical methods are available.

As a result, EPA is not promulgating, at this time, additional requirements for K009 and K010 wastes prior to disposal. However, EPA does reserve the right to develop new standards for these additional constituents as new data become available. At this time the Agency has determined that by regulation of the BDAT list constituents the non-BDAT list constituents will also be regulated.

6.4 Constituents Determined to Be Extraneous to the Manufacture of Acetaldehyde from the Oxidation of Ethylene

The Agency's data characterizing several process wastewaters from the production of acetaldehyde show several BDAT list constituents that the Agency has determined to be extraneous to the manufacturing process of acetaldehyde from the direct oxidation of ethylene. Constituents that were ruled out as candidates for regulation met any of the following criteria: (1) the constituents are not expected to be generated by the

acetaldehyde manufacturing process of concern, (2) the presence of the constituents in some of the K009 and K010 characterization data could be the result of some other influences, such as cross-contamination; and (3) the constituents were not shown in the available characterization data for untreated and treated effluents of K009 and K010 from hydrolysis. Examples of these constituents are acrolein, acrylonitrile, benzene, 1,1-dichloroethane, 2,4-dinitrophenol, ethyl acetate, ethyl methacrylate, and toluene.

The determination of whether the above-mentioned constituents are extraneous to the acetaldehyde manufacturing process is based on a review of (1) all available data for the untreated K009 and K010 waste, (2) technical literature pertaining to the acetaldehyde manufacturing process, and (3) industry comments on K009 and K010 waste characterization received on the proposed rule.

The Agency concluded that all of the aforementioned constituents could be eliminated as potential constituents generated by the manufacturing process of concern for acetaldehyde. The Agency's rationale for this determination is presented below.

Constituents such as benzene and phenol were not expected to be present in K009 and K010 wastes because their vapor pressures are negligible at the temperature at which commercial ethylene (feedstock for production of acetaldehyde) production is purified (-101°C). In addition, nitrated phenols are not expected to be present. Air normally contains approximately 78 percent nitrogen. However, a review of all available process literature reveals that molecular nitrogen plays no

role in the process. There are no other sources of nitrogen atoms available in the process feedstock.

Available literature suggests that these aromatic constituents are unlikely to occur in K009 and K010 wastes because of the vast differences in vapor pressures between ethylene and simple aromatic compounds such as benzene and toluene. Early data suggesting the presence of benzene, toluene, or nitrated or halogenated phenols in K009 and K010 wastes were determined to represent data not from the acetaldehyde manufacturing wastewaters of concern, but originating from other types of acetaldehyde manufacturing wastewaters.

Acrylonitrile can similarly be dismissed as a process-related waste because no amines, cyanides, or other possible sources of a nitrile group are present in the feedstocks used.

The Agency received one comment on the proposed regulation from Texas Eastman Company (one of the two manufacturers of acetaldehyde, from which K009 and K010 are generated). The commenter challenged the Agency's proposed standards for additional suspected extraneous K009 and K010 waste constituents (i.e., acrolein, 1,1-dichloroethane, ethyl acetate, ethyl methacrylate, and methylene chloride). EPA originally proposed treatment standards for these constituents because their presence in some of the K009 and K010 characterization data could be the result of some other influences such as cross-contamination in the field or of the treatment of the wastes. After re-examining the available data, however, the Agency determined that such constituents were likely to be extraneous to the manufacturing process. This is because the majority of these

constituents were identified in the characterization data from the Office of Water representing characterization of process wastewaters from other acetaldehyde manufacturing processes that were not the one of concern. These other wastewaters (manufacturing processes) as well as K009 and K010 wastewaters (acetaldehyde manufacturing process from ethylene) are currently regulated under the Effluent Limitations Guidelines (see Chapter 2.1).

Because today's promulgated standards apply only to those constituents identified in wastes resulting from the manufacturing of acetaldehyde from the direct oxidation of ethylene, the Agency revised the proposed standards. These revisions resulted in EPA's withdrawal of the standards proposed for acrolein, 1,1-dichloroethane, and ethyl methacrylate in the final rule. Although no standard was proposed for ethyl acetate, the Agency notes its findings that ethyl acetate was present in other wastewaters that were not the one of concern.

7. DEVELOPMENT OF BDAT TREATMENT STANDARDS

The Agency bases treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available performance data and must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures.

BDAT standards are determined for each constituent by multiplying the arithmetic mean of analytical precision and accuracy-adjusted constituent concentrations detected in treated waste by a "variability factor" specific to each treatment technology defined as BDAT. Adjustment of performance data for analytical precision and accuracy was discussed in Section 5. Variability factors adjust for normal variations in the performance of a particular technology over time. These two adjustments are designed to reflect the 99th percentile level of performance that the technology achieves in commercial operation. (For more information on the principles of calculating variability factors, see EPA's publication Methodology for Developing Best Demonstrated Available Technology (BDAT) Treatment Standards (USEPA 1989c).

Where EPA has identified BDAT for a particular waste, but because of data limitations or for some other compelling reason cannot define specific treatment standards for that waste, the Agency instead can require the use of that treatment process as a technology standard. Similarly, where there are no known generators of a waste, or where EPA

believes that the waste can be totally recycled or reused as a raw material, the Agency may specify a "no land disposal" standard, which effectively amounts to setting the performance standard at zero for all waste constituents.

In the case of K009 and K010 wastes, the Agency is setting a treatment standard for chloroform as shown on Table 7-3.

7.1 Nonwastewaters

Treatment performance data for incineration of K009 and K010 nonwastewaters are not available to the Agency. Therefore, the Agency's rationale for establishing a standard for the only regulated nonwastewater constituent (i.e., chloroform) is based on performance data from incineration of K019 wastes. For the regulated organic constituent in K009 and K010 nonwastewaters, EPA used performance data for chloroform multiplied by a variability factor of 2.8. EPA is using a variability factor of 2.8 for the volatile (i.e., chloroform) treatment standard calculations because the effluent concentration of chloroform is less than its detection limit. The variability factor accounts for variations in technology performance and waste characteristics. The treatment standard calculation for chloroform is shown on Table 7-1.

7.2 Wastewaters

Treatment performance data for K009 and K010 wastewaters are not available to the Agency; therefore, EPA is establishing a standard for the only regulated constituent (i.e., chloroform) in K009 and K010

wastewaters based on treatment performance data from EPA's Office of Water, for which the Effluent Limitations Guidelines (ELGs) have been established for the Organic Chemicals, Plastics, and Synthetic Fibers Industry and are applicable to the Chemical Organic Commodity Industry. OW performance data are based on end-of-pipe biological treatment plus in-plant control technologies. The Agency wishes to point out that the OCPSF performance data are based on composite samples rather than the usual BDAT program methodology, which stipulates the use of grab samples for establishing performance standards. Standards derived from grab samples are statistically corrected to reflect the 99th percentile, and the Agency believes that the corrected OCPSF performance data are equivalent to corrected grab samples data. The Agency has therefore decided to promulgate the chloroform wastewater standard from these composite data, noting that the standard is based on composite data. The in-plant technologies for organic constituents include biological treatment, steam stripping, carbon adsorption, or any combination of these technologies. For the K009 and K010 wastewaters chloroform standard, EPA obtained the Summary of Analytical Data for the ELGs for Verification plants, which provided the recovery values. The Agency was therefore able to correct the chloroform data from the Option II Toxics (Subcategory One) Limitations data base. These data were multiplied by a variability factor that was determined by a statistical analysis of the various effluent concentrations. (After the OW treated data were

corrected for accuracy and precision, consequently, the variability factor increased from 3.34 to 3.59.) The variability factor accounts for variations in technology performance and waste characteristics and variations in the analytical instruments. The chloroform treatment standard calculation for K009 and K010 wastewaters is shown on Table 7-2.

Table 7-1. Calculation of Nonwastewater Treatment Standard for K009 and K010 Wastes

Regulated constituent	Average concentration in treated waste (ppm)	Analytical recovery correction factor	Corrected value (ppm)	Variability factor[a]	Treatment standard (ppm)
Chloroform	<2	1.06	2.13	2.8	6.0

[a] Variability factor of 2.8 is used when all samples are below the detection limit for the constituent.

Table 7-2. Calculation of Wastewater Treatment Standard for K009 and K010 Wastes

Regulated constituent	Average concentrations in treated waste (ppm) (plant 2631F)	Analytical recovery correction factor	Average corrected[a] value (ppm)	Variability factor[a]	Treatment standard (ppm)
Chloroform	0.026	1.05	0.028	3.59	0.10

[a] Effluent values were adjusted by applying the percent recovery value for chloroform (95 percent) from plant 2631V. Recovery value was taken from the Summary of Analytical Data to Support BAT Guidelines/Documentation of Analytical Method Priority Pollutant Removal by Treatment Systems. (Recovery data were available only for data from the Verification study (V plants).)

Table 7-3 BDAT Treatment Standard for K009 and K010

Nonwastewaters

Constituent	Maximum for any single grab sample	
	Total composition (mg/kg)	TCLP (mg/l)
Chloroform	6.0	Not Applicable

Wastewaters

Constituent	Based on composite samples
	Total composition (mg/l)
Chloroform	0.10

2788g

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APPENDIX A

Waste Characteristics Affecting Performance

List of Boiling Points and Bond Dissociation Energies for Constituents of Concern in K009 and K010 Wastes

APPENDIX A

Constituent	Bond dissociation energy (kcal/mole)	Reference	Boiling point (°C)	Reference
BDAT Constituent				
Acrolein	805	1,2,3	52.5-53.5	1
Acrylonitrile	860	1,2,3	77.5-79	1
Benzene	1335	1,2,3	80.1	1
Chloroform	350	1,2,3	61-61.2	1
1,1-Dichloroethane	645	1,2,3	57-57.3	1
1,2-Dichloroethane	645	1,2,3	83-84	1
2,4-Dinitrophenol	1530	1,2,3	209	1
Ethyl acetate	1305	1,2,3	76-77	1
Ethyl methacrylate	1735	1,2,3	118-119	1
Methyl chloride	380	1,2,3	-24	1
Methylene chloride	360	1,2,3	39.8-40	1
Napthalene	2095	1,2,3	217.9-218	1
Pentachlorophenol	1410	1,2,3	309	1
Phenanthrene[a]	2900	1,2,3	340	1
Toluene	1410	1,2,3	309	1
Non-BDAT Constituent				
Acetaldehyde	660	1,2,3	20.8	1
Acetic acid	755	1,2,3	117.9	1
Acetyl chloride	640	1,2,3	50.9	1
Chloral	600	1,2,3	97.8	1
Chloroacetaldehyde	640	1,2,3	157	1
Crotonaldehyde	1090	1,2,3	104-105	1
Dichloroacetaldehyde	620	1,2,3	90-91	1
Formaldehyde	375	1,2,3	-21	1
Paraldehyde	1935	1,2,3	128	1

[a]Phenanthrene is present in K019 waste with a higher bond dissociation energy and higher boiling point than those of any of the constituents present or suspected to be present in K009 and K010 wastes.

Sources:

1 - CRC Handbook of Chemistry and Physics, 65th Edition.
2 - Sanderson, R.T. Chemical Bonds and Bond Energy
3 - Lange's Handbook of Chemistry

APPENDIX B

Performance Data Base (for Chloroform): From the
Office of Water BAT Option II
Toxics (Subcategory One and Two)
Limitations Data Base
and
Recovery data for Chloroform from the
Summary of Analytical Data from OW

Table B-1

LISTING OF EDITED DAT OPTION II FOR1CS
(SUBCATEGORY ONE) LIMITATIONS DATA BASE
PLANTS WITH T SUFFIX DENOTE PLANTS FROM 12-PLANT STUDY
PLANTS WITH F SUFFIX DENOTE PLANTS FROM 5-PLANT STUDY
PLANTS WITH V SUFFIX DENOTE PLANTS FROM VERIFICATION STUDY
PLANTS WITH P SUFFIX DENOTE PLANTS FROM PUBLIC COMMENTS
AND SUPPLEMENTAL QUESTIONNAIRE
SORTED BY POLLUTANT NUMBER

---------- POLLUTANT NUMBER =23 PLANT =415T ----------

OBS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
851	CHLOROFORM	.	ND	EC-I	11/29/83	.	ND	S2-A	10
852	CHLOROFORM	.	ND	EC-I	11/30/83	.	ND	S2-A	10
853	CHLOROFORM	84		EC-I	12/01/83	.	ND	S2-A	10
854	CHLOROFORM	22		EC-I	12/02/83	29		S2-A	10
855	CHLOROFORM	20		EC-I	12/03/83	.	ND	S2-A	10
856	CHLOROFORM	135		EC-I	12/04/83	19		S2-A	10
857	CHLOROFORM	.	ND	EC-I	12/05/83	31		S2-A	10
858	CHLOROFORM	10		EC-I	12/06/83	22		S2-A	10
859	CHLOROFORM	573		EC-I	12/07/83	20		S2-A	10
860	CHLOROFORM	29		EC-I	12/08/83	86		S2-A	10
861	CHLOROFORM	12		EC-I	12/11/83	47		S2-A	10
862	CHLOROFORM	21		EC-I	12/12/83	37		S2-A	10
863	CHLOROFORM	.	ND	EC-I	12/13/83	10		S2-A	10
864	CHLOROFORM	14		EC-I	12/14/83	11		S2-A	10
865	CHLOROFORM	.	ND	EC-I	12/15/83	11		S2-A	10

---------- POLLUTANT NUMBER =23 PLANT =695V ----------

OBS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
866	CHLOROFORM	.			12/04/78	.	ND	EFF	10
867	CHLOROFORM	.			12/05/78	.	ND	EFF	10
868	CHLOROFORM	.			12/06/78	.	ND	EFF	10

---------- POLLUTANT NUMBER =23 PLANT =725T ----------

OBS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
869	CHLOROFORM	79		PCI	05/22/83	.	ND	SCF	10
870	CHLOROFORM	121		PCI	05/23/83	.	ND	SCF	10
871	CHLOROFORM	155		PCI	05/24/83	.	ND	SCF	10
872	CHLOROFORM	171		PCI	05/25/83	.	ND	SCF	10
873	CHLOROFORM	166		PCI	05/26/83	.	ND	SCF	10
874	CHLOROFORM	193		PCI	05/29/83	.	ND	SCF	10
875	CHLOROFORM	303		PCI	05/30/83	.	ND	SCF	10
876	CHLOROFORM	304		PCI	05/31/83	.	ND	SCF	10

1090V AND =1090V ARE TWO DIFFERENT TREATMENT SYSTEMS
FROM THE SAME PLANT

Table B-1 (continued)

LISTING OF EDITED DAT OPTION II TOXICS
(SUBCATEGORY ONE) LIMITATIONS DATA BASE
PLANTS WITH T SUFFIX DENOTE PLANTS FROM 12-PLANT STUDY
PLANTS WITH F SUFFIX DENOTE PLANTS FROM 5-PLANT STUDY
PLANTS WITH V SUFFIX DENOTE PLANTS FROM VERIFICATION STUDY
PLANTS WITH P SUFFIX DENOTE PLANTS FROM PUBLIC COMMENTS
AND SUPPLEMENTAL QUESTIONNAIRE
SORTED BY POLLUTANT NUMBER

POLLUTANT NUMBER =23 PLANT =725T

DOS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
877	CHLOROFORM	232		PCI	06/01/83	.	ND	SCF	10
878	CHLOROFORM	349		PCI	06/02/83	.	ND	SCF	10
879	CHLOROFORM	373		PCI	06/05/83	.	ND	SCF	10
880	CHLOROFORM	302		PCI	06/06/83	.	ND	SCF	10
881	CHLOROFORM	247		PCI	06/07/83	.	ND	SCF	10
882	CHLOROFORM	375		PCI	06/09/83	.	ND	SCF	10

POLLUTANT NUMBER =23 PLANT =725V

DOS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
883	CHLOROFORM	1029		INF	01/28/80	.	ND	EFF	10
884	CHLOROFORM	1500		INF	01/29/80	.	ND	EFF	10
885	CHLOROFORM	2650		INF	01/30/80		ND	EFF	10

POLLUTANT NUMBER =23 PLANT =1609V

DOS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
886	CHLOROFORM	217		INF	09/11/78	.	ND	EFF	10
887	CHLOROFORM	870		INF	09/12/78	.	ND	EFF	10
888	CHLOROFORM	248		INF	09/13/78	.	ND	EFF	10

1090V AND =1090V ARE TWO DIFFERENT TREATMENT SYSTEMS
FROM THE SAME PLANT

Table B-1 (continued)

LISTING OF CODED DAT OPTIONS II TOXICS
ISMCATEGORY (NEW) LIMITATIONS DATA BASE
PLANTS WITH T SUFFIX DENOTE PLANTS FROM 12-PLANT STUDY
PLANTS WITH F SUFFIX DENOTE PLANTS FROM 5-PLANT STUDY
PLANTS WITH V SUFFIX DENOTE PLANTS FROM VERIFICATION STUDY
PLANTS WITH P SUFFIX DENOTE PLANTS FROM PUBLIC COMMENTS
AND SUPPLEMENTAL INFORMATION
SORTED BY POLLUTANT NUMBER

POLLUTANT NUMBER =23 PLANT =2631F

085	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
889	CHLOROFORM	46		INF	06/02/80	.	ND	EFF	10
890	CHLOROFORM	49		INF	06/03/80	.	ND	EFF	10
891	CHLOROFORM	2705		INF	06/04/80	18		EFF	10
892	CHLOROFORM	494		INF	06/05/80	22		EFF	10
893	CHLOROFORM	942		INF	06/09/80	19		EFF	10
894	CHLOROFORM	3227		INF	06/10/80	15		EFF	10
895	CHLOROFORM	1169		INF	06/11/80	22		EFF	10
896	CHLOROFORM	105		INF	06/12/80	.	ND	EFF	10
897	CHLOROFORM	4238		INF	06/16/80	31		EFF	10
898	CHLOROFORM	4215		INF	06/17/80	42		EFF	10
899	CHLOROFORM	5250		INF	06/18/80	48		EFF	10
900	CHLOROFORM	4685		INF	06/19/80	68		EFF	10
901	CHLOROFORM	1790		INF	06/23/80	14		EFF	10
902	CHLOROFORM	2430		INF	06/24/80	14		EFF	10
903	CHLOROFORM	2070		INF	06/25/80	16		EFF	10
904	CHLOROFORM	2164		INF	06/26/80	15		EFF	10
905	CHLOROFORM	1460		INF	06/30/80	.	ND	EFF	10
906	CHLOROFORM	681		INF	07/01/80	.	ND	EFF	10
907	CHLOROFORM	302		INF	07/02/80	.	ND	EFF	10
908	CHLOROFORM	542		INF	07/03/80	18		EFF	10
909	CHLOROFORM	400		INF	07/07/80	14		EFF	10
910	CHLOROFORM	123		INF	07/08/80	.	ND	EFF	10
911	CHLOROFORM	162		INF	07/09/80	.	ND	EFF	10
912	CHLOROFORM	165		INF	07/10/80	.	ND	EFF	10

POLLUTANT NUMBER =23 PLANT =2631V

085	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
913	CHLOROFORM	552		INF	01/16/79	.	ND	EFF	10
914	CHLOROFORM	1000		INF	01/17/79	26		EFF	10
915	CHLOROFORM	730		INF	01/18/79	12		EFF	10

1090V AND =1090V ARE TWO DIFFERENT TREATMENT SYSTEMS
FROM THE SAME PLANT

Table B-1 (continued)

LISTING OF EDITED DAT OPTION II TOXICS
(SUBCATEGORY ONE) LIMITATIONS DATA BASE
PLANTS WITH T SUFFIX DENOTE PLANTS FROM 12-PLANT STUDY
PLANTS WITH F SUFFIX DENOTE PLANTS FROM 5-PLANT STUDY
PLANTS WITH V SUFFIX DENOTE PLANTS FROM VERIFICATION STUDY
PLANTS WITH P SUFFIX DENOTE PLANTS FROM PUBLIC COMMENTS
AND SUPPLEMENTAL QUESTIONNAIRE
SORTED BY POLLUTANT NUMBER

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POLLUTANT NUMBER =23 PLANT =2693P

085	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (ND)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
916	CHLOROFORM	.			03/07/83	20		EE11A	10
917	CHLOROFORM	.			03/13/83	23		EE11A	10
918	CHLOROFORM	.			03/21/83	61		EE11A	10
919	CHLOROFORM	.			03/27/83	68		EE11A	10

1090V AND =1090V ARE TWO DIFFERENT TREATMENT SYSTEMS FROM THE SAME PLANT

TABLE B-2

SUMMARY OF ANALYTICAL DATA TO SUPPORT BAT GUIDELINES
DOCUMENTATION OF ANALYTICAL METHOD
PRIORITY POLLUTANT REMOVAL BY TREATMENT SYSTEMS
(CONCENTRATION (UG/L)

FRIDAY, JUNE 17, 1983

PLANT=3380-010

POLNUM	SAMPNT	SAMDATE	SAMNUM	LAB	ANAL	METHOD	CONFIRM	TYPE	HOLDNT	CONC	NOTE	SPLVL	SPCONC	%REC	REPSAM
15	INF	01/16/79	33131	15	GC	8-2		E111		ND	<10	200	200	100	P
15	INF	01/16/79	33131	8	GC	8-2		E111		1100		.	.	.	P
15	INF	01/17/79	33132	15	GC	8-2		E111		10		.	.	.	P
15	INF	01/18/79	33133	15	GC	8-2		E111		ND	<10	.	.	.	P
15	EFF	01/16/79	33121	15	GC	8-2	5	E111		ND	<10	40	50	125	P
15	EFF	01/16/79	33121	15	GC	8-2		E211		ND	<10	.	.	.	P
15	EFF	01/17/79	33122	4	GCMS	SCRPR		E111		ND	<10	.	.	.	P
15	EFF	01/17/79	33122	8	GCMS	SCRPR		E111		ND	<1	.	.	.	P
15	EFF	01/17/79	33122	8	GC	8-2		E111		150		.	.	.	P
15	EFF	01/18/79	33123	15	GC	8-2		E111		18		.	.	.	P
POLLUTANT : CHLOROETHANE															
16	INF	01/16/79	33131	4	GCMS	SCRPR	0	E111		ND	<10	.	.	.	P
16	INF	01/16/79	33131	8	GCMS	SCRPR	0	E111		ND	<10	.	.	.	P
16	INF	01/16/79	33131	15	GC	8-2		E211		110		.	.	.	P
16	INF	01/16/79	33131	15	GC	8-2		E111		27		390	490	119	P
16	INF	01/16/79	33131	8	GC	8-2		E111		ND	<80	.	.	.	P
16	INF	01/17/79	33132	15	GC	8-2		E111		14		.	.	.	P
16	INF	01/18/79	33133	15	GC	8-2		E111		340		.	.	.	P
16	EFF	01/16/79	33121	15	GC	8-2		E111		ND	<10	77	75	97	P
16	EFF	01/16/79	33121	15	GC	8-2		E211		ND	<10	.	.	.	P
16	EFF	01/17/79	33122	4	GCMS	SCRPR	0	E111		ND	<10	.	.	.	P
16	EFF	01/17/79	33122	8	GCMS	SCRPR	0	E111		ND	<1	.	.	.	P
16	EFF	01/17/79	33122	8	GC	8-2		E111		ND	<5	.	.	.	P
16	EFF	01/18/79	33123	15	GC	8-2		E111		ND	<10	.	.	.	P
POLLUTANT : CHLOROFORM															
23	INF	01/16/79	33131	4	GCMS	SCRPR	0	E111		180		.	.	.	P
23	INF	01/16/79	33131	8	GCMS	SCRPR	0	E111		630		.	.	.	P
23	INF	01/16/79	33131	15	GC	8-2		E211		780		.	.	.	P
23	INF	01/16/79	33131	15	GC	8-2		E111		970		200	1100	65	P
23	INF	01/16/79	33131	8	GC	8-2		E111		730		.	.	.	P
23	INF	01/17/79	33132	15	GC	8-2		E111		1000		.	.	.	P
23	INF	01/18/79	33133	15	GC	8-2		E111		730		.	.	.	P
23	EFF	01/16/79	33121	15	GC	8-2	5	E111		ND	<10	40	38	95	P
23	EFF	01/16/79	33121	15	GC	8-2		E211		ND	<10	.	.	.	P
23	EFF	01/17/79	33122	4	GCMS	SCRPR	0	E111		40		.	.	.	P
23	EFF	01/17/79	33122	8	GCMS	SCRPR	0	E111		11		.	.	.	P
23	EFF	01/17/79	33122	8	GC	8-2		E111		14		.	.	.	P
23	EFF	01/18/79	33123	15	GC	8-2		E111		12		.	.	.	P
POLLUTANT : 1,1-DICHLOROETHYLENE															
29	INF	01/16/79	33131	4	GCMS	SCRPR		E111		ND	<10	.	.	.	P
29	INF	01/16/79	33131	8	GCMS	SCRPR		E111		ND	<10	.	.	.	P
29	INF	01/16/79	33131	15	GC	8-2		E211		330		.	.	.	P

Table B-3

LISTING OF EDITED STEAM STRIPPER LIMITATIONS DATA BASE
(SUBCATEGORY TWO)
PLANTS WITH T SUFFIX DENOTE PLANTS FROM 12-PLANT STUDY
PLANTS WITH P SUFFIX DENOTE PLANTS FROM PUBLIC COMMENTS
AND SUPPLEMENTAL QUESTIONNAIRE
SORTED BY POLLUTANT NUMBER

---------- POLLUTANT NUMBER=23 PLANT=415T EFFLUENT SAMPLING SITE=SSE ----------

OBS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (PPB)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
146	CHLOROFORM	370000		SSI	11/29/83	.	ND	SSE	10
147	CHLOROFORM	340000		SSI	11/30/83	.	ND	SSE	10
148	CHLOROFORM	48000		SSI	12/01/83	.	ND	SSE	10
149	CHLOROFORM	7330		SSI	12/02/83	.	ND	SSE	10
150	CHLOROFORM	85000		SSI	12/03/83	.	ND	SSE	10
151	CHLOROFORM	157698		SSI	12/04/83	.	ND	SSE	10
152	CHLOROFORM	749360		SSI	12/05/83	11		SSE	10
153	CHLOROFORM	818000		SSI	12/06/83	.	ND	SSE	10
154	CHLOROFORM	723560		SSI	12/07/83	.	ND	SSE	10
155	CHLOROFORM	760990		SSI	12/08/83	.	ND	SSE	10
156	CHLOROFORM	232000		SSI	12/11/83	.	ND	SSE	10
157	CHLOROFORM	147000		SSI	12/12/83	.	ND	SSE	10
158	CHLOROFORM	12000		SSI	12/13/83	.	ND	SSE	10
159	CHLOROFORM	1000000		SSI	12/14/83	.	ND	SSE	10
160	CHLOROFORM	400000		SSI	12/15/83	16		SSE	10

---------- POLLUTANT NUMBER=23 PLANT=913P EFFLUENT SAMPLING SITE=EC5B ----------

OBS	POLLUTANT NAME	INFLUENT CONCENTRATION (PPB)	INFLUENT BELOW MINIMUM LEVEL (ND)	INFLUENT SAMPLING SITE	SAMPLING DATE	EFFLUENT CONCENTRATION (PPB)	EFFLUENT BELOW MINIMUM LEVEL (PPB)	EFFLUENT SAMPLING SITE	MINIMUM LEVEL (PPB)
161	CHLOROFORM	.			08/12/85	43		EC5B	10
162	CHLOROFORM	.			08/13/85	11		EC5B	10
163	CHLOROFORM	.			08/14/85	.	ND	EC5B	10
164	CHLOROFORM	83300		IC5AB	08/19/85	156		EC5B	10
165	CHLOROFORM	.			08/20/85	11		EC5B	10
166	CHLOROFORM	.			08/29/85	166		EC5B	10
167	CHLOROFORM	.			08/30/85	209		EC5B	10
168	CHLOROFORM	.			09/16/85	290		EC5B	10
169	CHLOROFORM	.			09/17/85	68		EC5B	10
170	CHLOROFORM	109000		IC5AB	09/18/85	92		EC5B	10
171	CHLOROFORM	.			09/19/85	93		EC5B	10
172	CHLOROFORM	.			09/20/85	289		EC5B	10
173	CHLOROFORM	.			09/25/85	181		EC5B	10
174	CHLOROFORM	.			10/09/85	190		EC5B	10

APPENDIX C

Performance Data Base: From the Incineration of K019 Waste for Treated Nonwastewater (Ash)

Table C-1

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,000	<8	<2
9. Chlorobenzene	3,000	<8	<2
14. Chloroform	4,600	<8	<2
22. 1,1-Dichloroethane	2,200	<8	<2
23. 1,2-Dichloroethane	93,000	<8	<2
34. Methyl ethyl ketone	<1,000	940	<10
38. Methylene chloride	<1,000	910	<10
42. Tetrachloroethene	7,300	490	<2
43. Toluene	<200	2,300	<2
45. 1,1,1-Trichloroethane	81,000	130	<2
47. Trichloroethene	3,210	360	<2
215-217. Xylene (total)	<200	3,400	<2
222. Acetone	<1,000	1,200	<10
226. Ethyl benzene	<200	2,200	<2
229. Methyl isobutyl ketone	<1,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	280	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	81	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	20	53	<2
110. Hexachlorobenzene	69	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-1 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	120	<100	<10	
121. Naphthalene	470	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	61	<100	<10	
141. Phenanthrene	21	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	76	<50	<5	
150. 1,2,4-Trichlorobenzene	100	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	8.0	<0.060
155. Arsenic	1.2	94	3.6	<0.002
156. Barium	0.97	1.3	26	0.033
158. Cadmium	0.63	<0.3	0.66	<0.003
159. Chromium	4.0	40	44	0.200
160. Copper	2.1	165	2,370	2.690
161. Lead	3.4	27	120	0.380
163. Nickel	3.0	8.8	66	0.680
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	4.1	<0.020
168. Zinc	5.8	4,170	12	0.052
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	38	
171. Sulfide	790	830	68	

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-1 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)+	*	1825-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 13.1 RCRA Blend, Waste Burner #1: 3.9-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-2

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,800	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,800	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	96,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,700	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	33,000	130	<2
47. Trichloroethene	2,400	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	280	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	74	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	16	53	<2
110. Hexachlorobenzene	60	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-2 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	85	<100	<10	
121. Naphthalene	314	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	51	<100	<10	
141. Phenanthrene	15	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	62	<50	<5	
150. 1,2,4-Trichlorobenzene	65	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	6.8	<0.060
155. Arsenic	<0.2	94	2.8	<0.002
156. Barium	<0.9	1.3	23	0.036
158. Cadmium	0.46	<0.3	0.96	0.004
159. Chromium	3.4	40	60	0.130
160. Copper	1.7	165	3,430	2.380
161. Lead	2.3	27	42	0.260
163. Nickel	3.6	8.8	89	0.560
165. Silver	<0.9	<0.9	3.4	<0.009
167. Vanadium	<2.0	2.2	4.8	<0.020
168. Zinc	6.9	4,170	13	0.071
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	5.1	
171. Sulfide	NA	830	<50	

NA Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-2 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)+	*	1800-1880
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 12.2 RCRA Blend, Waste Burner #1: 5.2-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,500	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	87,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,000	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	34,000	130	<2
47. Trichloroethene	2,200	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	290	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	80	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	73	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-3 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Ash Concentration	Kiln Ash TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	95	<100	<10	
121. Naphthalene	350	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	59	<100	<10	
141. Phenanthrene	11	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	67	<50	5	
150. 1,2,4-Trichlorobenzene	70	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.2	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	54	0.057
158. Cadmium	0.53	<0.3	3.6	0.005
159. Chromium	3.5	40	202	0.260
160. Copper	1.7	165	2,290	7.030
161. Lead	3.4	27	118	0.620
163. Nickel	2.3	8.8	169	0.960
165. Silver	<0.9	<0.9	1.9	<0.009
167. Vanadium	<2.0	2.2	6.0	<0.020
168. Zinc	4.4	4,170	16	0.170
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	6.1	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-3 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)+	*	1850-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 12.4 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 4.4-8.4
Kiln Rotational Speed (RPM)	*	0.19-0.21

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-4

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,900	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,300	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	122,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,200	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	44,000	130	<2
47. Trichloroethene	2,300	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	310	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	12
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	84	32	<2
98. Di-n-butyl phthalate	<10	31	230
108. Fluoranthene	<10	120	<2
109. Fluorene	21	53	<2
110. Hexachlorobenzene	61	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-4 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	94	<100	<10	
121. Naphthalene	360	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	64	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	82	<50	<5	
150. 1,2,4-Trichlorobenzene	74	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	<6.0	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	8.4	0.036
158. Cadmium	<0.3	<0.3	<0.3	0.005
159. Chromium	1.8	40	28	0.110
160. Copper	<1.0	165	1,270	1.940
161. Lead	2.4	27	25	0.320
163. Nickel	2.2	8.8	69	0.870
165. Silver	<0.9	<0.9	2.6	<0.009
167. Vanadium	<2.0	2.2	<2.0	<0.020
168. Zinc	9.4	4,170	11	0.056
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	3.2	
171. Sulfide	NA	830	<50	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-4 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)+	*	1775-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 12.7 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 4.4-7.3
Kiln Rotational Speed (RPM)	*	0.19-0.21

+ Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,000	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	6,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	130,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,800	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	45,000	130	<2
47. Trichloroethene	2,500	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	340	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	87	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-5 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Ash Concentration	Kiln Ash TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	113	<100	<10	
121. Naphthalene	371	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	63	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	73	<50	<5	
150. 1,2,4-Trichlorobenzene	72	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.1	<0.060
155. Arsenic	<0.2	94	3.9	<0.002
156. Barium	<0.9	1.3	21	0.054
158. Cadmium	0.36	<0.3	1.2	0.006
159. Chromium	3.2	40	125	0.210
160. Copper	2.1	165	2,780	2.140
161. Lead	2.5	27	86	0.290
163. Nickel	4.8	8.8	166	1.270
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	5.7	<0.020
168. Zinc	4.7	4,170	22	0.086
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	23	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-5 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)+	*	1775-1800
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 11.7 RCRA Blend, Waste Burner #1: 5.5-6.0 RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,100	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,600	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	98,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,900	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	44,000	130	<2
47. Trichloroethene	2,500	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenapthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	330	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	22	53	<2
110. Hexachlorobenzene	66	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-6 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Ash Concentration	Kiln Ash TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	88	<100	<10	
121. Naphthalene	390	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	65	<100	<10	
141. Phenanthrene	17	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	86	<50	<5	
150. 1,2,4-Trichloroenzene	79	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.6	< 0.06
155. Arsenic	<0.2	94	2.3	<0.002
156. Barium	<0.9	1.3	11	0.027
158. Cadmium	0.62	<0.3	2.2	0.006
159. Chromium	5.3	40	141	0.092
160. Copper	3.6	165	2,520	2.400
161. Lead	3.5	27	34	0.270
163. Nickel	6.0	8.8	288	0.690
165. Silver	<0.9	<0.9	3.1	<0.009
167. Vanadium	<2.0	2.2	8.7	<0.020
168. Zinc	8.4	4,170	13	0.061
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	4.7	
171. Sulfide	NA	830	92	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table C-6 (continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)+	*	1775-1850
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 11.5 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table C-7

MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUE

Spike Constituent	Original Amount Found (ppb)	Sample Result: Amount Spiked (ppb)	Sample Result: Amount Recovered (ppb)	Sample Result: Percent* Recovery (%)	Duplicate Sample Result: Amount Spiked (ppb)	Duplicate Sample Result: Amount Recovered (ppb)	Duplicate Sample Result: Percent* Recovery %
VOLATILES							
4. Benzene	<2	25	22.6	90	25	21.2	85
7. Carbon Tetrachloride	**						
9. Chlorobenzene	<2	25	24.8	99	25	25	100
14. Chloroform	**						
22. 1,1-Dichloroethane	**						
23. 1,2-Dichloroethane	**						
24. 1,1-Dichloroethylene	<2	25	21.2	85	25	19.4	78
42. Tetrachloroethene	**						
43. Toluene	**						
45. 1,1,1-Trichloroethane	**						

*Percent recovery = 100 x $(C_1 - C_0)/C_t$, where C_1 = amount recovered, C_0 = original amount found, and C_t = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 94% from the duplicate sample result.

Table C-8

CORRECTED TOTAL CONCENTRATION DATA
FOR ORGANICS IN ROTARY KILN INCINERATOR ASH FROM TREATMENT OF K019

Constituent*	Corrected Concentrations** in the Treated Waste, ppm					
	1	2	3	4	5	6
Volatiles						
9. Chlorobenzene	2.02	2.02	2.02	2.02	2.02	2.02
14. Chloroform	2.13	2.13	2.13	2.13	2.13	2.13
22. 1,1-Dichloroethane	2.13	2.13	2.13	2.13	2.13	2.13
23. 1,2-Dichloroethane	2.13	2.13	2.13	2.13	2.13	2.13
42. Tetrachloroethene	2.13	2.13	2.13	2.13	2.13	2.13
45. 1,1,1-Trichloroethane	2.13	2.13	2.13	2.13	2.13	2.13
Semivolatiles						
68. Bis(2-chloroethyl)ether	2.00	2.00	2.00	2.00	2.00	2.00
110. Hexachlorobenzene	10	10	10	10	10	10
113. Hexachloroethane	10	10	10	10	10	10
121. Naphthalene	2.00	2.00	2.00	2.00	2.00	2.00
136. Pentachlorobenzene	10	10	10	10	10	10
141. Phenanthrene	2.00	2.00	2.00	2.00	2.00	2.00
148. 1,2,4,5-Tetrachlorobenzene	5.00	5.00	5.00	5.00	5.00	5.00
150. 1,2,4-Trichlorobenzene	6.67	6.67	6.67	6.67	6.67	6.67

*Constituents present in untreated K019.

**Constituent concentrations have been adjusted to account for analytical recoveries ("corrected") as discussed in Section 5.0.