ECONOMICS BACKGROUND DOCUMENT

USEPA FINAL RULE
LISTING CERTAIN INDUSTRIAL WASTEWATER SLUDGES
GENERATED BY CHLORINATED ALIPHATIC CHEMICAL
MANUFACTURING FACILITIES,
AS RCRA HAZARDOUS WASTECODES K174 & K175:

INDUSTRY PROFILE AND ESTIMATION OF REGULATORY COSTS

Prepared by:

US ENVIRONMENTAL PROTECTION AGENCY
Office of Solid Waste
Economics, Methods and Risk Assessment Division
1200 Pennsylvania Avenue, NW (Mailstop 5307W)
Washington, DC 20460 USA

Phone: 703-308-8615
Fax: 703-308-0509
http://www.epa.gov/osw

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PREFACE

This final rule "*Economics Background Document*" was prepared by Mark Eads, Economist, of the Economics, Methods and Risk Analysis Division (EMRAD), of the Office of Solid Waste (OSW), US Environmental Protection Agency (USEPA). This background document presents the findings of an economic study in support of the USEPA-OSW's final RCRA listing rule, which lists certain types of industrial process wastes generated by chlorinated aliphatic hydrocarbon chemical manufacturers, as RCRA hazardous wastecodes K174 and K175. The primary purpose of this document is to provide information about the anticipated national costs of the final rule, as estimated by the USEPA-OSW.

This document responds to and incorporates public comments on the 1999 initial version of this background document, submitted to the RCRA Docket by the 23 November 1999 comment deadline, in response to the USEPA-OSW's 25 August 1999 proposed listing rule for K173, K174 and K175 wastecodes. The 1999 proposed rule "*Economics Background Document*" is dated 30 July 1999, and is available over the Internet at http://www.epa.gov/epaoswer/hazwaste/id/chlorali/economic.pdf . During August and September 2000, USEPA-OSW provided a working draft of this final rule background document to the Office of Management and Budget (OMB) for review, as required by Executive Order 12866 ("*Regulatory Planning & Review*", 30 Sept 1993). Modifications to this document in response to OMB review comments are described in Chapter I of this report.

EXECUTIVE SUMMARY

This background document presents an economic analysis which estimates a broad range of **$0.42 to $23.37 million** in average annualized, **national cost** for USEPA's K174 and K175 RCRA hazardous industrial waste listing final rule. The upper-end of this cost range reflects EPA's "full cost estimation uncertainty" which includes higher-cost assumptions, as well as higher-cost compliance options, in EPA's cost computations. Under EPA's "moderated" cost estimation uncertainty assumptions, the expected average annualized national cost is **$0.42 to $4.05** million.

The RCRA K174/K175 hazardous industrial waste listing final rule is intended to ensure the safe and appropriate management of wastewaters and wastewater treatment sludges generated by **chlorinated aliphatic hydrocarbon chemical** (CAHC) manufacturers in the US. This study does not provide an estimate of the expected human health and environmental **benefits** of the final rule.

As of the late 1990s, over **40 billion pounds** (20 million short-tons) of **17 to 33** different types of CAHCs, valued at over **$8 billion**, are manufactured annually by **39 facilities** in the US. CAHCs are usually **colorless liquids** at room temperature and are insoluble in water.

CAHCs are used in the economy as both intermediate feedstocks and in direct end-use applications. Over 90% of all CAHCs manufactured are two chemicals – ethylene dichloride (EDC) and vinyl chloride monomer (VCM) – used as chemical precursors for the manufacture of **polyvinyl chloride** (PVC) plastic. The remainder of CAHCs manufactured are mostly used directly in liquid form as industrial degreasing and cleaning **solvents** (e.g. methyl chloride, chloroform, methylene chloride, perchloroethylene, and trichloroethylene).

Eighteen of these 39 chemical manufacturers are potentially subject to the rule, 17 as generators of K174 waste, and one as a generator of K175 waste. None of these 18 facilities are owned by **small-sized companies**. The 21 remainder facilities do not currently manufacture the types of chemicals and associated industrial wastes which are listed by the rule.

As displayed in **Table 1** below, USEPA anticipates that the final rule will have "***targeted effects***" on three of the 18 facilities which generate K174 and K175 waste, largely consisting of costs to modify current waste management practices to comply with the requirements of the final rule. Otherwise, the reamining 15 waste generators are expected to incur minimal regulatory costs (e.g. recordkeeping documentation of conditionally-exempt waste management practices), if any.

Because of RCRA's "cradle-to-grave" statutory design, USEPA expects the final rule to have "***induced effects***" on four commercial waste handlers which are expected to receive K174 and K175 wastes (for transport, treatment and disposal). All 10 USEPA regional offices, the 49 state governments with RCRA authorized programs, and one other Federal agency (OMB) will also experience "induced effects" associated with the administration of the new rule.

The other 36 CAHC manufacturing facilities, one other Federal agency (USDOT), and 12 NGOs are expected to experience "***incidental effects***", largely consisting of documenting compliance, and/or reading and propagating the final rule.

Because the final rule:

- contains a "**conditional management**" listing approach, rather than a traditional, "across-the-board" or "straight listing" approach, and
- is based on **risk analyses** according to type of chemical manufactured,

the impact of this final rule is substantially less than what it otherwise would be, if all 18 EDC/VCM manufacturers (or all 39 CAHC manufacturers) had to comply with full RCRA Subtitle C regulatory requirements for all volumes of wastewaters and wastewater treatment sludges generated.

Table 1: Number of Entities Likely Affected by the RCRA K174/K175 Final Rule

Final Rule Component	Entities which generate wastes targeted by the final rule	Targeted Effects: Subset of waste generators likely to incur costs to meet final rule's requirements	Induced Effects: Other entities likely affected by RCRA statutory or economic linkages*	Incidental Effects: Entities likely to incur consequential or voluntary costs	Total Affected Entities
K174	17	2	3	0	5
K175	1	1	1	0	2
Other features	0	0	49+10+1= 60	39-3+1+12= 49	109
Totals =	18	3	64	49	**116**

* Although the final rule lists certain wastes ***generated from the production*** of certain chlorinated aliphatic chemicals, RCRA hazardous waste listing rules also affect waste "***handlers***" (treaters, disposers) subsequent to waste generation.
** Entity counts based on USEPA's 1997 industry survey data, and on public comments to the USEPA RCRA Docket in response to the 25 Aug 1999 K173/ K174/ K175 proposed rule).

EXECUTIVE SUMMARY (Continued)

Table 2 below summarizes the **national costs** of the final rule, as estimated in this background document. To simplify the presentation of costs in this document, all three cost categories (targeted effects + induced effects + incidental effects) are aggregated. As displayed in the bottom row of Table 2, although the upper-end of the present value cost range exceeds $100 million, for reasons explained in this document, the final rule is not "*economically significant*".

For purpose of benchmarking the anticipated national costs of the final rule, the average annual equivalent (AAE) cost displayed near the bottom of Table 2 below, represents an increase of **0.3% to 15%** in the $160 million in average annual, solid waste expenditures reported by the organic chemicals manufacturing (SIC 282) and the plastics and synthetics materials manufacturing (SIC 286) industrial sectors in the US.

Table 2: USEPA Estimate of National Costs for the Final Rule

Item	Regulatory Cost Component	Initial Costs ($ millions)	Annual Recurring Costs ($ millions)
K174 Final Listing (EDC/VCM wastewater treatment sludges):			
1	K 174 waste treatment	$0	$0
2	K174 waste disposal	$0.051 to $75.044	$0.032 to $15.207
3	K174 recordkeeping	$0	$0
4	K174 mixture-derived from	$0.014 to $4.213	$0
K175 Final Listing (wastewater treatment sludges from VCM-A process):			
5	K175 waste treatment	$0	$0 to $0.327
6	K175 waste disposal	$0	$0.020 to $0.027
7	K175 recordkeeping	$0	$0
8	K175 mixture-derived from	$0	$0
Other Final Rule Features:			
9	Administrative	$0.343	$0
10	Enforcement	$0	$0.300 to $0.600
11	Emergency response	$0	$0
	Column Totals =	**$0.534 to $75.387**	**$0.352 to $16.161**
Average annual equivalent (AAE) cost* ($millions) =		**$0.42 to $23.37**	
Present value (PV) cost* ($millions) =		**$5.2 to $290**	

* AAE and PV based on 7.00% discount rate and 30-year future period-of-analysis (2001-2031).
Note: Costs in this table represent an aggregation of "targeted effects" + "induced effects" +" incidental effects".

Among other reasons, this cost range largely reflects EPA uncertainty concerning future industry compliance with the final rule for one K174 generator currently managing this waste in a surface impoundment. In this case, there appears to be at least three engineering feasible, alternative compliance options, (1) two of which are about five-to-seven times relatively higher in initial cost, and (2) all of which may require permitting and/or construction time exceeding RCRA's statutory six month effective date (RCRA Subtitle C, Section 3010(b)) for the K174/K175 final rule, possibly adding high monthly cost for temporary truck shipment of wastewater to offsite commercial waste handling facilities during any such effective data exceedance period. The above range in average annualized cost reflects both the lowest and highest cost options, as well as up to 22 months of temporary offsite management of affected wastewaters for this single K174 generator, under one of these options.

If effective date exceedance is avoided, EPA's estimate of average annualized national cost for the final rule, based on the apparent lowest cost option for the surface impoundment case, is **$0.42 to $4.05 million** (consisting of $0.534 to $7.207 million in initial cost, and $0.352 to $3.238 million in recurring annual cost).

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CHAPTER I

INTRODUCTION

I.A. Overview of This Study's Findings:

This document presents the methodology, data, analyses, and findings of an economic study which estimates **$0.42 to $23.37 million** in average annualized, ***potential national regulatory costs*** associated with the **RCRA K174/K175 final rule**. The **upper-end** of this relatively broad cost range reflects USEPA's "full cost estimation uncertainty" assumptions which includes the highest cost option, and assigns high contingency costs to all compliace cost estimation parameters. Under EPA's "moderated" cost estimation assumptions, which assigns the lowest cost option and low contingency costs to cost estimation parameters, the expected average annualized national cost of the final rule is **$0.42 to $4.05 million**.

The Economics, Methods, and Risk Assessment Division (EMRAD) of the USEPA Office of Solid Waste (OSW) designed and conducted this economic study. This study constitutes one analytic component of the **final listing determination** and **decision-making documentation**, and should be interpreted in conjunction with the other technical background documentation and materials identified in the *Federal Register* preamble to the announcement of the RCRA listing **final rule**.

The scope of this "*Economics Background Document*" is determined by the scope of the final rule, which in turn is determined by the terms and conditions of a 1989 US District Court Consent Decree (as amended). Furthermore, the scope and contents of this document are designed to complement the scope, methodology and findings contained in three other **background documents** in support of this final rule:

- "*Risk Assessment Technical Background Document*"
- "*Listing Background Document*"
- "*Response to Public Comments Background Document*"

The other background materials are referenced in the *Federal Register* announcement for this final rule, and are available to the public from the **RCRA Docket** (phone 800-424-9346, or request via the following website: http://www.epa.gov/epaoswer/osw/infoserv.htm#info). Consequently, this document does not contain information which duplicates the information contained in these other background documents.

I.B. Overview of the Final Rule:

This rule is issued by the Office of Solid Waste (OSW) of the US Environmental Protection Agency (USEPA), to list certain **chlorinated aliphatic hydrocarbon chemical** (CAHC) manufacturing wastewater sludges, as "hazardous" industrial wastecodes **K174 and K175**, under authority of Subtitle C of the

Resource Conservation and Recovery Act (RCRA) of 1976.[1] The relatively wide range in cost estimate reflects: (a) alternative compliance option possibilities (scenarios), and (b) EPA uncertainty in the numerical value of some key cost estimation parameters.

RCRA Hazardous Waste Listing Final Rule: New RCRA Wastecodes Addressed in this Document	
Wastecode	Description
K174	**Wastewater treatment sludges** from the production of ethylene dichloride or vinyl chloride monomer (**EDC or VCM**).
K175	**Wastewater treatment sludges** from the production of vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process (**VCM-A**).

In addition to these two new RCRA wastecodes, the 25 August 1999 proposed listing contained an additional K173 wastewater proposed wastecode, which is dropped from the final rule.

CAHCs are a specific **class** of chemical compounds which share in common, the following three **chemical structure characteristics**:

Attributes of Manufactured Chemicals Covered by the USEPA's RCRA K174 & K175 Listing Final Rule		
Item	Attribute	Description
1	**Chlorinated**	Chemical compounds containing only chlorine in one or more substitution positions for hydrogen atoms on the aliphatic hydrocarbon structure (chlorinated aliphatic hydrocarbon chemicals containing other one or more other halogens in hydrogen substitutions are not covered by the listing description of the final rule; e.g. chlorofluorocarbon production is not covered by the final rule).
2	**Aliphatic**	Chemical compounds without an aromatic ring system (an aromatic ring consists of six carbon atoms bonded together with three alternating double bonds and three single bonds).
3	**Hydrocarbons**	Chemical compounds consisting only of carbon and hydrogen atoms.

[1] For purpose of facilitating both public and scientific review, effort has been made in this report to present a balance between both general descriptive information and specialized technical information. Although the text of this report presents summary definitions of Federal laws and regulations, and of economic, statistical and other scientific concepts applied in this study, references and footnotes are also provided for readers interested in obtaining more in-depth information. One convenient source of additional information (general and technical) about RCRA is available to the public over USEPA's "RCRA Hotline", which may be contacted between 9:00am to 6:00pm EST by phoning 800-424-9346 (800-553-7672 for hearing impaired), or via computer Internet at http://www.epa.gov/epaoswer/hotline/index.htm). The USEPA also publishes informational and educational booklets, such as(a) Guide to Environmental Issues (EPA document no. 520/B-94-001, Sept 1996, 84pp.) which provides definitions and explanations of environmental laws, regulations, and technical terms and phrases, available by phone request from USEPA's "Public Information Center" 202-260-7751; and (b) RCRA Orientation Manual 1998 Edition, EPA report nr. 530-R-98-004, May 1998, pp., available from National Service Center for Environmental Publications at 800-490-9198, or via the Internet at http://www.epa.gov/epaoswer/general/orientat/index.htm. Other sources of information about the USEPA and RCRA in general, may be accessed via the Internet at http://www.epa.gov and http://www.epa.gov/rcraonline ,respectively.

I.C. Overview of the Industry Sector Subject to the Final Rule:

Chlorinated aliphatic hydrocarbon chemicals (**CAHCs**) entered into commerce in the US in the early 1920s. As of the late 1990s, annual US production of CAHCs is over **40.1 billion pounds** per year (20 million short tons), manufactured by **39 chemical plants** located in **eight states** .

CAHCs are a group of ***organic chemicals*** -- most of which are colorless liquids at room temperature -- primarily used as intermediate feedstocks for the production of polyvinyl chloride (PVC) plastics. CAHCs are also used directly in liquid form as various types of solvents, as intermediates for the production of other types of chemicals, and in assorted other commercial use categories. A range of **17 to 33 different CAHCs** have reportedly been produced in the US during the 1990s, with only two CAHCs – vinyl chloride monomer (**VCM**) and ethylene dichloride (**EDC**) – constituting over 90% of US total CAHC production.

The industrial chemical processes used to produce CAHCs result in the production of **waste by-products** which may take many physical and chemical forms as gases, liquids, and solids from the following industrial process sources (EPA, 1984, p.5306):

Types/Sources of Industrial Wastes Generated by CAHC Manufacturing Facilities			
1	Process & treatment wastewaters	5	Distillation residues
2	Wastewater treatment sludges	6	Heavy ends & tars
3	Spent reaction catalysts	7	Reactor clean-out wastes
4	Spent process filters and filter aids	8	Dessicant wastes

The type of wastes within the scope of the final listing rule are only **wastewater treatment sludges**[2], not all types of wastes generated by this particular industry, for reasons discussed in the regulatory history section of this document, as well as in the preamble to the final rule.

I.D. Review of This Document by the Office of Management & Budget:

White House Executive Order (EO) 12866 "*Regulatory Planning and Review*" (30 September 1993) contains a statement of philosophy, principles, procedures, guidelines, and a planning mechanism, for Federal regulatory agencies to follow during the development, evaluation, selection and finalization (i.e. promulgation) of **"*significant*" regulatory actions**. Section 3(f) of EO-12866 defines "*significant*" regulatory actions as any action which may result in a rule that may:

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[2] "**Sludges**" are any solid, semisolid, or liquid waste generated from a municipal or industrial wastewater treatment plant, water supply treatment plant, or air pollution control device (e.g. filters, baghouse dust). The quantity and nature of sludge generated relates to the character of the raw wastewater and processing units employed. Combinations of physical, chemical and biological processes are employed in handling sludges. While the purpose in treating wastewater is to remove impurities from dilute solution and consolidate them into a smaller volume of liquid, the objective of processing sludge is to extract water from the solids and dispose (i.e. safely manage) the dewatered sludge residue. The majority of sludge solids from biological wastewater processing are organic with a 60% to 80% volatile fraction. The concentration of suspended solids in a liquid (watery) sludge is determined by straining a measured sample through a glass-fiber filter. Non-filterable residue (i.e. suspended solids) is usually expressed in milligrams-per-liter or as a weight-percent. For example, dewatering of sludges by mechanical centrifugation may concentrate sludges to 20% solids content (similar to consistency of wet mud or clay), and dewatering by mechanical pressure filtration may increase solids content to 40% (a cake-like or chunky consistency). The method of ultimate disposal and market economics dictate the degree of moisture reduction necessary. The majority of municipal and industrial wastewater sludges are disposed of on land, with about 75% being used as soil conditioner and the remainder buried in landfills. Dewatered raw sludges may also be incinerated generally if the organic solids content is greater than 35%. For additional information about the physical, chemical and treatment properties of sludges, consult Chapter 13 "Processing of Sludges" (pp.569-661) in Viessman & Hammer.

- Have an annual effect on the economy of $100 million or more (or other material effects).
- Create a serious inconsistency or otherwise interfere with another Federal agency.
- Materially alter the budgetary impact or recipients of Federal entitlements, grants, user fees, or loan programs.
- Raise novel legal or policy issues.

As stated in its *Federal Register* announcment, the USEPA designated the RCRA K174/K175 final rule as "*significant*" for the fourth reason listed above; in particular, because of the final rule's "*conditional listing*" approach, which narrowly targets the listing to particular wastestreams with unacceptable hazard risks, rather than broadly listing all wastestreams generated by the industry sector.

Among its multiple requirements as specifically applicable to this *Economics Background Document*, EO-12866[3] (Section 6(a)(3)(E)(ii)) requires Federal regulatory agencies to identify for the public, the substantive changes made between the draft economic assessment document submitted for review to the Office of Management and Budget (OMB), and the final version in conjunction with publication of the regulatory action in the *Federal Register*.

USEPA submitted a draft of this document to OMB during August 2000, and received a total of **12 written comments** from OMB, six comments (07 Sept 2000) directed at the summary of the findings of this background document in the draft final rule preamble, and six comments (13 Sept & 28 Sept 2000) directed at the contents of this document:

OMB's **six comments** on the draft preamble's summary of this background document:
- Clarify the preamble summary of affected number of facilities.
- Define in the preamble "targeted effects", "induced effects" and "incidental effects".
- Explain in the preamble the feasibility and cost of maintaining dedicated landfill cells for purpose of isolating certain classes of industrial wastes for co-disposal.
- List in the preamble the 11 specific economic analysis comments solicited in the 1999 proposed rule preamble.
- Expand characterization of public comments on the 1999 economic analysis.
- Expand the preamble summary of the findings of this background document.

OMB's **six comments** on this background document:
- Clarify EO-12866's definition of "significant" regulations.
- Clarify that the spirit of EO-12866 is much broader than formal submissions to OMB
- Clarify definition of "*private costs*".
- Three comments concerning editorial changes to text in Chapter IV.

In response to these comments, USEPA modified in September 2000, the associated preamble sections and the sections of this background document. Refer to the preamble of the *Federal Register* notice for identification of and responses to OMB's other review comments.

[3] EO-12866 (and other Executive Orders) are available to the public over the Internet at the following websites: http://www.legal.gsa.gov/legal1geo.htm and http://www.nara.gov/fedreg/eo.html#top . On 11 January 1996, OMB issued "best practices" guidance to Federal agencies for compliance with the regulatory development and analysis requirements of EO-12866; OMB's guidance is available at the website: http://www.whitehouse.gov/WH/EOP/OMB/html/miscdoc/riaguide.html .

CHAPTER II

SUMMARY OF PUBLIC COMMENTS ON THE USEPA's ECONOMIC ANALYSIS FOR THE 1999 PROPOSED RULE

For the 25 Aug 1999 K173/K174/K715 RCRA listing proposed rule, the 1999 "*Economics Background Document*" (http://www.epa.gov/epaoswer/hazwaste/id/chlorali/economic.pdf), contained different types and levels of information and references, to facilitate review by at least four different anticipated audiences:

- General public review.
- State, local, and tribal government review.
- Affected industry sector review.
- Social scientific review.

In addition, an initial draft of the 1999 EBD (along with the other background documents, draft Federal Register preamble, and proposed regulatory language), circulated during the period May-July 1999 for review within the USEPA Office of Solid Waste (OSW), and the Office of Management and Budget (OMB). Consequently, USEPA did not design the format and contents of the economic analysis to target or optimize the information for review by any single audience.

The USEPA solicited public comments during the designated 90-day review period indicated in the 25 Aug 1999 Federal Register announcement for the 1999 listing proposal. USEPA's RCRA Docket Information Center (800-424-9346) received a total of **20 sets** of public comments by the **90-day** deadline of **23 Nov 1999** specified in the 1999 Federal Register announcement. The RCRA Docket assigned ID numbers (CALP-00001 to CALP-00020) to each set of comments. A total of **61 comments** contained within **14 of the 20** comment sets, address USEPA's economic analysis. The following three tables summarize this subset of 61 comments. For the convenience of readers of this report, **Attachment A** to this document presents these 61 comments.

Summary of Public Commentor Identity: Public Comments on EPA's Economic Analysis for the 25 Aug 1999 Proposed Rule				
Row Item	RCRA Docket Commentor ID Nr.	Commentor Name	Commentor City/State	Comment ID Nr Assigned by USEPA- OSW-EMRAD
1	CALP-00001	DuPont Dow Elastomers LLC	LaPlace, LA	1 to 5
2	CALP-00002	American Petroleum Institute	Washington, DC	6
3	CALP-00004	The Vinyl Institute, Inc.	Arlington, VA	7 to 12
4	CALP-00005	Synthetic Organic Chemical Manufacturers Assoc, Inc.	Washington, DC	13
5	CALP-00006	Borden Chemicals & Plastics	Geismar, LA	14, 15
6	CALP-00007	Chlorine Chemistry Council	Arlington, VA	16
7	CALP-00009	Formosa Plastics Corp., USA	Livingston, NJ	17 to 25
8	CALP-00010	Louisiana Chemical Association	Baton Rouge, LA	26 to 33

9	CALP-00011	Shell Chemical Company	Houston, TX	34 to 40
10	CALP-00012	Dow Chemical Company	Midland, MI	41 to 43
11	CALP-00013	Occidental Chemical Corp. (OxyChem)	Carrollton, TX	44 to 48
12	CALP-00016	Equiva Services LLC	Houston, TX	49
13	CALP-00019	Chemical Manufacturers Association	Arlington, VA	50 to 58
14	CALP-00020	Vulcan Chemicals	Birmingham, AL	59 to 61

Explanatory Notes:
(a) The RCRA Docket received a total of 20 sets of comments by the 23 Nov 1999 deadline for the 90-day public comment period specified in the 25 August 1999 Federal Register announcement (64 FR 46476-46538) of the RCRA K173/K174/K175 listing proposed rule. The above-listed 14 of the 20 sets contained comments on USEPA's economic analysis (i.e. *Economics Background Document*) for the 1999 RCRA listing proposed rule.
(b) Note that not all "economic-related" comments are summarized here, only ones directed at the proposed rule. For example, one additional commentor (CALP-00005) provided a comment about waste testing costs associated with a different USEPA proposed rule (i.e. the USEPA's 1995 "HWIR" proposal). Another commenter (CALP-00001) provided economic information about its own company facilities. At least one other commenter (CALP-00008) addressed the documentation aspect of the K174 conditional listing, but did not specifically comment on associated industry burden (i.e. economic cost) for such documentation. Such comments are not itemized above because they do not address the USEPA's economic analysis, *Economics Background Document*, or economic aspects of the 1999 proposed lrule.
(c) Public comments about other aspects (e.g. risk analysis) of the 1999 proposed rule are provided elsewhere in the USEPA's "*Response to Public Comments*" background document for the final rule.
(d) Commentor city/state location may represent a single facility, or may represent a company's central business office.

Summary of Public Comment Scope:
Public Comments on EPA's Economic Analysis for the 25 Aug 1999 Proposed Rule

Item	Primary Scope of Comment	Comment Count	%	Comment ID Nr.
1	K173: Regulatory Compliance Costs for Listing Wastewaters from Production of Chlorinated Aliphatic Chemicals	33	54%	1,2,3,4,5,7,8,9,10,12,14,18,19, 20,21,22,23,24,25,27,28,29,30, 31,32,35,41,46,47,48,57,59,60
2	K174: Regulatory Compliance Costs for Listing Wastewater Treatment Sludges from Production of EDC/VCM Chemicals	4	6%	11,13,17,33
3	K175: Regulatory Compliance Costs for Listing Wastewater Treatment Sludges from Production of VCM-A Chemicals	1	2%	15
4	Economic Analysis Scope/Framework for Entire Rule (K173 & K174 & K175)	11	18%	26,36,37,39,42,43,51,52,56, 58,61
5	Magnitude of Total Compliance Cost, or Cost-Effectiveness of Entire Rule (K173 & K174 & K175)	9	15%	6,16,34,38,40,44,45,49,50
6	Chlorinated Aliphatic Manufacturing Industry Characterization Data (e.g. Number of Facilities, Annual Sales)	3	5%	53,54,55
	Column Totals =	61	100%	

Explanatory Notes:
(a) Column total of 61 comments represents 100% of the subset of the portions of the 20 sets of public comments submitted to the RCRA Docket by the 23 Nov 1999 (90-day) comment deadline specified in the 25 Aug 1999 Federal Register announcement of the proposed K173/K174/K715 listing rule (64 FR 46476-46539). Fourteen of the 20 comment sets contained comments on the 1999 economic analysis. Public comments pertaining to other aspects of the proposed rulemaking (e.g. risk analysis) are provided elsewhere in the "*Response to Public Comments*" document available from the RCRA Docket (phone: 800-424-9346).
(b) Comments categorized above according to primary context and/or subject matter (scope) in relation to the 1999 proposed rule; many comments address multiple and inter-related topics.

Summary of Public Comment Topics:
Public Comments on EPA's Economic Analysis of the 25 Aug 1999 Proposed Rule

Scope	Topic of Public Comment	Comment ID Nr.
1. K173 Regulatory Compliance Costs:		
1	Undue, large & underestimated costs for K173 tank cover and Subpart CC air vent control requirements	1,2,3,4,12,14,18,19, 20,21,22,27,28,35,41, 46,47,56,59,60
1	Failed to consider practical implications of retrofitting K173 tanks with covers	7,14,27,32,46
1	Did not include time/cost to obtain or modify other K173 environmental permits (air, NPDES, & underground injection well no-migration petition)	5,8,23,28,29,47
1	Did not include cost of testing K173 tank control devices after installation	9,23,30,48
1	Did not estimate costs for temporary offsite disposal of K173 wastewaters while retrofitting facilities	5,28
1	Did not allow sufficient construction time for retrofitting K173 tanks	10,25,41
1	Did not include impact of K173 listing on state-level haz waste fees/taxes	31
1	Underestimated K173 wastewater dioxin sampling/analysis costs	24
	Subtotal =	42 comments
2. K174 Regulatory Compliance Costs:		
2	Large/small recordkeeping burden for K174 conditional landfill exclusion	11,13,17
2	Failed to consider costs associated with K174 mixture/derived-from wastes	33
	Subtotal =	4 comments
3. K175 Regulatory Compliance Costs:		
3	Unrealistic assumed market availability of K175 sludge RMERC treatment	15
4. Economic Analysis Scope/Framework:		
4	Did not consider other types of facilities/wastes possibly impacted by rule	26,28,36,38,43,57,58,61
4	Used inappropriate parameters for annualized cost computations	37,42,51,52,55,58
4	Should have applied 20-year rather than 30-year future period-of-analysis	37,56
4	Should have applied a higher growth rate to future industry production	37
4	Clarify scope of listing (F024/F025, solvent recycling, PVC resin process)	39,42
	Subtotal =	19 comments

5. Magnitude of Total Cost & Cost-Effectiveness of Entire Rule:		
5	Rule is not cost-effective (i.e. very high cost-per-cancer-case avoided)	6,16,40,45,49,50
5	Total industry compliance cost of rule underestimated (average annual cost & present value cost)	2,5,12,14,18,20,24, 27,34,35,36,37,38,40,44, 50,51,58,60
5	Should conduct benefit-cost study because is major ($100 million) mandated rule	2,5,34,35,38,44,58,60
	Subtotal =	33 comments
6. Affected Industry Characterization:		
6	Underestimated the affected US universe number of industrial facilities	37,52,54
6	Did not accurately characterize the industry's wastewater tanks	19,21
6	Did not accurately characterize industry's annual sales and growth rate	53,55
	Subtotal =	7 comments
Note: Comments containing multiple economic analysis topics are listed more than once above.		

CHAPTER III

REGULATORY HISTORY OF THE RCRA K174/K175 FINAL RULE

The USEPA[4] publicly began the RCRA listing process – including both CAHCs as waste constituents and CAHC-related process wastes -- **over 20 years ago in 1978**, with the proposed listing of certain types of CAHC manufacturing wastes as hazardous waste under the authority of RCRA. The USEPA RCRA regulatory actions targeted at CAHCs and at the CAHC manufacturing sector unfolded according to the following Federal Register announcement milestones (other studies completed and Federal Register notices issued under different USEPA authorities and offices, targeted at CAHCs and the CAHC manufacturing sector, are not listed below):

Regulatory History of RCRA Hazardous Waste Listings Targeted at CAHC Production Processes		
Item	Year	Description of Relevant RCRA Regulatory Event
1	1978	As required under RCRA Section 3001(b)(1) "Identification and Listing [of Hazardous Waste]", the USEPA first proposed an **initial list of RCRA hazardous solid wastes** in 1978 (Federal Register, Vol. 43, No. 243, 18 Dec 1978, pp.58946-), which included: • Two types of chlorinated solvent uses and wastes. • Four types of industrial process wastes generated in CAHC-manufacturing (SIC 2869); • Two types of industrial process wastes generated from using CAHCs as chemical production intermediates (SIC 2869); and • One type of industrial process waste containing CAHC constituents (SIC 2812).
2	1979	After publication of this first RCRA hazardous waste list in 1978, based on continuing review of available information on hazardous wastes, the USEPA proposed to expand its initial 18 Dec 1978 RCRA list, with a "Proposed Rule and Request for Comments", for the addition of **45 wastes** to the 1978 hazardous waste list, of which 16 wastes in the form of: • fractionation bottoms • distillation bottoms • washer wastes • spent catalysts, and • reactor clean-out wastes are generated in the production of chlorinated organic chemicals (i.e. chlorinated aliphatic, chlorinated aromatic and chlorinated cyclic aliphatic hydrocarbons), (Federal Register, Vol.44, 22 Aug 1979, pp.49402-49404).

[4] The USEPA is not the only US Federal Government agency which initiated regulatory rulemakings targeted at CAHCs. A Congressional Act which predates the 1976 RCRA is the Occupational Safety and Health Act of 1970, which authorized the US Department of Health, Education and Welfare to issue worker protection regulations. These occupational standards were designed to protect the health of employees in workplaces associated with the processing, manufacture, and use of hazardous chemicals. In carrying-out this authority, as early as 1976, the National Institute for Occupational Safety and Health investigated whether to regulate the largest volume CAHC manufactured: ethylene dichloride, for which a 1978 NIOSH study estimated that approximately two million workers in 148,165 US workplaces in 45 industries were potentially exposed to ethylene dichloride, with some 200,000 of these workers estimated to receive continuous exposure in the workplace (NIOSH, 1978, pp.2,3.)

3	1979 1980	USEPA's published three industrial waste studies targeted specifically at the CAHC manufacturing sector: • "Source Assessment: Chlorinated Hydrocarbons Manufacture", by Monsanto Research Corp for the USEPA's Industrial Environmental Research Laboratory, Research Triangle Park, report nr. EPA-600/2-79-019g, Aug 1979, 188pp. • "Identification of Pollutants from Chlorination and Related Unit Processes", by Mitre Corp for USEPA's Office of Research & Development (IERL-Cincinnati), grant nr. R805620-01, project nr. 15810, Feb 1980, 112pp. • "Preliminary Draft Report: Chlorinated Hydrocarbon Manufacture: An Overview", by Acurex Corp for USEPA's Effluent Guidelines Division, contract nr. 68-02-2567, TESC task nr. 4027, 29 Feb 1980, 222pp.
4	1980	"Rule and Request for Comments" pertaining to **chlorinated aliphatic hydrocarbon manufacturing wastes**, (Federal Register, Vol.45, 19 May 1980, p.33064).
5	1984	"Interim Final Rule and Request for Comments" pertaining to: • distillation residues • heavy ends • tars, and • reactor clean-out wastes from chlorinated aliphatic hydrocarbon manufacturing wastes listed as RCRA wastecode **F024** (Federal Register, Vol.49, No.29, 10 Feb 1984, pp.5306-5312).
6	1984	"Proposed Rule and Request for Comments" pertaining to: • light ends • spent filters & filter aids • dessicants from chlorinated aliphatic hydrocarbon manufacturing wastes listed as RCRA wastecode **F025**, (Federal Register, Vol.49, No.29, 10 Feb 1984, pp.5313-5315).
7	1984	The "**Hazardous and Solid Waste Amendments**" (HSWA - 08 Nov 1984), expanded the scope and requirements of the 1976 RCRA, in response to citizen concerns that existing methods of hazardous waste disposal, particularly land disposal, were not safe. Among other revisions, HSWA amended RCRA Subtitle C Section 3001 "Identification and Listing of Hazardous Waste", to require the USEPA to make a determination of whether to **list 21 chemical classes** of "Specified Wastes" (Section 3001(e)), one of which is "**chlorinated aliphatics**".
8	1989	"Final Rule" pertaining to finalization of RCRA wastecode **F024**, and amending the final **F025** RCRA wastecode, (Federal Register, Vol.54, No.236, 11 Dec 1989, pp.50968-50979). The effective date for the rule was 11 June 1990. The F024 listing targeted the following five industrial attributes of chlorinated aliphatic manufacturing operations: • *Manufacturing process*: Free radical catalyzed process for manufacturing CAHCs. • *Chlorinated products*: 25 CAHCs used in the economy as major commercial products. • *Chlorinated toxicants*: 30 chlorinated aliphatic chemical toxicants of concern as constituents in waste, indicated as the co-basis for the hazardous listing. • *Organic toxicants*: Three non-chlorinated organic toxicants of concern as constituents in waste, indicated as the *co-basis* for the hazardous listing. • *Waste categories*: Four industrial waste categories (i.e. distillation residues, heavy ends, tars, & reactor clean-out wastes). In addition to the RCRA F024 listing, the USEPA also issued the RCRA F025 listing in the same final announcement with F024. F025 pertains to four different types of chlorinated aliphatic manufacturing wastes (condensed light ends, spent filters and filter aids, and spent dessicant wastes). Notably excluded from the listed waste categories of both F024 and F025 were wastewaters, wastewater treatment sludges, spent catalysts, and heavy ends, spent catalysts, steam stripper, bottoms, and filter solids associated with the production of specific kinds of chlorinated aliphatic chemicals listed as other ("Kxxx" type) hazardous wastes by the USEPA.

9	1999	Proposed listing for **K173** wastewaters, and **K174** & **K175** wastewater sludges (Federal Register, Vol.64, No.164, 25 Aug 1999, pp.46476-46539). The scope of the proposed rule was determined by the conditions of a 08 March 1989 US District Court Consent Decree (Civ. Nr. 89-0598, J. Lamberth, as amended pursuant to motions filed through 12 June 1997), between the Environmental Defense Fund, Inc. (plaintiff), and the USEPA (defendants), and the American Petroleum Institute, et al. (intervener-defendants). The consent decree requires (page 15, paragraph m) the USEPA to propose and promulgate a final listing determination for: "[W]astewaters and wastewater treatment sludges generated from the production of the chlorinated aliphatics specified in the F024 listing." The "F024 listing" referenced in the consent decree is the prior RCRA industrial hazardous waste listing determination finalized by the USEPA in 1989. Consequently, the 1999 listing proposal addressed the two types of non-listed wastestreams identified in consent decree. For reasons explained in the preamble and the *Listing Background Document* for the Federal Register announcement of the 1999 listing proposal (64 FR 4679-46480), (a) the scope of the 1999 listing proposal was not restricted to only the "free radical catalyzed process", and (b) a different subset of waste toxicants of concern are identified, than those listed in the F024 (and F025) listing determination.

As of 1999, RCRA regulations contain a total of **564 RCRA wastecodes** (four of the five wastecode series are discontinuously numbered as of 1999). A **subtotal 61** of the 564 RCRA wastecodes (11%) are CAHC-related hazardous waste listings, as contained on four of the five RCRA hazardous waste lists (i.e. Dxxx, Fxxx, Kxxx, and Uxxx hazardous wastecodes), listed in the table below.

<table>
<tr><th colspan="4">Existing RCRA Hazardous Industrial Wastecodes Involving CAHCs
(Source: 01 July 1999 Code of Federal Regulations)</th></tr>
<tr><td rowspan="2">D-List</td><td colspan="3">Chemical Hazard Characteristics by Leachability Hazard Code = E
(n=9 CAHC listings at 40 CFR 261.24):</td></tr>
<tr><td>D019: Carbon tetrachloride
D022: Chloroform
D028: 1,2-Dichloroethane</td><td>D029: 1,1-Dichloroethylene
D033: Hexachlorobutadiene
D034: Hexachloroethane</td><td>D039: Tetrachloroethylene
D040: Trichloroethylene
D043: Vinyl chloride</td></tr>
<tr><td rowspan="2">F-List</td><td colspan="3">Non-Specific Industrial Waste Sources by Toxic Hazard Code =T
(n=5 CAHC listings at 40 CFR 261.31):</td></tr>
<tr><td colspan="3">F001: Spent halogenated solvents and spent solvent mixtures used in degreasing, and still bottoms from the recovery of spent solvents, containing (among other chemicals) tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, & carbon tetrachloride.
F002: Spent halogenated solvents and spent solvent mixtures, and still bottoms from the recovery of spent solvents, containing (among other chemicals) tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, & carbon tetrachloride.
F024: CAHC free radical catalyzed production process wastes including but not limited to, distillation residues, heavy ends, tars, & reactor clean-out wastes (excluding wastewaters, wastewater sludges, & spent catalysts).
F025: Condensed light ends, spent filters/aids, & spent desiccant wastes from free radical catalyzed CAHC production process wastes.
F039: Leachate resulting from the land disposal of other RCRA listed wastecodes relevant to CAHCs.</td></tr>
<tr><td>K-List</td><td colspan="3">Specific Industrial Waste Sources by Toxic Hazard Code=T
(n=24 listings involving CAHCs at 40 CFR 261.32).
Note that although some wastes listed below (e.g. K009, K156-K158) do not directly involve the production of CAHCs, such listings involve CAHCs because one or more CAHCs are listed in 40 CFR 261 "Appendix VII" as underlying hazardous constituents which form the basis for the particular wastecode listing (solely or with other non-CAHC constituents).</td></tr>
</table>

	K009: Waste (distillation bottoms) from production of acetaldehyde from ethylene. K010: Waste (distillation side cuts) from production of acetaldehyde from ethylene. K016: Waste (heavy ends) from distillation in carbon tetrachloride production. K017: Waste (heavy ends) from purification in the production of epichlorohydrin. K018: Waste (heavy ends) from fractionation in ethyl chloride production. K019: Waste (heavy ends) from distillation in ethylene dichloride production. K020: Waste (heavy ends) from distillation of vinyl chloride/vinyl chloride monomer production. K021: Waste (spent catalyst) from production of fluoromethane K028: Waste (spent catalyst) from production of 1,1,1-trichloroethane. K029: Waste (steam stripper) from production of 1,1,1-trichloroethane. K030: Waste (bottoms/heavy ends) from production of trichloroethylene & perchloroethylene. K032: Waste (treatment sludge) from the production of chlordane. K033: Waste (wastewater/scrub water) from the chlorination of cyclopentadiene in chlordane production. K034: Waste (filter solids) from the filtration of hexachlorocyclopentadiene in chlordane production. K073: Waste (chlorinated hydrocarbons) from diaphragm cell anodes used in chlorine production. K095: Waste (bottoms) from distillation in 1,1,1-trichloroethane production. K096: Waste (heavy ends) from production of 1,1,1-trichloroethane. K116: Waste (condensate) from solvent recovery in production of toluene diisocyanate via phosgenation. K149: Waste (bottoms) from production of chlorinated toluenes and benzoyl chlorides. K150: Waste (residuals) from gas recovery in production of chlorinated toluenes & benzoyl chlorides. K151: Waste (treatment sludges) from production of chlorinated toluenes & benzoyl chlorides. K156: Waste (organic) from production of carbamates and carbamoyl oximes. K157: Waste (wastewaters) from production of carbamates and carbamoyl oximes. K158: Waste (bag house dusts & solids) from production of carbamates & carbamoyl oximes.	
U-List	**Discarded/Off-specification Commercial Product Wastes** by Toxic Hazard Code =T (n=23 CAHC listings at 40 CFR 261.33):	
	U043: Chloroethene (vinyl chloride) U044: Trichloromethane (chloroform) U045: Chloromethane (methyl chloride) U074: 1,4-dichloro-2-butene U076: 1,1-dichloroethane U077: 1,2-dichloroethane U078: 1,1-dichloroethene U079: 1,2-dichloroethene U080: Dichloromethane (methylene chloride) U083: 1,2-dichloropropane U084: 1,3-dichloropropene U128: Hexachlorobutadiene	U130: Hexachlorocyclopentadiene U131: Hexachloroethane U184: Pentachloroethane U208: 1,1,1,2-tetrachloroethane U209: 1,1,2,2-tetrachloroethane U210: Tetrachloroethene U211: Tetrachloromethane (carbon tetrachloride) U226: 1,1,1-trichloroethane (methyl chloroform) U227: 1,1,2-trichloroethane U228: Trichloroethene U243: Hexachloropropene

Eleven of these 61 CAHC-related existing RCRA wastecodes are targeted at:

- Different types of CAHC production process industrial wastes.
  (F024, F025, K016, K018, K019, K020, K028, K029, K030, K095, K096).

The remaining 50 CAHC-related wastecodes (i.e. 61-11= 50), pertain to either CAHC commercial products, or to manufacturing intermediates which are:

- Container residues,
- Present in any residue or contaminated soil, water or other debris from the cleanup of a spill onto land or water, or
- Underlying constituents in specific sources of industrial wastes.

Inventory Count of RCRA Hazardous Industrial Wastecodes (40 CFR 268.40, revised as of 01 July 1999)					
Item	Category of RCRA Hazardous Industrial Wastecodes	Industrial Wastecodes	Total Count	CAHC-Related	% of Total
RCRA "***Characteristic***" Hazardous Wastes:					
1	Chemical Hazard Characteristics	D001-D043	43	9	21%
RCRA "***Listed***" Hazardous Wastes:					
2	Non-Specific Industrial Waste Sources	F001-F039	28	5	18%
3	Specific Industrial Waste Sources	K001-K172	121	24	20%
4	Discarded Products & Residues/Spills (Acute Toxic)	P001-P205	124	0	0%
5	Discarded Products & Residues/Spills (Toxic)	U001-U411	248	23	9%
		Totals =	564	**61**	11%

In addition to appearing on the D, F, K, and U-Lists themselves (published in 40 CFR Parts 261.24, 261.31, 261.32, and 261.33) , the above-listed CAHC-related existing waste numbers also appear on other types of supplementary RCRA lists codified in the CFR, including:

Other RCRA Hazardous & Non-Hazardous Waste Regulatory Lists Which Address CAHCs			
Item	Type of RCRA Regulatory List		CFR Citation
1	List of "Basis for Listing Hazardous Waste" which identifies the particular chemical constituents associated with each waste numbered on the F- and K-Lists.		40 CFR 261 Appendix VII
2	List of "Hazardous Constituents" which identifies the common chemical names (cross-referenced to chemical abstracts name/number) associated with hazardous chemical constituents numbered as wastes on the U- and P-Lists.		40 CFR 261 Appendix VIII
3	List of "Wastes Excluded from Non-Specific Sources" which identifies particular facilities in the US exempt to non-specific waste numbers and chemical constituents in wastes.		40 CFR 261 Appendix IX Table 1
4	List of "Wastes Excluded from Specific Sources" which identifies particular facilities in the US exempt to specific waste codes and chemical constituents in wastes.		40 CFR 261 Appendix IX Table 2
5	List of "Examples of Potentially Incompatible Waste" which identifies particular classes of chemical constituents in wastes according to 12 groupings.		40 CFR 264 Appendix V
6	List of "Groundwater Monitoring" which identifies practical quantitation limits (PQLs) in micrograms per liter for specific chemical constituents in wastes.		40 CFR 264 Appendix IX
	Lists pertaining to burning RCRA-listed hazardous wastes in boilers or industrial furnaces:		
7		List of "Reference Air Concentrations" which identifies RACs in micrograms per cubic meter for specific chemical constituents in wastes.	40 CFR 266 Appendix IV
8		List of "Risk Specific Doses" which identifies RsDs in micrograms per cubic meter for specific chemical constituents in wastes.	40 CFR 266 Appendix V
9		List of "Residue Concentration Limits which identifies RCLs in milligrams per kilogram for specific chemical constituents in wastes.	40 CFR 266 Appendix VII
	Lists pertaining to land disposal prohibitions for RCRA-listed hazardous wastes:		
10		List of "Schedule for Land Disposal Prohibition and Establishment of Treatment Standards" which identifies RCRA-listed hazardous wastes that will be evaluated for land disposal prohibition.	40 CFR 268.10-.12

11		List of -"Prohibitions on Land Disposal" which identifies RCRA-listed hazardous wastes that are prohibited from land disposal.	40 CFR 268.31-.38
12		List of "Treatment Standards for Hazardous Wastes" which identifies wastewater and non-wastewater concentration levels by RCRA hazardous waste codes.	40 CFR 268.40
13		List of "Universal Treatment Standards" which identifies wastewater and non-wastewater concentration levels for specific chemical constituents in wastes.	40 CFR 268.48
14		List of "Halogenated Organic Compounds Regulated Under Section 268.32" which identifies specific chemical constituents which must be included in the calculation of hazardous waste concentrations for land disposal.	40 CFR 268 Appendix III
15	List of hazardous constituents and concentrations as criteria for construction design, groundwater monitoring and corrective action for municipal solid waste landfill units.		40 CFR 258.40 & 258 Appdcs I & II

In addition to the above RCRA listings, the USEPA also maintains (in 40 CFR) other lists of chemicals for other statutory purposes, on which CAHCs also appear. For example, CAHCs appear on the USEPA lists developed for implementation of at least four other environmental regulatory programs listed in the following table.

Examples of Other USEPA Environmental Regulations Which Address CAHCs		
Item	Type of USEPA Environmental Regulation	CFR Citation
1	The Toxic Substances Control Act reporting requirements applicable to manufacturers, importers and processors of commercial chemical compounds.	40 CFR 712.30 & 716.120
2	The Federal Water Pollution Control Act effluent limitation guidelines for industrial process wastewater discharges from CAHCs manufacturers.	40 CFR 414.70(d)
3	The Federal Water Pollution Control Act for designating hazardous substances and reportable quantities.	40 CFR 116.4 & 117.3
4	The water and human consumption concentration criteria for priority toxic pollutants for states not complying with the Clean Water Act.	40 CFR 131.36

None of the existing RCRA-listed wastes include CAHC manufacturing wastewaters or wastewater sludges; these non-specific sources were specifically excluded from the prior rulemaking on CAHC manufacturing wastes (i.e. F024 & F025), because the USEPA believed it then had insufficient data to determine the hazardousness of wastewaters and wastewater sludges on a generic basis, and indicated these wastes would be evaluated for listing at a later date (Federal Register, Vol. 49, No.29, 10 Feb 1984, p.5308). The 1999 proposed listing of K173, K174 and K175 wastecodes, and the present final listing rule of K174 and K175 wastecodes, together constitute the 1984-referenced "later date" evaluation. (Note: In addition to the final rule's two wastecodes, the 25 August 1999 listing proposal contained a **K173**[5] wastewater wastecode, which is dropped from the final rule for reasons explained in the Federal Register preamble to the final rule).

[5] **K173**: "**Wastewaters** from the production of chlorinated aliphatic hydrocarbons, except for wastewaters generated from the production of vinyl chloride monomer [VCM] using mercuric chloride catalyst in an acetylene-based process [i.e. "VCM-A" process]. This listing includes wastewaters from the production of chlorinated aliphatic hydrocarbons that have carbon chain lengths ranging from one to, and including five, with varying amounts and positions of chlorine substitution." (64 FR 46480).

CHAPTER IV

FRAMEWORK
OF THIS ECONOMIC ANALYSIS

As indicated in Chapter II, USEPA designed this background document to provide information to different types of anticipated audiences. Consequently, this study contains different levels of information on a variety of interrelated topics, from the general to the specific. As described below, this study represents a particular type of **analytic role**, within the framework of the RCRA hazardous waste determination process (i.e. "listing" rulemakings) at the USEPA.

From a social scientific methodological standpoint, this study also applies particular types of **analytic methodologies** which constitute only a subset of all possible methodological options for conducting an economic study, in support of a hazardous waste listing process in particular, or in support of a study of environmental topics in general. In particular, the scope, methodology and limitations of this study in conjunction with an industrial hazardous waste RCRA listing rule, relate to at least four different possible **economic study frameworks**. The applicability, contribution and limitation of each framework to this study is described below.

Alternative Economic Study Frameworks Applicable to the Formulation and Assessment of Hazardous Waste and Other Environmental Regulations			
1	Regulatory analysis framework	3	Industrial ecology framework
2	Risk assessment framework	4	Economic assessment framework

IV.A. Study Methodology Within a Regulatory Analysis Framework

Because of the fact that the RCRA K174/K175 final rule is a Federal regulation, one obvious starting point for selecting an appropriate economic analysis framework, is to consult with relevant Federal regulatory analysis procedures and guidelines, of which the following two are of direct relevance to the RCRA K174/K175 final rule:

- Executive Order 12866 "Regulatory Planning and Review" (30 Sept 1993).
- EPA's RCRA "Criteria for Listing Hazardous Waste" (40 CFR 261.11; 19 as originated on 19 May 1980, and amended on 04 May 1990 & 02 Jan 1992)

IV.A.1. What is Executive Order 12866?

EO-12866 contains three main sections (additional details on EO12866 and other Executive Orders, are available via the Internet at http://www.legal.gsa.gov/legal1geo.htm):

- Objectives: Four regulatory process reform objectives.
- Philosopy: Regulatory philosophy consisting of 12 regulatory principles.
- Guidelines: Three agency guidelines, one of which contains six agency procedures for development of regulatory actions.

The purpose and philosophy of EO-12866 is (bracketed numbers added by EPA for enumeration):

> "Federal agencies should promulgate only such regulations as [1] are required by law, [2] are necessary to interpret the law, or [3] are made necessary by compelling public need such as material failures of private markets to protect or improve the health and safety of the public, environment, or the well-being of the American people." (EO-12866 Section 1(a)).

The RCRA K174/K175 final rule conforms to all three of the EO-12866's **regulatory promulgation conditions**, as explained by the following corresponding points (numbered below to coincide with bracketed numbers in the EO-12866 excerpt above):

Correspondence Between General Principles of EO-12866 Regulatory Philosophy, and RCRA Hazardous Waste "Listing" Rulemaking		
Item	Principle	Explanation of Compliance with Principle
1	Required by law	As a Federal law, RCRA is a ***statutory authority*** provided to the EPA by Congress for the express purpose of promulgating regulations and standards concerning the proper management of hazardous waste. EPA's RCRA industrial waste listing regulations are required by Congress (RCRA, Subtitle C, Section 3001).
2	Interpret the law	Congress only provided ***general guidelines*** and ***broad terms*** in RCRA for the waste management program envisioned by Congress, and directed EPA to interpret, develop and promulgate details in the form of waste management regulations. These Congressional law directives are also contained in RCRA, Subtitle C, Section 3001.
3	Compelling public need	This final rule compensates for the failure of the Nation's market-oriented, socio-economic system, to provide adequate protection of public and ecosystem health, as described in the *Risk Analysis Background Document* accompanying this final rule (available from the RCRA Docket by phone 800-424-9346 or Internet http://www.epa.gov/epaoswer/hotline/index.htm).

In addition to ***general philosophy*** and principles, the EO-12866 also sets forth the following ***specific philosophy*** directed at the design and application of economic analysis in support of Federal regulatory actions (bracketed numbers added by EPA for enumeration):

> "In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including [1] the alternative of not regulating. Costs and benefits shall be understood to include both [2] quantifiable measures (to the fullest extent that these can be usefully estimated) and [3] qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that [4] maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." (EO-12866 Section 1(a)).

Section 6 of EO-12866 also sets forth a "***Centralized Review of Regulations***" in the form of **three Federal agency responsibilities and guidelines** applicable to all "***significant***"[6] regulatory actions. The third guideline contains **six agency procedures**, three of which contain instructions to Federal agencies to perform particular types of economic analyses. These three guidelines and procedural requirements are summarized below (numbered and lettered below to correspond with the notation in EO-12866):

[6] Section 3(f)(1) of EO-12866 defines the expression "***significant regulatory action***" as constituting any regulatory action that is likely to result in a rule that may: (1) have $100 million or more in annual effect on the national economy, or adversely affect the economy in a material way; (2) create a serious inconsistency with another agency; (3) materially alter the budgetary impact or recipients of entitlements, grants, user fees, or loan programs, or (4) raise novel legal or policy issues.

EO-12866 "Centralized Review of Regulations": Federal Agency Responsibilities and Guidelines		
Item	Responsibility	Guideline Description
1	Public participation	Provide meaningful public participation in the regulatory process; before issuing a notice of proposed rulemaking, seek to involve those who are intended to benefit and those expected to be burdened by an regulation; afford the public a meaningful opportunity to comment on any proposed regulation of not less than 60 days; explore consensual mechanisms for developing regulations including negotiated rulemaking.
2	Regulatory officer	Federal agencies shall designate Regulatory Policy Officer who shall be involved at each stage of the regulatory process to foster the development of effective, innovative, and least burdensome regulations.
3	Agency procedures	Federal agencies shall adhere to the six procedures listed below in developing a regulatory action:
		• Provide the Office of Management and Budget (OMB) with a list of planned regulatory actions.
		• For "***significant***" regulatory actions (broadly defined), provide OMB with: • The text of the draft regulatory action. • Description of the need for regulation. • Explanation of how the regulation will meet the need. • Assessment of potential costs and benefits of the regulation. • Explanation of how the regulation is consistent with statutes. • Explanation of how the regulation promotes the President's priorities and avoids undue interference with State, local and tribal governments.
		• For "***significant***" regulatory actions (as narrowly defined within the scope of $100 million in annual effect), provide OMB with: • Assessment and quantification of anticipated benefits • Assessment and quantification of anticipated costs. • Assessment of costs and benefits of feasible alternatives.
		• Provide OMB with sufficient time to review regulatory actions.
		• Provide the public with information specified above.
		• Provide all information to the public in plain language.

In the formulation of both the proposed and final listing rules directed at chlorinated aliphatic manufacturing wastestreams, the EPA conformed to EO-12866's regulatory philosophy and guidelines as summarized above. Information about the need for the regulation is provided in the Federal Register preamble to both the proposed rule and the final rule, while EPA's quantification of anticipated benefits of the listing rule, is provided in the *Risk Assessment Background Document* (available to the public from the EPA's RCRA Docket). The role of economic analysis in both the proposed rule and the final rule (this study), consists of quantification of the anticipated national costs of the listing rule, including costs associated with multiple, alternative regulatory options. These regulatory options ranged from an "*across-the-board*" listing approach which would have affected all wastestreams and all facilities in the targeted industry sector (at a significantly higher national cost), to the relatively narrower and targeted "*conditional listing*" approach of the final rule (at a significantly lower national cost).

With respect to ***regulatory analysis***, there are additional Federal requirements concerning the application of economic analysis to regulatory development and regulatory actions, which are focused on different definitions of economic impact (such as "*direct expenditures*"), classes of targeted entities (such as small businesses, and state, local and tribal governments), and procedural aspects of the regulatory process (such as small government consultation during the formulation stage of a proposed Federal regulation). Such additional requirements, as well as the applicable requirements of EO-12866, are described and addressed in Chapter IX of this document.

IV.A..2. EPA's RCRA Authority & RCRA Hazardous Waste "Listing" Criteria

A second, Federal-level source for establishing an appropriate economic analysis framework, is the RCRA program itself, which contains the following **three elements** of relevance to hazardous waste "listings" determinations:

Congressional Authorities Relevant to RCRA "Listing" Rulemakings		
Item	Authority	Language Contained in the Authority
1	RCRA Hazardous Waste National Policy	"The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of ***so as to minimize the present and future threat to human health and the environment***." (SWDA, Section 1003(b)).
2	RCRA Hazardous Waste Listing Criteria	"[T]he [USEPA] shall ... develop and promulgate criteria for identifying the characteristics of hazardous waste, and for listing hazardous waste, which should be subject to the provision of this subtitle, ***taking into account toxicity, persistence, and degradability in nature, potential for accumulation in tissue, and other related factors such as flammability, corrosiveness, and other hazardous characteristics***. Such criteria shall be revised from time to time as may be appropriate." (SWDA, Section 3001(a)).
3	RCRA Hazardous Waste Generator Standards	"[T]he [USEPA] shall ... promulgate regulations establishing such standards applicable to generators of hazardous waste identified or listed under this subtitle, ***as may be necessary to protect human health and the environment***." (SWDA, Section 3002(a)).

The EPA has established **six criteria** – one of which contains **11 factors** – for determining whether to designate (i.e. "*to list*") a solid waste, as a RCRA "*hazardous waste*":

EPA's RCRA Hazardous Waste "Listing" Criteria (40 CFR 261.11)	
Criterion #1	The solid waste exhibits any of four characteristics of hazardous waste (ignitability, corrosivity, reactivity, chemical leachability).
Criterion #2	The solid waste has been found to be fatal to humans in low doses.
Criterion #3	The solid waste has been found to have lethal doses (oral or dermal) or lethal concentrations (inhalation) in animal (rat) studies.
Criterion #4	The solid waste has been found to otherwise be capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible illness.
Criterion #5	The solid waste contains one or more toxic, carcinogenic, mutagenic or teratogenic constituents (as listed in 40 CFR 261 Appendix VIII), and is capable of posing a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed, based on consideration of 11 factors (listed at 40 CFR 261.11(a)(3)).
Criterion #6	The solid waste is within a class or type of waste, which is typically or frequently hazardous under the definition of "hazardous waste" in the RCRA statute (Section 1004(5)).[7]

The RCRA statutory authorities and listing criteria do not explicitly address the application of a "*non-regulatory approach*" as an alternative to Federal RCRA regulation, nor do they explicitly address

[7] The RCRA statute (Section 1004(5)) defines "hazardous waste" as: "[A] solid waste, or combination of solid waste, which because of its quantity, concentration, or physical, chemical or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness, or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of , or otherwise managed."

quantification of regulatory costs, benefits, or net benefits, in the establishment of RCRA hazardous waste listings and of RCRA hazardous waste generator regulations. Collectively, these RCRA statutory elements and listing criteria focus on the protection of human health and the environment through analysis of waste characteristics.

In contrast to some other Federal agencies, and to some authorizing statutes for other USEPA programs (e.g. the economic achievability criterion for effluent guidelines of Section 301 of the 1977 Clean Water Act), Congress' 1976 RCRA hazardous waste authorizing statute (with 1984 amendments) does not direct the USEPA to apply economic analysis criteria, such as measures of cost-effectiveness, in either:

- Promulgating RCRA Subtitle C hazardous waste regulations in general, or in
- Developing and promulgating criteria for identifying and listing hazardous wastes, in particular (see RCRA Subtitle C Sections 3001(a) & (b)(1)).

For additional information about this specific aspect of RCRA, see USEPA's 1980 review of the legal history of RCRA (*Federal Register*, Vol.45, No.98, 19 May 1980, p.33089), which arrived at the following determination:

> "*Although the legislative history is sparse, it does contain sufficient indications of Congressional intent to lead the Agency to the conclusion that EPA may not consider cost burden upon industry in choosing the level of its standards. The Agency may, however, take cost considerations in account in order to select the most cost effective regulation among various alternatives... There is no explicit requirement in the Act directing EPA to consider costs in the development of its initial regulations. The singular focus of protecting human health and the environment distinguishes RCRA from other major pollution control statutes... The silence of the statute itself appears especially significant because earlier drafts of the legislation had contained language which either explicitly called for considerations of cost or implicitly sanctioned such consideration... Congress was aware that the hazardous waste regulation would impose substantial costs on the regulated community. Despite this recognition, Congress deliberately rejected provisions that would require consideration of cost burden on industry or to moderate the Act's environmental objectives. For these reasons, the Agency concludes that the Act prohibits it from considering such costs in the development of Subtitle C regulations as a basis for lessening the standards it considers necessary to ensure protection of human health or the environment.*"

However, as explained above, even though (a) USEPA anticipates that the annual effects of both the 1999 proposed listing rule (with exception of its higher cost "*across-the-board*" listing option which was not selected as the basis for USEPA's proposed rule), and of the 2000 final rule, will be significantly less than EO-12866's $100 million "*significant*" rule threshold, and (b) the RCRA statutory authority does not authorize EPA to apply economic analysis in hazardous waste listing determinations, the USEPA conducted both a **regulatory cost analysis** (in the form of *Economics Background Documents*), and a **benefits analysis** which quantified the projected reduction in cancer and non-cancer health risks to individuals, as a result of listing the wastestreams as hazardous (in the form of *Risk Assessment Background Documents*), in support of the rulemaking.[88]

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[8] Although provision is made in EO-12866 for "alternative regulatory approaches" to cost-benefit and net-benefit type analysis, the Office of Management and Budget's (OMB's) 11 Jan 1996 guidelines to Federal agencies for complying with EO-12866, reaffirm its philosophy and principles, particularly with respect to providing regulatory alternatives even when limited by Congressional statute:

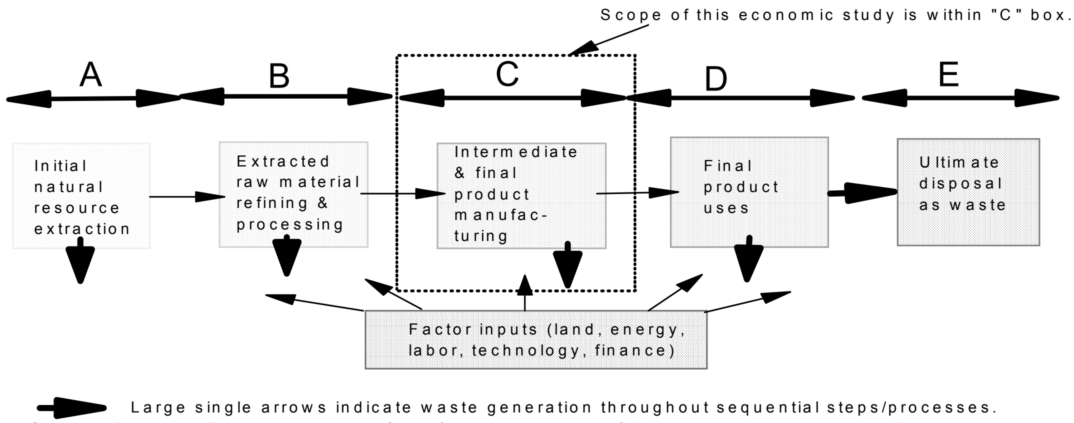
> "The amount of analysis (whether scientific, statistical, or economic) that a particular issue requires depends on ... the nature of the statutory language and the extent of statutory discretion ... In particular, a less detailed or intensive analysis of the entire range of regulatory options is needed when regulatory options are limited by statute. Even in these cases, however, agencies should provide some analysis of other regulatory options that satisfy the philosophy and principles of the Executive Order [EO-12866], in order to provide decisionmakers with information for judging the consequences of the statutory constraints."

Additional information about the design of the methodology for this RCRA final rule – and the initial identification and ultimate selectionof the regulatory options contained in this final rule in light of both EO-12866 and OMB's guidelines – is provided in the Federal Register preamble and other background material identified in the preamble for the final rule.

IV.B. Study Methodology as an Industrial Ecology Framework

The potential for environmental and human health exposure risks to CAHCs may be characterized as relating to the complete **cycle of economic (commercial) activities** associated with these chemicals from "**cradle-to-grave**" (i.e. from "source" to "sink"). Such activities from an industrial ecological framework includes sequential (process flow) processes associated with six general stages of industrial activities depicted in the exhibit below:

Generalized Industrial Activity Stages Within an Industrial Ecology Framework



Source: Boxes A-E above adapted from five major steps of "Industrial metabolism" or "industrial ecological" approach (e.g. Graedel & Allenby, 1995, pp.110-114, Anderberg, 1998, p.312).

This ***commercial cycle*** or ***materials flow*** perspective represents an ***industrial ecology*** framework, which includes the basic idea of analyzing the entire flow of materials such as chemical substances (i.e. ***industrial metabolism flow***, ***substance flow analysis***, ***anthropogenic flow***, ***mass balance***, or ***life-cycle assessment***) through society and the economy (i.e. the ***anthroposphere***).[9] From this perspective, in addition to chemical production, industrial processing and use, various other associated handling, storage and transportation and waste-related activities (e.g. treatment and disposal) may also be associated with each stage of the economic cycle involving CAHCs. Each activity and stage in this societal flow may also have an associated emission/release pathway for potential environmental and human health risks to the various physical and chemical forms of a material substance.

An industrial ecology framework may be expanded from a static (e.g. single year) and isolated flow (e.g. single chemical) approach, to include time-geographical (i.e. temporal-spatial) dimensions, for the purpose of illuminating and analyzing ***flow trajectories*** and inter-related processes and chemicals/materials in a ***process landscape*** framework (after Hägerstrand 1993). To this end, this economic study provides: (a) static single-year data "snapshots", as well as (b) historical time-series data (e.g. spanning different time intervals over the period 1925-96), (c) time-series future scenarios (e.g. 2001-2030), and (d) descriptive information related to not only CAHC manufacturing, but also to upstream chemical inputs, CAHC processing, downstream use, and waste treatment/disposal, although not in a formalized and thorough industrial ecology or process landscape framework.

[9] Two recent articles (among others) contribute to the developing field of industrial ecology with respect to chemical flow analysis -- building upon the conceptual work of Robert U. Ayers (1989) -- both of which are directly relevant to this economic study of chlorinated aliphatic hydrocarbons: (a) Kleijn et al. (1997) describe substance flow analysis theory and the results of such modeling applied to chlorine (and chlorinated hydrocarbons) in the Netherlands' economy; and (b) using a petrochemical industry process network mathematical model containing 428 chemical processes and 224 chemical feedstocks, intermediates and final products, Chang & Allen (1997) present an analysis based on mass balance of material and energy flows, of chlorine use in the manufacturing of chlorinated intermediates.

IV.C. Study Methodology Within a Risk Assessment Framework

As described in academic literature as well as in governmental guidance, there are many types, purposes and frameworks to human, ecological and environmental risk analysis, risk assessment, and risk management. Three examples from US Federal Government sources are summarized below and reviewed for incorporation of, and reference to, economic analysis.

Examples of Different Functions Served by Economic Analysis Within Risk Assessment Frameworks		
Example #1	The **US Presidential/Congressional Commission** on Risk Assessment and Risk Management, assembled in May 1994 as directed by the 1990 Clean Air Act Amendments, released a two-volume report in 1997, detailing a "real-world public health and ecological context" framework for researching, characterizing, assessing, and reducing risk. The report was designed to provide an alternative to traditional risk assessment approaches such as: (a) chemical-specific, (b) medium-specific, and (c) risk-specific strategies. The Commission report provided the following six methodological stages to conducting risk assessment:	
	Stage 1:	Define the risk problem and place in a proper context (five steps).
	Stage 2:	Analyze risks associated with the problem (potential for harm).
	Stage 3:	Examine options to reduce risks (benefits, **costs, impacts**, feasibility).
	Stage 4:	Make decisions regarding which options should be implemented.
	Stage 5:	Take action to implement the decisions (involve stakeholders).
	Stage 6:	Evaluate results by comparing actual **benefits/costs**, and reconsider.
	Both Stages 3 and 6 of this Commission's risk assessment methodology involve economic analysis. Because of its focus on estimating potential industry compliance costs for the listing proposal, the scope of the present *Economics Background Document* may be considered to fall within **Stage 3** of this generalized risk assessment framework.	
Example #2	Prior to the above 1997 Commission report, the **USEPA's Science Policy Council** established in February 1995 its own agency "***Guidance for Risk Characterization***". The principles of this guidance acknowledge that (Section I.B.2): "[T]he regulatory decision is usually not determined solely by the outcome of the risk assessment... For decision-makers, this means that societal considerations (e.g., **costs and benefits**) that, along with the risk assessment, shape the regulatory decision should be described as fully as the scientific information set forth in the risk characterization... Decision-makers should be able to expect, for example, the same level of rigor from the economic analysis as they receive from the risk analysis... Risk management decision involve numerous assumptions and uncertainties regarding technology, **economics and social factors**, which need to be explicitly identified for the decision-makers and the public." However, although the USEPA's 1995 risk assessment principles acknowledge the role of economic analysis in risk decision-making, the Agency's March 1995 "Policy for Risk Characterization" which is based upon the Science Policy Council Guidance, defines the risk assessment process as consisting of the following four steps, none of which explicitly address or include economic analysis:	
	Step 1:	Hazard Identification
	Step 2:	Dose-Response Evaluation
	Step 3:	Exposure Assessment
	Step 4:	Risk characterization and communication.
Example #3	The **Office of Management and Budget** (OMB) also provides guidelines for Federal agency risk assessments, in the "general principles" section of its 11 January 1996 guidance for complying with the economic analysis requirements of the September 1993 Executive Order 12866. Although the "major rule" benefit-cost requirements of EO-12866 do not apply to the scope of this document (for reasons given elsewhere), the OMB guidance (Section III.A.4(b)) also serves to illustrate an explicit potential link between risk assessment and economic analysis, in the form of four analyses:	
	Monetize risks:	Assign **monetary values** to risk probabilities.
	Net benefits:	Estimate **net benefits** of risk change, by accounting for the probability distribution of risk outcomes and **future costs**.

	Risk premium:	Assess certainty equivalent value for regulatory options which reduce the overall variability of net benefits.
	Risk distribution:	Assess incidence and distribution of **monetized risk**.

The above three examples of risk assessment frameworks serve to illustrate that:

- There are different institutional approaches to risk assessment in conjunction with economic analysis.[10]
- Economic analysis is not always explicitly defined and contained as a separable and/or integral element within the analytic scope of risk assessment frameworks.
- When explicitly included, economic analysis does not always serve the same purpose in the risk assessment framework.

This *Economics Background Document* best fits within the "Stage 3" cost analysis of the first example risk assessment framework above.

IV.D. Study Methodology Within an Economic Assessment Framework

With respect to interpretation and application of the findings of this study for risk management and regulatory decision-making, the analytic objective of this study is not to provide an exact and overly-comprehensive economic analysis -- which is an unreasonable expectation relative to the state-of-art in social science, risk assessment, and economic analysis, as well as relative to the limited level of detail and comprehensiveness in the information and data USEPA collected to support this study -- but to provide "*order-of-magnitude*" and "*approximating*" indicators and measures of economic impacts, for application in USEPA decision-making, and for informing and engaging the public.

For this reason, it is important to emphasize that although this study presents quantitative data and findings, and is presented as a separable and self-standing background document in support of the listing final rule, the information and results of this study are appropriately interpreted in conjunction with the information contained in the other background documents (as identified in the *Federal Register* preamble announcement).

For the reasons presented in this chapter above, this document does not represent a complete economic assessment, because its scope is limited to estimating **industry compliance costs** for the final rule, not to providing a broader assessment and comparison of the anticipated benefits and costs of the final rule (i.e. a "benefit-cost" or "cost-effectiveness" analysis). The ***potential benefits*** of the final rule are described and quantified in the "*Risk Analysis Background Document*" in the form of projected, individual health risk reductions, but are not monetized in this economic study for comparison with estimated industry compliance costs. Although USEPA only quantified the anticipated human health benefits to individuals (i.e. cancer cases and non-cancer cases avoided), USEPA anticipates that the following four RCRA program benefit sources, will produce a larger set of at least eight categories of anticipated national benefits for the RCRA K174/K175 final rule:

[10] Other risk analysis and risk assessment frameworks of chemicals in the environment include: (a) global approach, (b) systems approach, (c) epidemiological and toxicological approaches, (d) British Toxicology Society approach, (e) pharmacokinetic approach, and (f) total index of environmental quality approach (based upon multicritical axiomatic multiattribute utility theory). One convenient descriptive overview of these alternative, multi-disciplinary analytical approaches is provided in Richardson, Mervyn L, ed, Risk Assessment of Chemicals in the Environment, The Royal Society of Chemistry, London, 1988, 600pp.

Four Sources of Anticipated National Benefits for the RCRA K174/K175 Final Rule		
Item	RCRA Program Feature	Source of Anticipated Benefits
1	Waste management	Resultant changes to baseline (current) industrial waste management practices in the sector subject to the final rule, by compliance with the protective hazardous waste management practices specified in the terms and conditions of the final rule.
2	Waste transport	Resultant changes to baseline waste transportation practices, by instituting waste transport manifests and certified hazardous waste transporters.
3	Waste information	Resultant changes to baseline information and databases maintained, processed, and analyzed by the USEPA, other organizations, and the public, by expanded coverage of industrial waste volumes, waste types, waste constituents and other waste description information.
4	Waste generation	Resultant changes to the sources and rates of baseline waste generation, for example, as stimulated by RCRA's required hazardous waste generator certification (on waste manifests), to have a waste volume and waste toxicity minimization program in place, and to have selected the best waste management method which minimizes the present and future threat to human health and the environment.

Anticipated Categories of National Benefits from the RCRA K174/K175 Final Rule			
Final Rule Feature	Benefit Item	Benefit Category	Benefit Description
K174	1	Human health	Benefits of future human cancer cases avoided, from the reduction in exposure pathways of individuals to toxic* constituents (such as dioxins) in K174 released into the environment.
	2	Ecological**	Benefits to biogeochemical cycles*, biological resources*, ecosystems*, and biota*, from reduction in the release of chemical constituents (such as dioxins) in K174 waste, to the land and to the natural environment.
	3	Land-use**	Anticipated future aversion of deterioration and damages to quality of land and surface water, from reduction in future loading of known toxic* chemical constituents in K174 wastes, into the natural environment. • Avoided future loss in the value of commercial, residential, agricultural, recreational, or other future land-use opportunities.
	4	Land-use	Anticipated aversion of some or all potential societal costs associated with future site remediation projects (e.g. contaminated soil and/or groundwater cleanup), resulting from reduction after the final rule, in the annual volumes of K174 waste placed on the land or into the natural environment.
K175	5	Human health	Benefits of future human non-cancer, adverse health effects cases avoided, from the reduction in exposure pathways of individuals to toxic constituents (e.g. mercury) in K175 waste released into the environment.
	6	Information	Benefits of extending RCRA hazardous waste recordkeeping requirements to K175 waste: • Improvement in community right-to-know information and awareness about K175 waste.
	7	Knowledge	Benefits of hazardous waste descriptive data collection (through the EPA's RCRA Biennial Reporting System), about the industrial sources/origins, annual volume generated, chemical and physical properties, and waste management (treatment/disposal) systems involving K175 waste, in the form of: • Anticipated improvement in USEPA's and others' qualitative and quantitative general understanding of the nature and generation of industrial wastes in society.

	8	Transportation	Benefits of hazardous waste manifesting for transport between generator and waste treatment/disposal facility in the form of: • Anticipated improvement in the efficiency, effectiveness and cost of future community emergency response actions (e.g. if acute events such as roadway accidents occur involving K175 waste in truck transport to an off-site waste treatment facility).

Explanatory Notes:

(a) * "Biogeochemical cycle" = Cycling of chemical elements through the air, land, water, and organisms.
"Biological resources" = Attributes of land, water and air which support ecosystems and life.
"Ecosytem" = Community of living organisms and its local, non-living physical environment in which chemicals and energy cycle and flow.
"Biota" = All living things (humans, animals, plants, micro-organisms) within a given area.
"Toxic" constituent = Chemicals in wastes which can produce some adverse biological effect or damage in biota. In theory, every chemical can be "toxic" if too much of it is present, i.e. it its concentration is too high for the particular circumstance. Toxic effects are of all kinds; they may occur quickly or show up many years after exposure; the may affect people, plants, animals, fish, birds or other living organisms; they may affect the nervous system, the reproductive system, eyesight, vital organs; they may be mild or severe.

(b) ** In addition to the direct "*use value*" to current generations of land-use benefits and ecological benefits, the environmental economics literature also defines "*non-use values*" benefits, consisting of at least three possible categories:
(1) "*bequest value*" is the value that the current generation (i.e. current individuals or current households) places on the availability of preserved (protected) land-use opportunities and ecological resources to future generations;
(2) "*existence value*" is the value that current individuals (or households) place on simply knowing that land-use opportunities and ecological resources are preserved, independent of any human use; and
(3) "*altruistic value*" is the value that current individuals (or households) place on others having preserved land-use opportunities and ecological resources today. For an example of how these "non-use" valuation concepts may be applied to assessing potential benefits of the USEPA's RCRA regulatory program, see the research study "*Methods for Measuring Non-Use Values: A Contingent Valuation Study of Groundwater Cleanup: Innovative Approaches for Valuing Perceived Environmental Quality*", prepared by the Center for Economic Analysis of the University of Colorado, for the USEPA Office of Policy, Planning & Evaluation, Oct 1992, 332pp.

It is also important to indicate that the anticipated costs of the final rule, as described and monetized in this document, represent a mix of ***private expenditures*, and other types of private opportunity costs (e.g. the possibility of foregone business revenues)** to affected entities, and **real resource costs** to the **national economy**. For example, the estimate of opportunity cost associated with unplanned plant closure to retrofit waste management processes represents a private cost, not a national resource cost, because the loss of the associated quantity of CAHC production net income to the retrofitting facility, will likely be temporarily offset in the national economy, by increased production from one or more other CAHC facilities, assuming that industrial inputs are mobile, and assuming that industrial production capacity is variable. If prices remain unchanged during the temporary adjustment period (i.e. industrial capacity mobilization costs are zero), this opportunity cost may represent a national economy transfer of net income between competing companies in the affected market, not a real resource cost to society.[11] Because of the fact that this report aggregates private costs with national economy costs, the total costs presented in this report represent an over-estimate of the anticipated ***national economic cost*** of the final rule.

For purpose of placing this document within an economic analysis methodological context, the list below indicates seven alternative economic analysis tools and approaches, and those of which (in whole or in part) USEPA adopted in this document:

[11] However, relative prices may not always remain unchanged during any such temporary adjustment period, because of the possibility of added production factor mobilization costs to the remaining companies in the market, who increase production to offset the temporary marketshare loss. These companies are likely to pass-through any additional factor mobilization costs to consumers in the form of higher prices, at least temporarily. In such case, there will be a net "loss" (i.e. real resource opportunity cost) to the national economy.

Alternative Economic Assessment Frameworks, and Their Applicability to the Scope and Framework of This Background Document			
Item	Framework	Framework Definition	Applicability to this Document
1	Benefit-cost analysis	Method usually applied to public sector projects for measuring and expressing project benefits and costs in common monetary units (dollars). Results may be expressed as "net benefits" (benefits minus costs), or as a "benefit-cost ratio" (benefits divided by costs).	Anticipated regulatory costs monetized, but not anticipated benefits; "benefit-cost ratio" and "net benefits" not computed in this document.
2	Cost-effective-ness analysis	Applied in cases where benefits may not be measurable in monetary units (dollars), in the form of a ratio of costs to unit of benefit. May be computed using total project costs and total project output (benefit) units, or using incremental costs and benefit units.	Anticipated regulatory costs monetized, and some human health benefits quantified (see *Risk Assessment Background Document*"), but "cost-effectiveness ratio" not computed in this document.
3	Incremental analysis	Used to choose among mutually exclusive, alternative project options, whereby the incremental cost of the next expensive option, is compared to its incremental benefit (using either incremental net benefits or incremental benefit-cost ratio), to determine which option is selected.	Anticipated costs of alternative regulatory "listing" approaches monetized (e.g. "across-the-board" approach, versus "conditional" approach targeted at particular facilities/wastes), but incremental "benefit-cost ratio" and "net benefits" not computed in this document.
4	Ecological economic analysis	A relatively new field (1990s) integrating ecology and economics, including concepts such as sustainability, sustainable development, carrying capacity, industrial ecology, life cycle analysis, steady-state economy, and non-market oriented approaches to valuation of environmental attributes, among other topics.	Industrial ecology framework used in this document to illustrate the scope of the industrial sectors subject to the final rule, and their relationship to other sectors in the national economy.
5	Environmental economic analysis	A field which took-off in the 1970s, among other topics and characteristics, explores market-oriented approaches to the quantification and monetization of benefits from environmental projects (e.g. pollution control). Although still under development and refinement, benefit monetization tools include contingent valuation* (willingness-to-pay), hedonic valuation, travel cost valuation, and ecosystem services valuation.	Anticipated regulatory costs monetized, but benefits quantified but not monetized in this document.
6	Engineering economic analysis	Consists of projecting cash flows, establishing the time value and economic equivalence of money, through present worth analysis, annual equivalent worth analysis, rate of return analysis.	Applied in this document to portray anticipated future stream of regulatory costs, for computing discounted present value costs and annual equivalent costs.
7	Risk-based** economic analysis	Growing out of the applications of computers to computations, may be designed as an extension of any of the above approaches, in the form of applied statistical method (i.e. "Monte Carlo" random sampling or "Latin Hypercube" stratified sampling simulations) for establishing probability distributions, in both inputs and outputs of economic analyses, rather than single numerical point values (i.e. "deterministic" computations). This method accommodates different mathematical forms of uncertainty ranges in numerical values applied as inputs in economic computations.	Random sampling methods not applied, but ranges in numerical values assigned to cost computation parameters in this document, to reflect uncertainty in numerical values for key parameters. Resultant regulatory cost estimates expressed as low- and high-bounded cost ranges in this document.

Footnotes:
* One example of the "contingent valuation" approach of relevance to national benefits provided by the EPA's RCRA regulatory program, is the USEPA research study: "*Methods for Measuring Non-Use Values: A Contingent Valuation Study of Groundwater Cleanup: Innovative Approaches for Valuing Perceived Environmental Quality*", prepared by the Center for Economic Analysis of the University of Colorado, for the USEPA's Office of Policy, Planning & Evaluation, Oct 1992, 332pp.
** "*Risk*" in an economic analysis context refers to the generic definition of "*risk*", as a synonym for different degrees of "*uncertainty*" and of likelihoods (probabilities) of possible outcomes, for a given action, event, situation, or condition.

CHAPTER V

OVERVIEW OF THE CAHC MANUFACTURING SECTOR IN THE US

V.A. What is the Significance of CAHCs in the US Economy?

Chlorinated aliphatic hydrocarbon chemicals (CAHCs) are a distinct subset of manmade (synthetic) organic chemicals, consisting in the late 1990s of **17 to 33 commercially-significant**[12], intermediate and final chemical products in the US economy.

In addition to containing one or more chlorine atoms, some CAHCs manufactured in the US may also contain other types of halogens (bromine, fluorine, iodine) in addition to chlorine. More broadly, chlorinated compounds may also contain other types of chemical elements and functional groups in addition to chlorine (e.g. oxygen, nitrogen). However, chlorinated compounds with other halogens and with other chemical elements are not within the scope of the listing description for the final rule.

CAHCs are largely man-made materials synthesized for commercial purposes, either as end products or as intermediate chemical feedstocks. Commercial CAHC production may consist of continuous, large volume industrial operations (e.g. ethylene dichloride and vinyl chloride), or relatively small, discontinuous, or infrequent annual production operations (e.g. n-butyl chloride).

The commercial importance of CAHCs reflects the fact that the replacement of halogens such as chlorine in a halogenated (e.g. chlorinated) aliphatic compound, by another chemical group, is regarded as one of the most important reactions in organic chemistry, because of the wide range of chemical product classes that may be produced using CAHCs as intermediates (Streitwieser, pp.127, 132).

V.B. What Are Commercial Applications for CAHCs?

CAHCs are important as starting materials (i.e. **chemical intermediates**) for the chemical synthesis of other compounds (primarily **plastics**), and are important as **solvents** in various applications, as described below. Overall demand for CAHCs in the US has grown an **average annual rate of 4.1%** over the 27-year period 1970-1996.

As of 1996, the production of three CAHCs -- ethylene dichloride, vinyl chloride, methyl chloride -- were on the list of the top-50 chemicals produced in the US (at ranks #12, #16, and #49, respectively). In that year relative to the largest volume chemical produced in the US -- sulfuric acid -- the production of these three top-50 CAHCs represented 20%, 17% and 1.2% relative volumes by weight (based on CMA, 1997, p.40). The two primary use categories, and a third other miscellaneous uses category, are described below:

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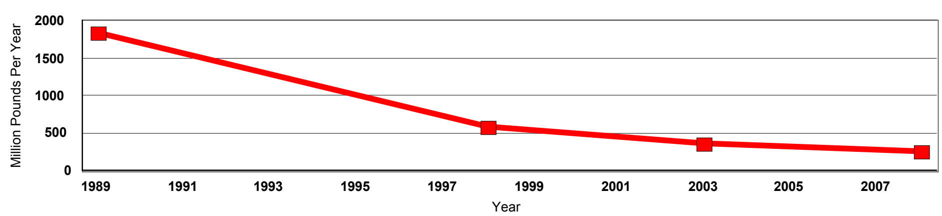
[12] The total number of types of commercial CAHCs in the US is uncertain; three sources contain the following estimates:
(a) US International Trade Commission identified US production of 17 different CAHCs in 1994 (see table in this chapter);
(b) USEPA's Toxic Release Inventory contains 33 different CAHCs, part or all of which might be manufactured, processed or used in the US (see TRI data tables in **Attachment C** to this document), and
(c) CAHC manufacturer respondents to the 1997 USEPA-OSW RCRA Section 3007 industry survey, reported (CBI and non-CBI) a total of 22 different CAHCs (see non-CBI data table in this chapter). The range suggested by these three sources is **17 to 33 commercial CAHCs** in the US as of the late-1990s.

Commercial Use Categories for CAHCs in the US Economy	
Use	**Use Description**
Plastic Resins	The largest portion of CAHC production (>90% during the 1990s) is for use as an intermediate chemical building block for the production of **polyvinyl chloride** (PVC) plastics (and in lesser volumes for synthesis of other compounds). This use category has grown in the USA an average of 4.4% annually over the 27-year period 1970-1996. 1,2-dichloroethane (ethylene chloride) was reportedly the first CAHC to be synthesized in the year 1795, whereas the first reported commercial production of 1,2-dichloroethane in the US was in the year 1922 (WHO, 1979, p431), and is the largest quantity CAHC produced in the US, with annual capacity reported at 30.5 billion pounds. EDC and vinyl chloride monomer are consumed as plastic resins according to 11 plastic product demand categories consisting of both industrial users (i.e. processors, fabricators/finishers, and industrial end users), as well as consumer end products in the following applications (Source: Kline, 1980, pp.154-159; & CMA, 1997, p.20): • Packaging (meat wrap, blister packs) • Building/construction (pipe & fittings, flooring, windows, panels, siding, swimming pool liners/covers, wall coverings). In the 1970s, plastic pipe has been one of the fastest growing end uses for any chemical, with plastic pipe production increasing at an annual rate of 14 percent (Kline, 1980, p.154). • Housewares (blow-molded bottles, luggage) • Transportation • Electric/electronic (wire & cable, lighting fixtures) • Paints • Furniture (upholstery, lawn furniture) • Household appliances • Toys • Other miscellaneous plastics products • Exports
Solvents	For applications in **cleaning, degreasing, extractive, and dissolving carrier**. This application category has grown in the USA an average of 1.0% over the 27-year period 1970-1996. Although the first known laboratory preparation of CAHCs dates back to the early 1800s, the earliest commercial production for use as a solvent was carbon tetrachloride in 1907 (WHO, 1979, p.33). Solvent applications have included metal cleaning and vapor degreasing of engine parts in the automotive, railway and aircraft industries, high-purity cleaning applications in missile and electronics parts (e.g. electric motors and computer circuitry), formulation of adhesives and resins, textile dry cleaning, processing and finishing, drain cleaners, shoe polishes, spot cleaners and textile cleaning fluids, stain repellents, lubricant carrier, low-temperature heat transfer fluids, printing inks, paint and varnish removers, and as industrial chemical reaction process solvents. One recent survey of US national demand for solvents reported that demand is expected to decline by an average annual rate of -9.3% over the next decade (to 2008). The survey reported that in the chlorinated solvents area, closed-loop solvent recovery systems, training and information have helped may solvent customers to reduce chlorinated solvent use by over 90%, and to cut environmental emissions of chlorinated solvents by over 95% without substituting other compounds. The survey provided the following chlorinated solvent US demand data and forecast (Chem.Eng, Dec 1999):

1999 Forecast of US Demand for Chlorinated Solvents



Other Misc. Uses	Reported uses are numerous and have included (in random order): • **Fumigants** as agricultural and commodity pesticides and insecticides • Ingredients in **drugs and cosmetics** • Intermediates for **synthesis of other chemicals** for use as: • Pesticides • Insecticides • Mothproofing agent • Dyes • Drugs & cosmetics • Refrigerants • Aerosol propellants • Foaming agents • Silicone polymers & rubber • Formulation of gasoline additives • Surgical anaesthetics/ analgesics/ disinfectants/ detergents Not all historical secondary miscellaneous uses for CAHCs are current because of changing market conditions, emergence of new substitutes, technological changes, toxic side-effects, and in many cases, because of Federal regulatory actions.[13]

V.C. What are the Chemical Inputs into CAHC Production?

The **hydrocarbon backbones** of CAHCs are natural products produced by living processes and the decomposition of animal and vegetable matter buried in the earth's crust, in the form of hydrocarbon mixtures known as petroleum and crude oil, which may be distilled to separate the constituents for use as basic feedstocks to the chemical industry. These hydrocarbon feedstocks are combined with chlorine (in assorted chemical forms depending on the industrial process used), to form CAHCs.

Chlorine is one of the basic raw materials of the chemical industry, constituting the ninth largest volume chemical produced in the United States (1996=12.6 million tons; CMA 1997, p.40), produced by electrolysis of salt water. Different physical and chemical forms of chlorine (e.g. diatomic gas or in compound form such as sulfuryl chloride or hydrochloric acid liquids; Streitweiser, p.83) may be used for the production of CAHCs. The demand for chlorine for the production of chemicals has grown tremendously, from constituting 17 percent of total US demand for chlorine in 1925, to 80 percent by the 1960s (Sconce, p.13). For large volume, halogenated aliphatic compounds in industrial uses, chlorine is almost exclusively as the halogen of choice, because of the comparatively high cost of bromine and iodine, compared to the lower cost of chlorine. However, for small-volume laboratory uses where cost is

[13] Three examples of governmental regulatory actions affecting the elimination of commercial end-uses of CAHCs are:

(a) As of 1976, The US Food and Drug Administration (FDA) listed approximately 1,900 human drug products that contained chloroform (i.e. trichloromethane), such as cough syrups, expectorants, antihistamines, liniments and decongestants; the FDA banned the use of chloroform as an ingredient (active or inactive) in human drug and cosmetic products as of 29 July 1976 (WHO, 1979, p.404).

(b) By the 1960s, about 85% of US ethyl chloride production (455 million pounds), and15% of US ethylene dichloride production (195 million pounds), were used as chemical intermediates in the production of tetraethyl lead (TEL) and tetramethyl lead (TML) antiknock fluid additives for vehicle gasoline (Sconce, 1972, pp.543, 563). Lead has been blended with gasoline, primarily to boost octane levels, since the early l920s. The USEPA began working to reduce lead emissions soon after its inception in Dec1970, issuing standards in l973 which called for a gradual phasedown of lead to one tenth of a gram per gallon by l986. The average lead content in gasoline in 1973 was 2-3 grams per gallon. In 1975, passenger cars and light trucks were manufactured with a more elaborate emission control system which included a catalytic converter that required lead-free fuel. In l995 leaded fuel accounted for only 0.6 percent of total gasoline sales. Effective 01 Jan 1996, the Clean Air Act banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, although fuel containing lead may continue to be sold for off-road uses, including aircraft, racing cars, farm equipment, and marine engines.

(c) Not only are the manufacturing and end-uses of CAHCs affected by US regulations, but international regulations have acquired a significant influence on the global market for some CAHCs. The manufacture of one subclass-2 category of CAHCs -- chlorofluorocarbons (CFCs) – is under rapid global phaseout, because CFC emissions alleged reach the stratosphere and deplete the layer of ozone. CFCs were invented in 1928 and found many uses in aerosols, foams (e.g. insulation board, panels, pipe covers), refrigeration, freezers, auto and building air conditioners, heat pumps, water coolers, ice machines, solvents, fire extinguishers, etc. The United Nations has been addressing this issue since 1977, and more recently with the 1987 "Montreal Protocol on Substances that Deplete the Ozone Layer", which became effective on 01 Jan 1999. It aims to reduce and eventually eliminate the emissions of man-made CFCs around the globe, including elimination of 58 listed subclass-2 CAHCs (refer to http://unep.unep.org/unep/secretar/ozone/mont_t.htm for the entire list of affected CFCs).

not as great a consideration, brominated aliphatic hydrocarbons are used preferentially because they are generally more reactive than chlorinated versions (Streitwieser, p.100).

V.D. What are the Physical Forms of CAHCs?

CAHCs are usually **colorless liquids** at room temperature and are insoluble in water (however some CAHCs such as chloromethane are colorless gases at room temperature, while at least one CAHC, hexachloroethane, exists as colorless crystals at room temperature). CAHCs are consumed and used as both intermediate feedstocks as chemical building blocks, and in direct end-use product applications.

CAHCs, as with many other classes of organic compounds, may be named with both a common and a systematic nomenclature based on the 1892 International Union of Pure and Applied Chemistry (IUPAC) Geneva rules for naming alkanes (hydrocarbon compounds), which is based on naming chemicals according to the longest single carbon chain present in the compound. A table below presents a list of 28 specific CAHCs reported by the US International Trade Commission[14] as manufactured in the US during 1994.

CAHCs may be produced at different levels of purity (e.g. reagent or analytic grade, technical, commercial (e.g. solvent grade), and pharmaceutical grades), and usually contain production ***impurities***, consisting of other by-product CAHCs (including isomers), other by-product chemicals, stabilizers, water, and metals. For example, a typical analysis of commercial grade vinyl chloride monomer (VCM) has been found to consist of 99%-99.9% VCM, with butadiene, 1,2-dichloroethane, 1,1-dichloroethane, hydrogen chloride, acetaldehyde, peroxides, sulfur, iron and water impurities (Albright, 1976, p.14); commercial dichloromethane (methylene chloride) may contain up to 1.0% methyl chloride, chloroform, 1,1-dichloroethane, and 1,2-dichloroethene as impurities (WHO, 1986, p.45). Some CAHCs are sold for commercial applications at low purity such as 1,3-dichloropropene, which in one product has been sold as a 55% mixture with production process impurities of 1,2-dichloropropane and dichloropropene isomers[15] (WHO, 1986, p.114).

Commercially available technical and solvent grade CAHCs may have a purity of 90-95% and contain from 3-8% ***stabilizers*** to prevent the generation of hydrochloric acid, which may occur from reaction with water (hydrolysis). For example, chemical compounds used as stabilizers for 1,1,1-trichloroethane based degreasing solvents may include nitromethane, nitroethane, N-methyl pyrrole, 1,4-dioxane, butylene oxide, 1,3-dioxolane, toluene, diisopropylamine, methyl ethyl ketone, isobutyl alcohol and 2-butanol. Another reported property of at least one stabilized CAHCs (technical grade 1,1,1-trichloroethane) is that they may contain potential mutagens or carcinogens such as vinylidene chloride, dichloroethane and 1,2-epoxybutene (WHO, 1992, pp.17-18).

Some CAHCs such as pentachloroethane are not produced in bulk quantities for commercial purposes, but are formed for minor applications and research purposes, and also may still be formed as

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[14] Since 1917, the US International Trade Commission (USITC) has compiled annual reports on the production and sale (domestic and foreign) of synthetic organic chemicals and the raw materials from which they are made. This service was terminated by Congress in 1995 (Fed.Reg, 28 Nov 1995, p.58639). The USITC sends questionnaires to domestic chemical manufacturing companies; In 1995 the final publication year, the USITC received questionnaires for this report from a total of 651 domestic chemical manufacturing companies. Production and sales data are presented in publicly-available annual reports only when there are three or more producers for a single chemical or chemical group. The production and sales data represent commodity quantities of undiluted chemical material (i.e. 95% or greater purity), excluding intermediate products which are formed in the manufacturing process but are not isolated from the chemical reaction system. CAHCs are listed in the USITC database under the Harmonized Tariff Schedule (HTS) numbers 29031 & 29032. In addition to chlorinated aliphatic (acyclic) hydrocarbons, the USITC database also includes brominated, fluorinated and iodinated aliphatic hydrocarbon compounds (HTS 29033 & 29034). The data in the list above are from extracted from the 76th annual USITC report Synthetic Organic Chemicals, Feb.1994.

[15] A chemical "isomer" is the unique structural form that a chemical compound may form during its production, when more than one structural form is chemically possible. Isomers contain the same number and type of chemical atoms, but differ in chemical bonding structure and in chemical properties. For example, chlorination of vinyl chloride or vinylidene chloride produces trichloroethane; but because trichloroethane ($C_2H_3Cl_3$) has two carbon atoms to which its three chlorine atoms may bond, it has two structural isomers: 1,1,1-trichloroethane which is the principle commercial reaction product, and 1,1,2-trichloroethane which may appear as an impurity in the manufacture of 1,1,1-trichloroethane (WHO, 1992, p.16).

an intermediate or by-product impurity in commercial CAHC production processes (e.g. pentachloroethane has been found as an intermediate product in the conversion of trichloroethylene to tetrachloroethylene (WHO, 1986, p.100)).

V.E. What Types and Quantities of CAHCs are Manufactured in the US?

As of 1997, OSW-EMRAD estimates based on installed annual production capacity, that over **40.1 billion pounds** (20 million short tons) of CAHCs, with a market value of **$8.0 billion**, are produced annually in the US as of the late 1990s.

During the mid-1990s (1992-96), **imports** have constituted a small percentage of CAHCs consumed in the US (about 270 million pounds or <1.0% of total US demand), while **exports** constituted about 4.0 billion pounds or 10% of total US demand (source: http://www.chemexpo.com/news/).

Prices for CAHCs in the late-1990s reportedly ranged from **$0.10 to $2.05 per pound** (1994 USITC, & ChemExpo 1998 website), with the bulk of CAHCs, as represented by EDC and VCM, averaging $0.17 to $0.22 per pound.

The following three tables display three alternative sources of data on the types and quantities of CAHCs produced in the US. USEPA-OSW's 1997 mail survey of facilities in the US suspected of manufacturing CAHCs resulted in a list of **22 different CAHCs** manufactured, of which the identity for 16 non-CBI reported CAHCs are displayed in the table below. Relative to the OSW-EMRAD's estimate of over 38.8 billion pounds (19.4 million short tons, or 17.6 metric tons) of CAHCs produced in 1997, this survey response represents only about **40% coverage rate** of the entire US industry CAHC manufacturing output, although the 23 facilities which provided survey responses represents 100% industry coverage. OSW has not determined the reason for this apparent discrepancy.

List of CAHCs Manufactured in the US During the 1990s (Source: Non-CBI responses to 1997 USEPA-OSW survey of chemical manufacturing facilities)			
1	1,1,1,2-tetrachloroethane	9	Hexachlorocyclopentadiene
2	1,1,2-Trichloroethane	10	Methallyl chloride
3	1,3-Dichloropropene	11	Methyl Chloride
4	Allyl chloride	12	Perchloroethylene ("Perc")
5	Chlorinated Methanes	13	Trans1,2-Dichloroethylene
6	Chloroethane	14	Trichloroethylene ("Tri")
7	Chloroprene	15	Vinyl Chloride Monomer ("VCM")
8	Ethylene Dichloride ("EDC" or "Dichloroethane")	16	Vinylidene chloride

US Annual Production Quantity and Market Value of CAHCs

Item	CAHC Common Name (IUPAC Name)	CAS Registry Nr.*	Nr. of CAHC Mfg		1997-98 Annual Capacity (mill.lbs)	1997 US Production (mill.lbs)	Capacity Use Rate	Production as % of All US CAHCs	US Avg FOB Tank Price* ($/lb)	Imputed Market Value* ($ million)
			Companies	Facility Location						
1	Ethylene dichloride (1,2-Dichloroethane)	107-06-2	11	16	30,530	23,600	77%	59%	$0.17	$4,012
2	Vinyl chloride (Chloroethene)	75-01-4	10	12	16,630	14,500	87%	36%	$0.218	$3,154
3	Methyl chloride (Chloromethane)	74-87-3	4	7	790	670	85%	<2%	$0.385	$258
4	Chloroform (Trichloromethane)	67-66-3	2	4	720	520	72%	<2%	$0.395	$205
5	Methylene chloride (Dichloromethane)	75-09-2	2	4	430	325	76%	<1%	$0.43	$140
6	Perchloroethylene (Tetrachloroethene)	127-18-4	3	3	355	290	82%	<1%	$0.335	$97
7	Trichloroethylene (1,1,2-Trichloroethene)	79-01-6	2	2	320	190	59%	<1%	$0.65	$123
8	Other misc CAHCs**	Multiple	???	???	???	???	???	???	???	???
		Totals*** =	>13	>20	>49,775	>40,095	81%	100%	$0.20	>$7,989

Explanatory Notes:
(a) Source: ChemExpo Chemical Profiles (http://www.chemexpo.com).
(b) CAS RN = Chemical Abstracts System Registry Number, a division of the American Chemical Society (http://www.cas.org).
(c) IUPAC =The International Union of Pure and Applied Chemistry first established chemical nomenclature rules in Geneva in 1892, which are continuously updated as new substances are discovered (http://iupac.chemsoc.org/).
(d) * Price & Market Value = Not all CAHC production volume is sold on the chemical products market; some CAHC production is used captively as intermediate chemicals within the same facility.
(e) ** Other misc CAHCs = Consist of at least 10 other CAHCs, based on 1994 USITC data (see the separate USITC data table in this document).
(f) *** Non-duplicative column totals for count of number of companies and facility locations (some manufacture more than one type of CAHC).

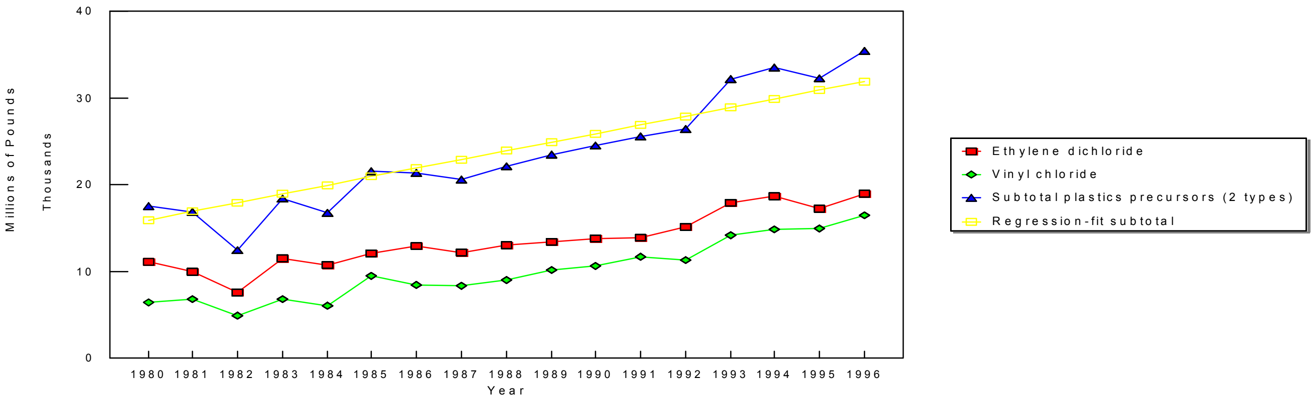
PRODUCTION OF CHLORINATED ALIPHATIC HYDROCARBON COMPOUNDS (CAHCs) IN THE UNITED STATES
(Million Pounds 1970-1996)

Name of Chlorinated		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Hydrocarbon Derivative	1970	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
A. Plastics precursors:																		
1 Ethylene dichloride	7460	11,108	9,974	7,619	11,506	10,710	12,101	12,940	12,197	13,028	13,383	13,850	13,920	15,150	17,947	18,699	17,263	18,950
2 Vinyl chloride	4040	6,466	6,874	4,902	6,875	6,085	9,463	8,439	8,402	9,058	10,135	10,624	11,695	11,307	14,220	14,818	14,977	16,450
Subtotal A (1+2) =	11,500	17,574	16,848	12,521	18,381	16,795	21,564	21,379	20,599	22,086	23,518	24,474	25,615	26,457	32,167	33,517	32,240	35,400
% annual change =		NR	-4.1%	-25.7%	46.8%	-8.6%	28.4%	-0.9%	-3.6%	7.2%	6.5%	4.1%	4.7%	3.3%	21.6%	4.2%	-3.8%	9.8%
% of total row C =	87%	90%	89%	88%	91%	89%	92%	91%	92%	92%	92%	93%	94%	93%	94%	94%	94%	94%
Effective annual rate of change 1970-1996 =																		**4.4%**
B. Solvents:																		
3 Chloroform	240	353	405	299	362	405	275	422	462	524	588	484	440	515	476	565	585	600
4 Methyl chloride	423	362	405	366	409	482	415	605	373	428	461	498	490	966	1,053	996	1,066	1,100
5 Methylene chloride	402	564	592	532	584	607	467	566	516	504	482	461	390	362	354	345	310	300
6 Perchloroethylene	707	765	691	585	547	573	678	414	473	498	481	372	240	245	271	247	260	275
Subtotal B (3+..+6) =	1,772	2,044	2,093	1,782	1,902	2,067	1,835	2,007	1,824	1,954	2,012	1,815	1,560	2,088	2,154	2,153	2,221	2,275
% annual change =		NR	2.4%	-14.9%	6.7%	8.7%	-11.2%	9.4%	-9.1%	7.1%	3.0%	-9.8%	-14.0%	33.8%	3.2%	-0.0%	3.2%	2.4%
% of total row C =	13%	10%	11%	12%	9%	11%	8%	9%	8%	8%	8%	7%	6%	7%	6%	6%	6%	6%
Effective annual rate of change 1970-1996 =																		**1.0%**
C. Total (A+B):	**13,272**	**19,618**	**18,941**	**14,303**	**20,283**	**18,862**	**23,399**	**23,386**	**22,423**	**24,040**	**25,530**	**26,289**	**27,175**	**28,545**	**34,321**	**35,670**	**34,461**	**37,675**
% annual change =		NA	-3.5%	-24.5%	41.8%	-7.0%	24.1%	-0.1%	-4.1%	7.2%	6.2%	3.0%	3.4%	5.0%	20.2%	3.9%	-3.4%	9.3%
Effective annual rate of change 1970-1996 =																		**4.1%**

Explanatory Notes:
(a) Source: Chemical Manufacturers Association, "US Chemical Industry Statistical Handbooks", 1992 & 1997.
(b) NR= Not relevant to annual change as first data point in series.

CHLORINATED ALIPHATIC HYDROCARBON - US PLASTICS

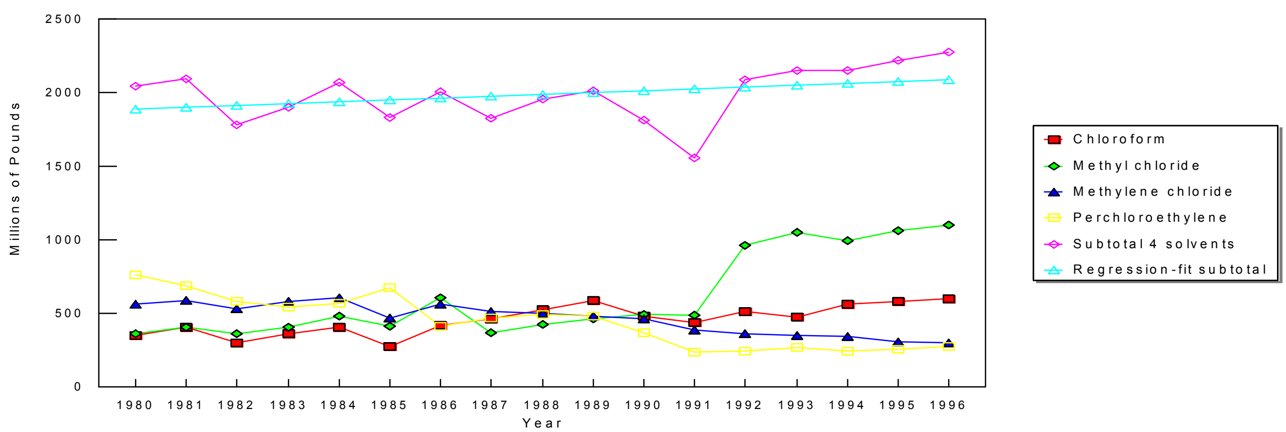
1980-96 Annual Quantity of US Production (two primary types)



Data source: "US Chemical Industry Statistical Handbook", Chemical Manufacturers Association.

CHLORINATED ALIPHATIC HYDROCARBON COMPOUNDS - US SOLVENTS

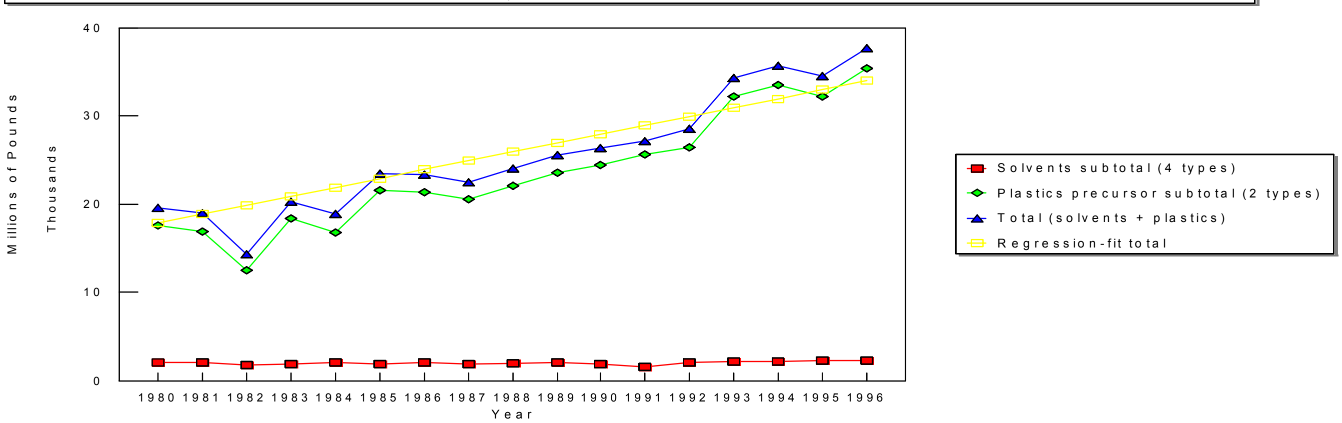
1980-96 Annual Quantity of US Production (4 primary types)



Data source: "US Chemical Industry Statistical Handbook", Chemical Manufacturers Association.
Note: Data above do not include other chlorinated aliphatics produced in smaller quantities.

CHLORINATED ALIPHATIC HYDROCARBON COMPOUNDS - US TOTAL

1980-96 Annual Quantity of US Production (Solvents & Plastics Precursors)



Data source: "US Chemical Industry Statistical Handbook", Chemical Manufactuers Association.
Note: Production total data above do not include other chlorinated aliphatics produced in smaller quantities.

CAHCs Manufactured in the US (1994 USITC Database)						
Item	USITC HTS Nr.	Chemical Name	Nr. US Companies	US Annual Production (million lbs)	US Avg Price ($/lb)	Market Value (million $)
A. Chlorinated Aliphatic Hydrocarbons (Without Other Halogens):						
1	29031100	Chloromethane (methyl chloride)	6	998.4	$0.25	$250
2	29031100	Chloroethane (ethyl chloride)	2	NR	NR	NR
3	29031200	Dichloromethane (methylene chloride)	3	403.0	$0.17	$69
4	29031300	Trichloromethane (chloroform)	3	479.1+	$0.19	$479
5	29031400	Tetrachloromethane (carbon tetrachloride)	3	NR	NR	NR
6	29031500	*1,2-dichloroethane (ethylene dichloride)	10	16,744	$0.10	$1,674
7	29031910	**Tetrachloroethane (perchloroethylene)	3	246.7	NR	NR
8	29031950	1,1,1-trichloroethane (methyl chloroform)	3	NR	$0.31	NR
9	29031950	1,1,2-Trichloroethane (vinyl trichloride)	1	NR	NR	NR
10	29031950	1-chlorobutane (n-butyl chloride)	1	NR	NR	NR
11	29032100	Chloroethylene (vinyl chloride)	11	13,836	$0.21	$2,906
12	29032200	Trichloroethylene	2	NR	NR	NR
13	29032900	3-chloropropene	2	NR	NR	NR
14	29032900	1,3-dichloropropene	1	NR	NR	NR
15	29032900	2,3-dichloropropene	1	NR	NR	NR
16	29032900	1,2,3-trichloropropane	1	NR	NR	NR
17	29032900	1,1-dichloroethylene (vinylidene chloride)	2	161.7+	$0.43	$70
Subtotal A (only with data shown) =				32,869	$0.17	$5,448
B. Chlorinated Aliphatic Hydrocarbons with Other Halogens (Bromine and/or Fluorine):						
18	29034000	Bromochloromethane	1	NR	NR	NR
19	29034000	2-bromo-2-chloro-1,1,1-trifluoroethane	1	NR	NR	NR
20	29034000	1-chloro-1,1-difluoroethane	2	NR	NR	NR
21	29034000	Chlorodifluoromethane	4	304.4	$1.07	$326
22	29034000	Chlorotrifluoroethylene	1	NR	NR	NR
23	29034000	Chlorotrifluoromethane	2	NR	NR	NR
24	29034000	Dichlorodifluoromethane	4	126.7	$2.05	$260
25	29034000	1,1-dichloro-1-fluoroethane	2	NR	NR	NR
26	29034000	Trichlorofluoromethane	4	16.1+	$1.45	$23
27	2903400	Trichlorotrifluoroethane	3	271.6	$1.65	$448
28	290319	Others not listed above	NR	910.7	NR	NR
Subtotal B (only with data shown) =				1,629	$0.65	$1,057
Total A + B (only with data shown) =				34,498	$0.19	$6,505
1 - 28	2903	Total halogenated hydrocarbon derivatives***	NR	36,174	$0.25	$9,044

Explanatory Notes:
(a) Production data include the total output of US plants (i.e. the quantities produced for consumption within the producing plant, as well as the quantities produced for domestic sale and export).
(b) 1994 US production data source: US International Trade Commission, Synthetic Organic Chemicals:1994, (Nov.1995). USEPA-OSW-EMRAD computed pounds production from USITC kilogram data, by multiplying USITC data by the conversion ratio 2.203 lbs/kgm.
(c) NR= Data for chemical not reported by the USITC to protect confidential data for <3 US producers.
(d) * Over 90% of 1,2-dichloroethane is used as an intermediate for the production of vinyl chloride and polyvinyl chloride.
(e) ** The symmetrical isomer 1,1,2,2-tetrachloroethane has commercial uses, whereas the unsymmetrical isomer 1,1,1,2-tetrachloroethane is not available in commercial quantities; it is present as an unisolated intermediate (impurity) in some processes for the manufacture of trichloroethylene and tetrachloroethylene from 1,2-dichloroethane (WHO, 1986, p.88).
(f) *** Total halogenated hydrocarbons include aliphatics greater than five carbons, plus cyclic and aromatic hydrocarbons (includes chlorinated plus brominated, fluorinated and iodinated compounds).
(g) Number of companies indicated above are overlapping; number of chemical plants may exceed number of companies.
(h) The chemical names and production quantities of all CAHCs are not listed above because data on minor quantities, captive intermediates (hexachlorocyclopentadiene, chloroprene, and dichlorobutane, USEPA 1984, p.8)), and by-product impurities are not reported by the USITC (e.g. pentachloroethane).
(i) List of chemicals above does not include polymers/copolymers manufactured from CAHCs as intermediate feedstocks.

V.F. What are the Names/Locations of Current CAHC Manufacturers in the US?

Attachment B to this document presents **five alternative lists** of companies and facilities which are known to manufacture CAHCs in the US during the 1990s. Each list represents information collected from five different reference sources, as summarized in the table below:

Alternative Information Sources on Identity of Companies/Facilities Which Manufacture CAHCs in the US

Item	Company/Facility Information Source	Data Year	CAHC Manufacturing	
			Company Count*	Facility Count
1	US International Trade Commission's (USITC) "Synthetic Organic Chemicals" production & sales annual database	1994	29	Not provided
2**	USEPA-OSW's RCRA Hazardous Waste "Biennial Reporting System" (BRS) database	1995	17	26
3	USEPA-OSW RCRA Section 3007 industry mail survey	1997	16	23
4	ChemExpo Chemical Profile "Online Purchasing" (http://www.chemexpo.com/news/)	1997	14	20
5***	Chemical Manufacturers Association public comment to the 1999 proposed K173/K174/K175 listing rule	1999	29	39

Explanatory Notes:
(a) * Company count shown may include separate subsidiaries or business divisions under the same parent company.
(b) ** BRS counts based on query of F024 & F025 RCRA hazardous waste generators.
(c) *** CMA counts included companies & facilities which manufacture halogenated aliphatic hydrocarbon chemicals containing other halogens (bromine, fluorine) in addition to chlorine in the same chemical.

As shown in the table above, the total number of CAHC manufacturing facilities (i.e. establishments and unique geographic sites) are actually greater than the number of companies, because many CAHC-producing companies own and operate more than one CAHC facility. Another conclusion from comparison of these alternative lists is that the exact number of CAHC producing facilities currently operating in the United States is not readily discernable.

During the course of developing the 1999 K173/K174/K175 listing proposed rule, USEPA developed a working list of current CAHC manufacturers, in consultation with industry contacts, for administering the RCRA Section 3007 survey in 1992 (initial mailing) and in 1997 (follow-up update). This 1999 working list initially contained 28 facilities with 20 associated parent companies, but USEPA refined this list by subtraction of two plants which closed their CAHC manufacturing processes, two which produce "de minimis" CAHC quantities annually, and one which was double-counted. Consequently, USEPA' industry survey-based, 1999 "working list" consisted of 23 US CAHC manufacturing facilities operated by 16 parent companies, as displayed in **Attachment B**. The map provided below displays the location of 26 of the 28 initially-identified facilities, 17 of which are clustered along the Gulf of Mexico coastal area of Texas and Louisiana.

USEPA modified this 1999 working list for the final rule, by including:

- More recent information (on 39 facilities) provided in the November 1999 public comments to the 1999 K173/K174/K175 listing proposal, from the Chemical Manufacturers Association (also provided in **Attachment B**).

- Follow-up research information into the types of chemical products manufactured by the companies on CMA's list (see memorandum referenced in the "*Listing Background Document*" for the K174/K175 final rule). About 15 of the companies listed on CMA's list are manufacturers of chlorofluorocarbons, which are types of mixed chlorinated/halogenated aliphatic hydrocarbon compounds, not covered by the scope of the K174/K175 rulemaking (39-15 = 23 relevant facilities on CMA's list).

- An additional information source ("ChemExpo" chemical profiles website). The findings from this website constitute one of the five alternative company lists presented in **Attachment B** to this document.

Although not displayed in this document, these three modifications resulted in a non-duplicative count of **16 companies** operating **25 facilities** which manufacture at least one type of CAHC in the US (as of 1999). These 25 CAHC manufacturing facilities are located in the following **eight states**:

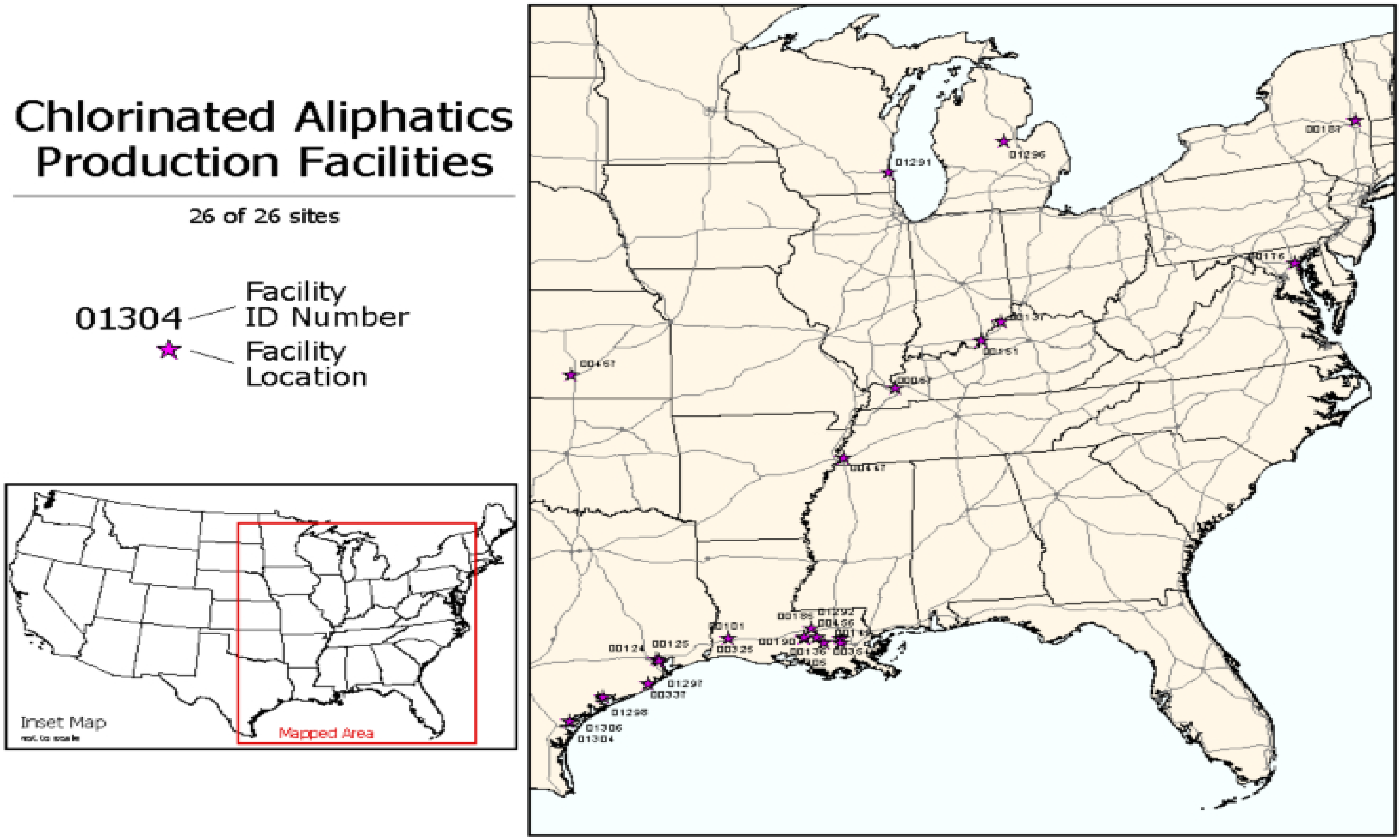
States Where CAHC Manufacturing Facilities are Located (in the 1990s) As Relevant to the Scope of the K174/K175 Final Rule			
Item	Facility Location (State)	CAHC Facility Count	EDC/VCM Facility Count
1	Kansas	1	1
2	Kentucky	2	1
3	Louisiana	10	9
4	Michigan	1	0
5	New York	1	0
6	South Carolina	1	0
7	Texas	8	7
8	West Virginia	1	0
	Column Totals =	25	18

Because of the fact that the scope of both the K174 and K175 components of the final rule is limited to only EDC/VCM manufacturers, not to all CAHC manufacturers, the relevant **master list** of companies and facilities potentially affected by the final rule, consists of the smaller subset of **11 companies** and **18 facilities** shown in the table below.

List of 18 EDC and/or VCM Manufacturing Companies in the US (as of 1999) (Source: Derived from Five Alternative Lists Displayed in **Attachment B**)					
Facility Count	Company Count	Company Name*	Facility Location		EDC or VCM Products Manufactured**
			City	State	
1	1	Borden Chemicals & Plastics Ltd.	Geismar	LA	EDC, VCM-A
2	2	Condea Vista (subsidiary of RWE-DEA of Hamburg, Germany)	Lake Charles	LA	EDC, VCM
3	3	Dow Chemical Company	Freeport	TX	EDC, VCM
4			Oyster Creek	TX	EDC, VCM
5			Plaquemine	LA	EDC, VCM
6	4	Formosa Plastics Corp. USA	Baton Rouge	LA	EDC, VCM
7			Point Comfort	TX	EDC, VCM
8	5	The Geon Company	LaPorte	TX	EDC, VCM
9	6	Georgia Gulf Corp	Plaquemine	LA	EDC, VCM
10	7	OxyChem (Occidental Chem Co., a subsidiary of Occidental Petroleum Corp.)	Convent	LA	EDC
11			Corpus Christi	TX	EDC
12	5 + 7	OxyVinyls LP (76:34 joint venture between OxyChem & Geon)	Deer Park	TX	EDC, VCM
13	7 + 8	OxyMar (joint venture of OxyChem & Marubeni Corp of Japan)	Ingleside (Gregory)	TX	EDC, VCM
14	6 + 9	PHH Monomers (50:50 joint venture between PPG Industries & Georgia Gulf***)	Lake Charles	LA	VCM
15	9	PPG Industries	Lake Charles	LA	EDC
16	10	Vulcan Chemicals (business unit of Vulcan Materials Company)	Geismar	LA	EDC
17			Wichita	KS	EDC
18	11	Westlake Monomers Corp.	Calvert City	KY	EDC, VCM

Explanatory Notes:
(a) Source: Compilation from alternative tables of company and facility lists presented in **Attachment B** to this document.
(b) * Company name shown may represent subsidiary (affiliate), not parent company name.
(c) ** Some companies or facilities listed above may also manufacture other types of CAHCs.
(d) *** Georgia Gulf acquired Condea Vista's 50% share in August 1999 (http://www.condea.de/presse1.html).
(e) VCM-A = acetylene-based VCM manufacturing process using a mercuric chloride catalyst.

Some manufacturers of CAHCs use them captively onsite (i.e. in ***vertically integrated*** industrial processes), to produce other chemical products. For example, the chemicals ethylene dichloride (**EDC**) and vinyl chloride monomer (**VCM**) are used by some companies captively for the production of polymers (i.e. plastics precursors for the manufacture of polyvinyl chloride). Based on the USITC 1992 and 1994 data, there have been 20 CAHC-based polymer manufacturing companies, of which at least seven companies (Borden, Dow, Formosa, Geon, Georgia Gulf, Occidental, Westlake), are also CAHC manufacturers.


Chlorinated Aliphatics
Production Facilities
26 of 26 sites
01304
Facility
ID Number
Facility
Location
Inset Map
not to scale
Mapped Area

V.G. Is the US CAHC Manufacturing Industry Static or Dynamic?

In addition to changing CAHC manufacturing plant locations, this industry sector exhibits dynamic business activity involving changing company ownership and plant production capacities.

After USEPA's generation of a master list of relevant industrial facilities, for purpose of designing the risk analysis for the 1999 K173/K174/K175 proposed rule, there have been a number of recent and planned changes in the **market structure** (i.e. number of facilities and annual capacity) and **facility ownership** of the US CAHC manufacturing industry, as summarized in the table below.

Examples of Dynamic Business Plans (1996-2003) for CAHC Manufacturing in the US

News Item	Event Year	Companies Involved	Description of Planned Business Changes in the US CAHC Manufacturing Industry
1	1996	Georgia Gulf Company	Added 350 million pounds EDC/VCM capacity (at Plaquemine LA) in late 1996.
2	1996	PHH Monomers	The 50:50 joint venture between PPG Industries and Condea Vista, opened a 500 million pound VCM facility (at Lake Charles LA) in late 1996
3	1997	Occidental Chemicals & Marubeni Company of Japan ("OxyMar")	"OxyMar", a joint venture of Occidental Chemicals and Marubeni Companies, completed a 700-million pound expansion of its Ingleside, TX VCM facility in July 1997, increasing capacity to 2.1 billion pounds
4	1999	Dow Chemical	In multiple stages beginning in 1999, Dow Chemical will spend more than $10 million to upgrade its chloromethanes plant in Freeport, TX. The plant will be modernized, increasing its reliability as well as its annual production capacity for methyl chloride, and downstream production of methylene chloride and chloroform. (C&EN, 03 Aug 1998, p.12).
5	1999	Occidental Chemicals & Geon Company	These two companies in April 1999 completed formation of their "OxyVinyls" joint venture (76%:24% shares, respectively), creating North America's largest producer of PVC resins, with annual capacities of 4.2 billion pounds PVC and 4.8 billion pounds VCM (C&EN, 29 June 1998, p.13, 26 April 1999, p.12, 10 May 1999, p.11).
6	1999	Condea Vista, PHH Monomers & Georgia Gulf	Georgia Gulf agreed to purchase Condea Vista's vinyls business, gaining two plants in Lake Charles LA; a VCM plant, and 50% share in PHH Monomers, in August 1999 (http://www.condea.de/presse1.html ; C&EN, 06 Sept 1999, p.14)
7	2000	Borden Chemicals & Plastics Co.	Plans after the end of 1999, to expand its 320 million pound (160,000 short tons) acetylene-based VCM plant (in Geismar LA), by 250 million pounds
8	2000	Vulcan Chemicals Co. & Mitsui & Company of Japan	Planned joint venture between Vulcan Chemicals and Mitsui & Company of Japan (51%:49%, respectively), to expand ethylene dichloride (EDC) production at Vulcan's Geismar LA plant by early 2000. The $200 million project is designed to expand EDC annual capacity at the plant from 300 million to 540 million pounds, using an oxygen-based EDC technology which will reduce air emissions, and rather than being consumed internally for polyvinyl chloride (PVC) production, Mitsui plans to buy all the EDC output for export to Asian PVC plants (C&EN, 29 June 1998, p.17, 07 Sept 1998, p.17).
9	2000	Borden Chemicals & Plastics Co, Vulcan Chemicals & Mitsui, PPG Industries, Dow Chemicals, Geon Co.	Construction by year 2000 of pipelines to connect facilities in the Gulf Coast region into "triangular" linkages, which manufacture chlor-alkali, isocyanates, EDC/VCM, and PVC chemicals (C&EN, 07 Sept 1999, pp.17-20).

10	2002	Shintech Company (subsidiary of Shin-Etsu of Japan)	Plans to construct a new $700 million vinyls complex, with 500,000 metric tons (1.102 billion pounds) each annual production capacity for VCM and PVC (in St.James Parish, LA). This plan was reportedly put on hold because of community resistance (USA Today, "LA Town Successful in Stopping Plastics Plant", Traci Watson, 18 Sep 1998, http://archives.usatoday.com). Recent industry news indicated that construction of Shintech's new PVC unit will be 900 million pounds annual capacity, located in Plaquemine LA, and completed in early 2002 (http://www.manufacturing.net 04 Nov 1999)
11	2002	Vulcan Materials Company	$50 million plant startup for pentachloropropane production in mid-2002 at Geismar LA (Chem.Eng., July 2000, p.145 http://www.che.com)
12	2003	EVC International NV of Belgium & Bechtel (San Francisco)	These two companies signed an agreement to design and build the first industrial-scale plant to produce VCM using EVC's ethane-to-VCM process. The plant will probably be located in the Gulf of Mexico region, and will go onstream in 2003, with either one or two lines of 150,000 metric tons annual capacity. Traditional VCM production requires two steps (chlorination of ethylene to EDC, followed by cracking of EDC to VCM), whereas the EVC process is one step using a proprietary catalyst, with 30% lower production costs expected (Chem..Eng., Oct 1999, p.19).

V.H. Have CAHCs Been Produced Historically in Other Locations in the United States?

In addition to current databases, there are assorted documents which contain historical information about the CAHC production industry in the United States. Historically, CAHCs have been manufactured and/or used as feedstocks/intermediates in chemical production plants in at least 15 states in the US. The historical data on the number and location of CAHC production facilities serves to illustrate the dynamic business activity in this industry sector. As late as 1975, CAHCs were produced in the United States by about 32 companies in 59 plant locations, the identity of those which no longer apparently produce CAHCs are listed in the table below.

38 US Locations Where CAHCs Were Once Manufactured as of 1960-1975 (Historical Annual CAHC Production Capacities in Metric Tons)					
Location	Met.tons	Location	Met.tons	Location	Met.tons
1.Cold Creek AL	11,300	14.Berlin NH	???	27.Cedar Bayou TX	59,000
2.LeMoyne AL	90,700	15.Deepwater Pt NJ	111,100	28.Corpus Christi TX	136,100
3.Carson CA	45,400	16.Newark NJ	???	29.Houston TX	27,200
4.Irwindale CA	1,800	17.Lockport NY	3,600	30.Oyster Creek TX	499,000
5.Pittsburg CA	45,400	18.Texas City TX	59,000	31.Port Neches TX	81,600
6.Watson CA	11,300	19.Niagra Falls NY	68,000	32.Marinette WS	???
7.Delaware City DE	90,700	20.Syracuse NY	18,600	33.Belle WV	???
8.Brandenburg KY	59,000	21.Waterford NY	22,700	34.Institute WV	72,600
9.Sauget IL	64,900	22.Henderson NV	31,800	35.Moundsville WV	95,700
10.Mount Vernon IN	27,200	23.Ashtabula OH	22,700	36.Natrium WV	50,400
11.Taft LA	45,300	24.Barberton OH	2,300	37.N.Martinsville WV	111,100
12.Midland MI	163,300	25.Painesville OH	31,200	38.S.Charleston WV	136,100
13.Muskegon MI	4,500	26.Bayport TX	417,300	Total capacity =	2,717,900

Explanatory Notes:
(a) * Capacities may refer to final chemical product for which CAHCs were used as reaction feedstocks or intermediates. Non-CAHC chemicals produced using CAHCs in the manufacturing process included phosgene and propylene oxide. In addition to CAHCs, chlorinated benzene (aromatic ring) compounds were also produced in some of these plants.
(b) Metric ton = 1,000 kilograms = 2,204 pounds (multiply metric ton capacities above by 2,204 to convert to pounds).
(c) Sources: 1975 locations in USEPA report authored by the Monsanto Co., Aug 1979, Table 7, pp.42-47, and NRC 1978, p.66; 1960 locations from J.S.Sconce, Table 12-3, p.337 & Table 26-2, p.784.

V.I. What Are the CAHC Manufacturing (Supply) Processes in the US?

CAHCs are manufactured by the chemical industry involving the further processing of five of the eight basic, **first-level derivative chemicals** in the organic chemical synthesis chain: butadiene, butylene, ethylene, methane, and propylene (CMA 1997, pp.9-17). The other three first-level organic chemical derivatives produced from oil, natural gas and coal raw materials -- benzene, toluene, xylene -- are cyclical compounds which are used for the manufacturing of chlorinated cyclic hydrocarbon compounds (among other chemicals), which are not included within the scope of this economic study.

In large part, CAHCs are manufactured by the ***chlorination*** of the first-level organic derivatives (i.e. aliphatic hydrocarbons refined from oil/gas), but may also be produced from second-level derivatives as direct products, co-products, and as by-products.[16] For example, carbon tetrachloride may be produced from at least three chemical chlorination processes through the methane or ethylene organic chemical chains: (a) chlorination of methane, (b) chlorination of carbon disulfide, and (c) chlorination of partially chlorinated short-chain hydrocarbons as a co-product with tetrachloroethylene (WHO, 1979, p.373). The production of CAHCs constitutes over 40 percent of total chlorine consumption by the US chemical industry (CMA, 1992, p.31).

Although the plants which manufacture CAHCs differ in process design, size and specific CAHC products manufactured, a common factor is the utilization of one or more general chemical reaction types in a series of ***unit processes*** to generate higher degrees of chlorinated compounds. Most of the CAHCs were first synthesized in the early 1800s, with commercial production in the US of 1,2-dichloroethane reported in 1922, and of carbon tetrachloride and chloroform reported as of 1925 (Sconce, p.15), but large volume growth of commercial production of many of the CAHCs did not begin in the US until the 1930s-50s.

More than one type (i.e. chemical composition) of CAHCs may be produced by a single chemical plant, while more than one chemical plant may produce CAHCs using different chemical reaction processes, in conjunction with different industrial product lines (as is illustrated by the array of multiple **Standard Industrial Classification (SIC) codes** associated with chemical manufacturing facilities, as displayed in a table in the Federal regulatory analysis chapter of this document). Furthermore, chemical plants in one geographic region (or country) may produce CAHCs using processes different from other regions (or countries).

For example, the chlorination reaction between ethylene and chlorine yields a mixture of ethylene dichloride, 1,1-dichloroethane, and 1,1,2-trichloroethane. By controlling the temperature of the reaction and by using specific catalysts (e.g. ethyl bromide, metal chlorides), the production of specific CAHC products may be enhanced. Specific CAHCs may be produced by more than one method; for example, ethylene dichloride may also be produced by hydrochlorination of ethylene, and as a by-product of trichloroethylene syntheses (NIOSH, 1976, p.16). Basically, the following five general ***chemical conversion processes*** may be used to manufacture CAHCs from chlorine, hydrocarbon and other feedstocks:

[16] CAHCs are unintended by-products from anthropogenic activities: (a) tetrachloroethane reportedly may be formed in small quantities as unwanted by-products during the sanitary chlorination of water in municipal sewage and water treatment plants, with concentrations in samples of water utilities ranging from 0.07-0.46 micrograms/liter (WHO, 1979, p.496), and (b) cigarette smoke contains chloromethane (WHO, 1986, p.168). These examples represent from a strict definition perspective, other sources besides chemical plants of CAHC production in the US, but which are outside the scope of the RCRA listing final rule.

Industrial Process Methods for Manufacturing CAHCs		
Item	Process Name	Chemical Reaction Description
1	Free radical initiation	Chemical addition, substitution, and pyrolysis reactions using molecular chlorine (diatomic gas) as a feedstock (i.e. gas phase reaction), at high reactor temperatures ranging from 200-900°C, and reactor residence time of 3-12 seconds.
2	Lewis acid catalyzed	Chemical addition and substitution reactions using molecular chlorine (diatomic gas) as a feedstock (i.e. gas phase reaction), at low reactor temperatures (40-50°C), and with metal-based catalysts (e.g. mercury chloride or zinc chloride).
3	Oxychlorination	Utilizing hydrogen chloride, air and metallic catalyst (e.g. copper) at medium temperatures (230-315°C), with 15-22 seconds reactor residence time.
4	Base catalyzed	Dehydrochlorination at low temperature using sodium hydroxide slurries.
5	Metal catalyzed	Catalyzed (e.g. zinc chloride) chlorination of alcohols at high temperature (500°C).
6	Ionic catalyzed	Liquid phase chemical reaction at well below 100°C reaction temperature.
Sources: Items 1-5 from USEPA 1984, pp. 8-15. Item 6 from DuPont Dow Elastomers LLC 19 Nov 1999 comments (CALP-00001) to the RCRA Docket, on the 1999 proposed K173/K174/K175 listing rule.		

Each process consists of an integrated series of chemical reactors and associated purification units employed to produce a range of desired CAHC products. One process involves low temperature acid catalyzed reactor units which reportedly do not generate quantities of hazardous chemical constituents in its process wastes. Most reaction mechanisms involve high temperatures in a chemical process catalyzed by "free radicals"; the free radical conversions have been of interest to the USEPA because there is carry-over of toxic by-products as well as intrinsically toxic intermediates and products formed during the these processes (USEPA 1984, p.22). Either process may occur in conjunction with other catalyzed reactions in integrated process units.

Some CAHC production methods involve using inorganic (metal) compounds as reactants or catalysts, such as the production of choromethane (methyl chloride) with a reaction involving dimethyl sulphate with aluminum chloride or sodium chloride, or involving decomposing monochlorodimethyl ether with zinc (WHO, 1986, p.163). CAHCs may also serve either as captive-process or as open-process intermediate feedstocks for the production of other chemicals.

CAHCs may also be manufactured unintentionally as byproducts associated with the manufacture of other types of chemicals. For example, trichloropropane is reportedly a byproduct of Dow Chemical Company's process for making epichlorohydrin at its Freeport TX plant. Epichlorohydrin is a chemical intermediate that Dow uses to manufacture epoxy resins. The trichloropropane is not marketed, but as of 1999 is incinerated because there is reportedly no economical way to use it. However, Dow reports that it may have successfully developed an enzymatic process to convert this byproduct to epichlorohydrin (Chem.Eng., Sept 1999, p.19).

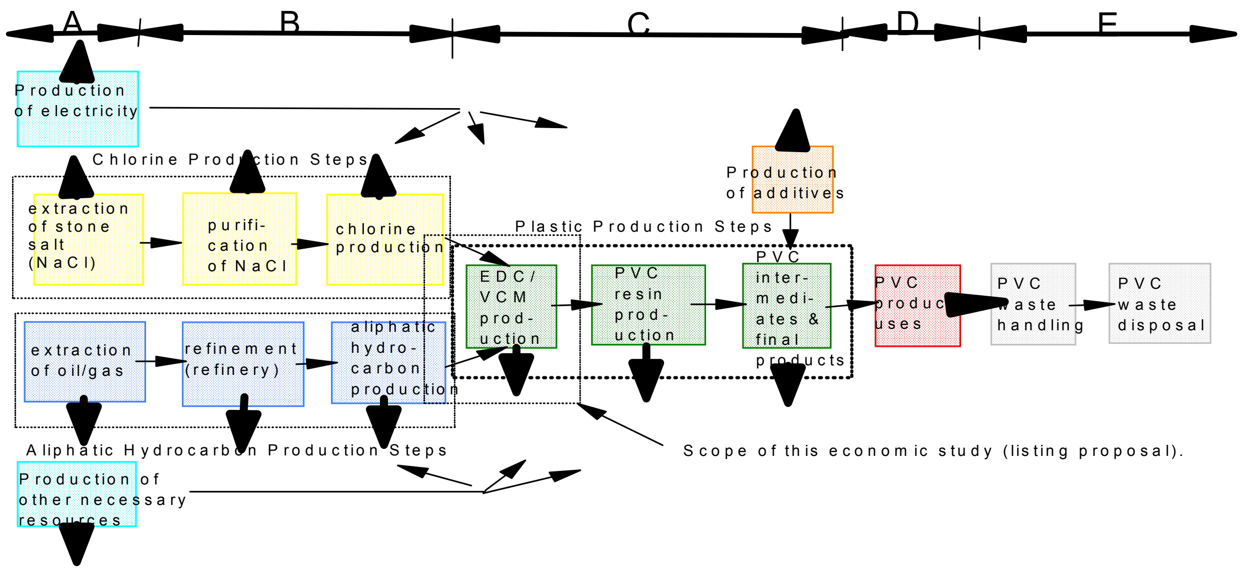
V.J. How is CAHC Manufacturing Situated Within the Material Flow Structure of the US Economy?

The two exhibits below present box-flow diagrams which depict the industrial processes associated with the production of CAHCs, including upstream and downstream processes and economic activities, from an ***industrial ecological perspective*** (i.e. within a "life cycle assessment", "substance flow analysis", "materials flow analysis", or "cradle-to-grave" framework). The arrowed sections designated as A, B, C, D, E on each exhibit represent the five basic life cycle stages (i.e. A=extraction, B=processing, C=manufacture, D=use, E=disposal).

Although these exhibits present two separate material flow diagrams, they are largely interlinked in the chemical industry, whereby EDC/VCM may be used as inputs not only for PVC production, but for the manufacture of chlorinated solvents. The manufacturing processes for chlorinated solvents, and the various products made from them, reportedly form one of the most complex and tightly integrated networks in the chemical industry, consisting of a web of substances and processes that are closely interlinked and often only produced economically on highly integrated industrial sites (Hampson, 1991, p.31).

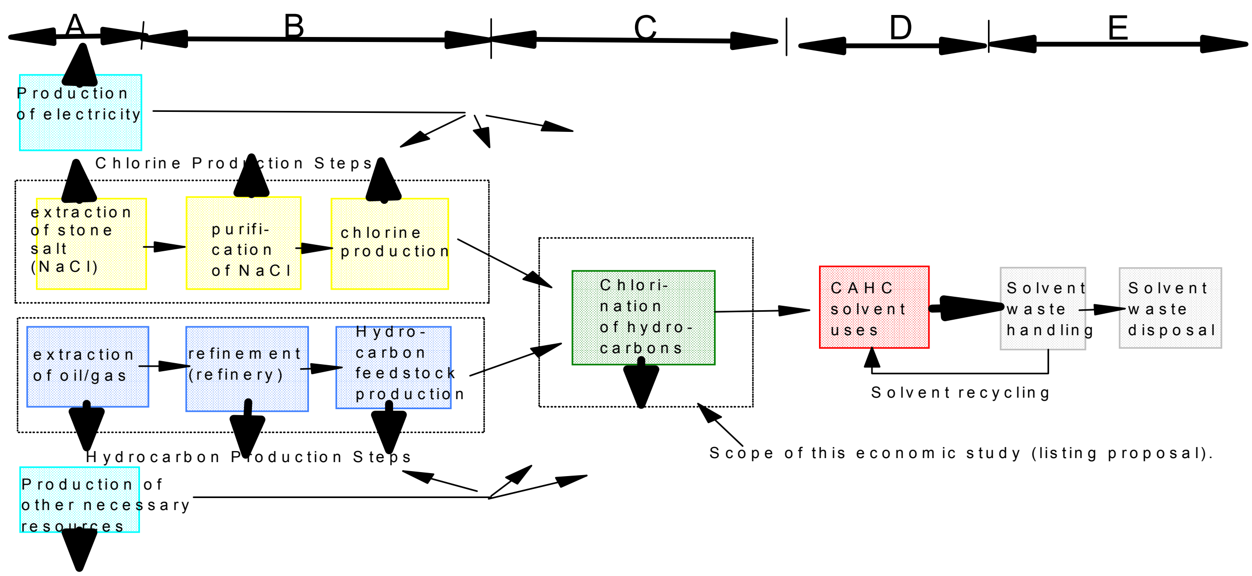
It is important to indicate that other types of industrial processes and operations not depicted in these two process-flow exhibits, but economically-linked, may be impacted by the listing. For example, the commercial waste management industry is impacted by the listing, but not shown within these two "industrial ecology" perspectives. USEPA's intention in providing these exhibits is not to depict all potentially affected economic sectors, but to provide a simplified overview of the interconnected economic sectors both "upstream" and "downstream" to the chlorinated aliphatics manufacturing sector. It is also important to indicate that these other upstream and downstream inter-linked industrial sectors – i.e., the chlorine production and the hydrocarbon production upstream steps, and the PVC and CAHC solvents downstream supply chains – are not subject to the RCRA K174/K175 final rule.

Industrial Ecology Life Cycle Depiction of CAHC-Based **Plastics Manufacturing**



Large arrows indicate by-product and waste generation/treatment/disposal in upstream processes.
Source: Adapted from Tukker et al, 1997, p.96, & Peerebom et al., 1998, p.112.

Industrial Ecology Life Cycle Depiction of CAHC **Solvent Manufacturing**



Large arrows indicate by-product and waste generation/treatment/disposal in upstream processes.
Source: Adapted from Peerebom et al., 1998, p.112, and Ayres & Ayres, 1997, p.83.,

V.K. How Effective Are CAHC Manufacturing Processes in Producing Desired Chemical Products?

The free radical catalytic processes are not totally specific in producing a single desired chemical product; thus reactor conditions can only be arranged to maximize the quantity of desired products. Therefore, for any given CAHC manufacturing facility, a **range of CAHC products** will be formed with different molecular structures (i.e. number of chlorine and carbon atoms), and these different products have been found in plant process wastes. In addition, other chlorinated aromatic products (i.e. ring-like molecular structures) have been found as contaminants in waste samples from these types of chemical manufacturing facilities (Fed.Reg. 10 Feb 1984, p.5309; USEPA 1984, p.23).

The technical "*Background Document*" to the 1984 USEPA listing proposal for chlorinated aliphatics (i.e. which created the RCRA F024 and F025 hazardous wastecodes), provides the following description of chemical formation during the ***free radical manufacture*** of chlorinated aliphatics, based on chemical reaction theory and knowledge of actual industrial processes:

> "[F]or any given C_1-C_5 process, a range of by-products will be formed having both higher and lower carbon atoms and higher and lower amounts of chlorine substitution... For example, the thermal free radical chlorination of ethylene will yield primarily the initial desired [i.e. two-carbon based molecule] products, ethyl chloride and dichloromethane. However, polychlorinated C2 compounds and longer carbon chain length chlorinated compounds and tars are also produced. The primary side reactions which are predicted to produce the majority of waste constituents are free radical initiated polymerizations, polychlorinations, and dechlorinations, carbon bond cleavages, and cyclizations... Therefore, free radical size reactions (as well as other types of side reactions) will theoretically lead to many different chemical species having greater and lesser carbon chain lengths, different skeletal [i.e. molecular] structures, degree of bond saturation, and degree and position of chlorination... For example, a two-carbon chain feedstock (e.g. ethylene) side product will include one carbon chlorinated species (chloromethane, dichloromethane) as well as chlorinated coupling products (chlorinated butanes, polychlorinated polymers, and tars). An almost infinite number of waste constituents can be predicted from organic chemical mechanistic considerations."
> (Sources: USEPA, 1984, pp.22-26; references for theoretical predictions cited in 1984 are Kirk Othmer, Encyclopedia of Chemical Technology; Van Oss, Chemical Technology: An Encyclopedic Treatment, Morrison & Boyd, Organic Chemistry (textbook); and Fieser & Fieser, Advanced Organic Chemistry (textbook)).

Because of the fact that **undesired side- or by-product constituents** have been found in the purification wastes from these processes, carry-over or retention of what in most cases is a toxic product -- as described in the following section below -- into these wastes typically occurs.

For both the 1984 listing proposal and the 2000 K174/K175 final listing rule for the CAHC manufacturing industry, the USEPA compared the predicted range of toxic constituent by-products, with actual chemical analyses of wastes from these processes. The 1984 USEPA technical "*Background Document*" (pp. 2-3 & Table 5, pp.49-52) listed a total of **36 hazardous constituents** of concern, and the more recent risk analysis report (RTI, 1998, p. 4-9) which supports the current listing final rule, listed a total of **61 constituents of concern**, based on chemical sampling analysis during 1997 of actual waste streams from CAHC manufacturing plants in the US. These constituents of concern include chlorinated and non-chlorinated volatile organics, metals, and aromatic and molecularly complex (e.g. dioxin and dibenzofuran) compounds, as described in the "*Risk Analysis Background Document*" for this listing rule (as cited in the Federal Register announcement for the rule, and as available from the RCRA Docket by calling 800-424-9346, or by Internet request via the website http://www.epa.gov/epaoswer/osw/infoserv.htm#info).

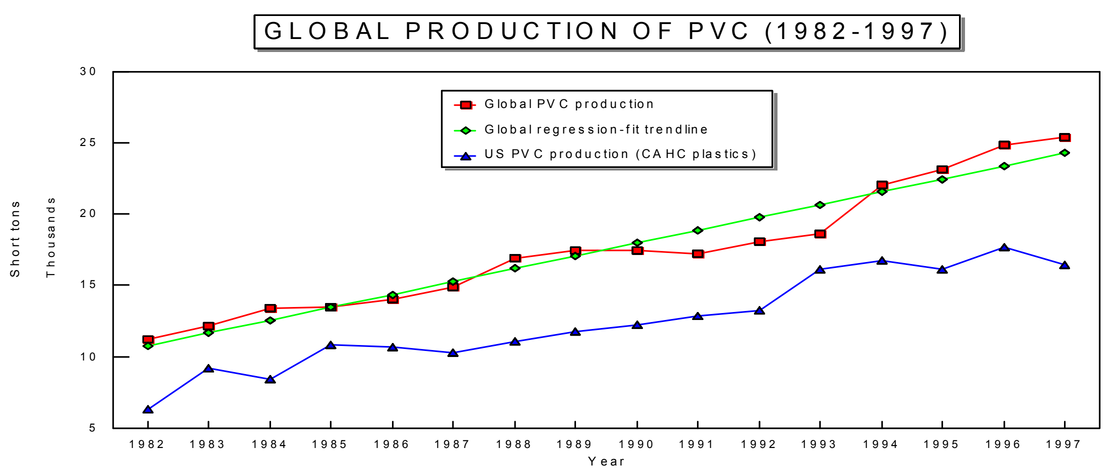
V.L. How Does US CAHC Production Compare to Global CAHC Production?

Because of the fact that PVC production represents about 95% of total CAHC consumption in the US, PVC production data in itself constitutes an approximating or "proxy" measure of CAHC production, which may be compared to the available global PVC production data, as displayed below in companion table and exhibit. Global PVC production (**39 countries**) has grown an average annual rate of 5.23% over the 16-year period 1982-1997, with US share of global production averaging about **71%** during this period.

US & Global Production of Polyvinyl Chloride (PVC)
as Indicator of Relative Marketshare

		Global PVC Production						**US PVC Production**	
Item	Year	Data source#1: (1000 metric tons)	Data source#2: Standard-ized units (1000 m.tons)	Data source#3: (1000 metric tons)	Average of 3 data sources (1000 m.tons)	Standardized average of 3 data sources (1000 tons)	Annual % change	Data source#4: standardized units (1000 tons)	US share as % of global prod-uction
1	1982	10,181.1			10,181.1	**11,225.0**		**6,260.5**	**56%**
2	1983	11,031.4			11,031.4	**12,162.5**	8.35%	**9,190.5**	**76%**
3	1984	12,112.6		12,102	12,107.3	**13,348.7**	9.75%	**8,397.5**	**63%**
4	1985	12,177.9		12,187	12,182.5	**13,431.6**	0.62%	**10,782.0**	**80%**
5	1986	12,672.7		12,684	12,678.4	**13,978.3**	4.07%	**10,689.5**	**76%**
6	1987	13,519.4		13,518	13,518.7	**14,904.9**	6.63%	**10,299.5**	**69%**
7	1988	14,522.0	17,000	14,510	15,344.0	**16,917.3**	13.50%	**11,043.0**	**65%**
8	1989	15,147.8	17,300	15,098	15,848.6	**17,473.6**	3.29%	**11,759.0**	**67%**
9	1990	15,250.9	17,500	14,763	15,838.0	**17,461.9**	-0.07%	**12,237.0**	**70%**
10	1991	14,869.3	17,400	14,552	15,607.1	**17,207.4**	-1.46%	**12,807.5**	**74%**
11	1992		18,000	14,737	16,368.5	**18,046.9**	4.88%	**13,228.5**	**73%**
12	1993		19,000	14,807	16,903.5	**18,636.7**	3.27%	**16,083.5**	**86%**
13	1994		20,000		20,000.0	**22,050.7**	18.32%	**16,758.5**	**76%**
14	1995		21,000		21,000.0	**23,153.3**	5.00%	**16,120.0**	**70%**
15	1996		22,500		22,500.0	**24,807.1**	7.14%	**17,700.0**	**71%**
16	1997		23,000		23,000.0	**25,358.3**	2.22%	**16,439.7**	**65%**
						Annual Averages =	**5.23%**		**71%**

Explanatory Notes & Data Sources:
#1: United Nations, "Industrial Statistics Yearbook 1991, Vol.II: Commodity Production Statistics", New York, 1993.
#2: Kirk-Othmer, "Encyclopedia of Chemical Technology", 4th ed., Vol.24, 1993, p.1037.
#3: United Nations, "Industrial Statistics Yearbook 1993, Vol.II: Commodity Production Statistics", New York, 1995.
#4: Chemical Manufacturers Association, "US Chemical Industry Statistical Handbook", 1997, pp.38,40.
Ton=short ton= 2,000 lbs; Metric ton= 1,000 kilograms = 2,204 lbs; 1.0 kilogram (kg)= 2.204 lbs.
m.ton= metric ton; Conversion: 1.0 short tons = 0.907 metric tons.



V.M. Are CAHCs Also Naturally-Occurring or Only Man-Made?

As late as the 1980s, the scientific community asserted that CAHCs have only infrequent, known natural occurrences. Three of the then reported exceptions are the following CAHCs (WHO, 1979, pp.375, 405, 550, & WHO 1986, p.166):

- Carbon tetrachloride: (tetrachloromethane) which may be formed in the troposphere by solar-induced photochemical reactions of manmade chlorinated alkenes which have been released into the air;

- Chloroform: which may be formed naturally in the troposphere by solar-induced photochemical reactions of trichloroethylene, which itself is not known to be a naturally-occurring substance; and

- Chloromethane: (methyl chloride) which is produced by in the oceans by seaweeds and a variety of marine microorganisms, and by combustion of organic matter such as forest fires.

However, by the 1990s, the scientific community published new assertions that about 2,000 chlorinated and other halogenated chemicals are discharged into the physical environment by plants, marine organisms, insects, bacteria, fungi, mammals, and by other natural processes (Gribble, 1994). The first international conference on naturally occurring organohalogens was held in 1993 in the Netherlands. It is now reported that chloride ions are normally present in plants, wood, soil and minerals, and their combustion (e.g. brush fires, vegetation fires, forest fires, volcanoes) inevitably leads to the formation of chlorinated organic compounds.

One study of lava gas emanations from four volcanoes in Japan and Italy revealed that more than 300 organic substances were detected among which 100 were chlorinated organic compounds (Jordan, et al. 2000). The most abundant organohalogen chemical species were chlorinated methanes, unsaturated chlorohydrocarbons, and chlorobenzene. The study identified 42 types of CAHCs in lava gas, 16 with different isomers. Chloromethane, chloroethene, chloroethyne, and tetrachloromethane reached concentrations of up to 100 parts-per-billion-volume (ppbv).

Marine and terrestrial organisms are now also known to have biogenic mechanisms involving enzymes which may chlorinate (and halogenate) organic compounds in vivo (Gribble, p.316A). At least **19 CAHCs** consisting of seven subclass#1 CAHCs (i.e. chlorinated only), and at least 12 subclass#2 CAHCs (i.e. chlorinated with other halogens), are now identified as naturally-occurring (Gribble, p.315A). **Global natural production** by marine and terrestrial organisms, of the simplest CAHC, chloromethane, is estimated at five million tons (**10 billion pounds**) annually (Gribble, p.310A).

CHAPTER VI

US CAHC MANUFACTURING WASTE MANAGEMENT BASELINE PRACTICES

VI.A. What is the Source of USEPA's Information on Baseline Waste Management in this Industry?

This document presents complementary and overlapping information collected from two sources, on baseline waste management practices used by CAHC manufacturing facilities, one source which is a publicly-available, annually updated database on industrial chemicals, and a second source which was custom-designed in support of this listing rule.

Presentation of both data sources in this document is consistent with the stated methodological orientation of this study, in at least two ways: (a) maximizing the transparency and public review of the data and information which underlie the analysis in this document, and (b) providing an industrial ecological framework to consideration of industrial wastes, and to wastes generated in association with the production and use of CAHCs in the economy, in particular:

Sources of Data on Industrial Wastes Generated by CAHC Manufacturing Facilities	
Source	Description
USEPA Annual TRI Database	USEPA's annual "Toxic Release Inventory" (TRI) database contains waste management and environmental release[17] information on over 640 chemicals manufactured, processed and used in the US economy. One of the specific purposes for the TRI database is to provide the public with a means to identify facilities and chemical release patterns that may warrant further study and analysis, including using the TRI as a tool for risk identification. The TRI is a relatively broad database compared to the narrow scope of this K174/K175 listing rule. USEPA's TRI data are available via the Internet at http://www.epa.gov/tri/ .
1997 USEPA Industry Survey	USEPA-OSW's 1992/1997 RCRA Section 3007 industry survey targeted at CAHC manufacturing facilities potentially affected by this RCRA listing. The survey instrument was a **46-page questionnaire** mailed directly by USEPA-OSW to facilities identified by OSW (a blank copy of the questionnaire is contained in the "*Listing Background Document*"). Compared to the TRI database, this custom-designed survey provides a narrow focus on the particular subset of industrial facilities, industrial operations, and types of CAHCs relevant to the listing rule.

[17] In contrast to other information sources, the vocabulary used in the USEPA's Toxic Release Inventory (TRI) database may be unique in the following way. The TRI defines the phrase "environmental releases" to include discharges (intentional or unintentional) of a chemical to the air, water, land, or underground environment. TRI-defined "releases" apply to wastes which are otherwise defined as "managed" or "disposed" in other information references. For example, some databases may classify wastes as being "managed" or "disposed" if handled in landfills, landfarming, surface impoundments, wastepiles, or discharged in directly to underground wells or to surface waters. However, the TRI classifies such handling as waste "releases", not waste "management". The TRI defined waste "management" as constituting recycling, and the destruction or alteration of the chemicals in wastes via energy recovery (excluding incineration), and treatment. For more information about the TRI, call the USEPA EPCRA Hotline at 800-424-9346 or via the Internet website http://www.epa.gov/enviro/html/tris/tris_overview.html.

The descriptive information collected from each of these two data sources concerning current (baseline) waste management practices associated with the manufacture of CAHCs, is summarized below.

VI.B. What Are the CAHC-Related Industrial Waste Management Practices Reported in the TRI?

The following series of tables in this section present baseline waste management data for chemical manufacturing, processing and otherwise using, industrial facilities reporting to the TRI. The data are expressed in tons of CAHCs in wastestreams managed, and are displayed for 66 different CAHCs grouped according to three CAHC subclasses (i.e. chlorinated only, chlorinated plus other halogens, and chlorinated plus other chemical elements). Baseline waste management practices are also grouped according to onsite and offsite management, as summarized in one of the tables below.

Manufacturing facilities reported a total of **819,000 tons** (1.64 billion pounds) of CAHCs in industrial wastes generated in 1996. The total amount of waste generated is larger than the quantities shown below, because wastestreams may contain more than one type of chemical or other constituent. However, this quantity is not directly relevant to the K174/K175 listing rule because the rule is targeted not at CAHCs in wastes, but at the small subset of industrial facilities which manufacture CAHCs. Also, the scope of the "*Risk Analysis Background Document*" for this listing rule is not limited to only CAHCs in wastes, but also to the potential risks associated with other chemical constituents in wastes generated by CAHC manufacturing facilities.

The table below displays the relative annual waste-generation magnitude between the three different types of chlorinated compounds – chlorine-only, with other halogens, and chlorine with other chemical elements (e.g. oxygen, nitrogen).

Summary of the Quantity of Chlorinated Chemicals Contained in Wastes From Their Manufacture, Processing, or Other Use in the US Economy (USEPA 1996 Toxics Release Inventory)

Item	Class of Chlorinated Chemicals	Nr. of Chlorinated Chemicals	US Annual Waste (tons)		
			Captive	Non-Captive	Total
1	CAHCs	33	614,400	57,200	671,600
2	CAHCs with at least one other halogen	36	118,500	16,000	134,500
3	Chlorinated/halogenated aliphatics with other chemical elements	16	12,900	<100	12,900
	Totals =	85	745,800	73,200	**819,000**

Explanatory Notes:
(a) As of the 1996 data year, the TRI data reporting threshold is manufacturing facilities in SIC codes 20-39, with ten or more employees, and which either manufacture or process at least 25,000 pounds (11.3 metric tons) per year, or otherwise use at least 10,000 pounds (4.5 metric tons) of a TRI-listed chemical per year (see http://www.epa.gov/tri).
(b) "Captive" waste = quantity of CAHC constituents in industrial wastes destroyed or chemically altered in industrial waste management operations such as treatment, recycling, combustion or energy recovery.
(c) "Non-Captive" waste = quantity of CAHC constituents in industrial wastes which ultimately are deposited without prior treatment into the environment via waste management operations involving landfills, landfarming, surface impoundments, surface water discharges, underground injection, and fugitive point or non-point emissions.

As displayed in **Attachment C** to this document, the **top five CAHCs occurring in wastes** generated in 1996 by US manufacturing facilities are, as measured by total quantities as constituents in industrial waste, are the following:

1. Dichloromethane
2. Vinyl chloride (vinyl chloride monomer or "VCM")
3. 1,2-Dichloroethane (ethylene dichloride or "EDC")
4. Trichloroethylene
5. Tetrachloroethylene

These top-five CAHCs comprise 52% of the total chemical mass of 66 different chlorinated aliphatic chemicals reported in US industrial manufacturing wastes in 1996 (source: USEPA TRI database).

VI.C. What are the Characteristics of CAHC Manufacturing Wastes Subject to this Listing?

In formulating the 1999 K173/K174/K175 listing proposal, USEPA identified a subset of 17 industrial facilities relevant to the scope of the proposed rule, according to both the:

- Types of chemical products manufactured.
- Types of industrial wastestreams generated from the chemical manufacturing processes (i.e. targeted to wastewaters and wastewater treatment sludges).

USEPA administered a written questionnaire (RCRA Section 3007 survey) initially in 1992, with a follow-up in 1997, to collect descriptive information about the chemical and waste handling operations at these facilities. USEPA-OSW identified a total of 28 facilities in the 1992 survey, and a total of **26 facilities** in the 1997 follow-up survey (two facilities closed). However, USEPA-OSW estimated that only **23 facilities** were potentially relevant to the 1999 listing proposal, because of additional plant closures, de minimus CAHC production volumes, and a double-counted facility.

As displayed in a table below, the 23 CAHC manufacturing facilities surveyed in USEPA-OSW's 1997 survey, employ **18,970 employees** in these 23 facilities, although the total, worldwide employment associated with the parent companies which own these facilities is much larger at about **116,000 employees** (as displayed in a table contained in the Federal regulatory analysis chapter of this document).

According to information compiled from data contained in the "*Listing Background Document*" – refer to the Federal Register announcement for the final listing rule -- USEPA-OSW estimates that the 23 CAHC manufacturing facilities generated in 1996, over **127 million metric tons** of wastewaters from various different operations at these facilities, and about **11.5 million metric tons** of wastewaters that may be attributed specifically to CAHC manufacturing processes.

The 14 facilities in the 1997 survey which are known to manufacture EDC and/or VCM, are estimated to generated 120 million metric tons of wastewaters with an associated 104,600 metric tons of treatment residual sludge (from all operations), of which 10.1 million metric tons of wastewaters with an associated treatment residual sludge volume of 6,400 metric tons, are generated by EDC/VCM processes.

However, the responses to the USEPA-OSW's 1997 Section 3007 survey did cover these entire wastewater and wastewater treatment sludge volumes. As displayed in a table below, the 23 CAHC manufacturing facilities surveyed in 1997, reported a total of **109 wastestreams** generated by their CAHC manufacturing operations. The annual quantity of waste generated reported in the survey is about **11.6 million metric tons** (25.7 billion pounds), consisting of 11.47 million metric tons (98%) liquid form as ***wastewaters***, and 0.18 million metric tons (2%) semi-solid form as ***sludges***. In relation to the over 6.9 million metric tons in annual quantity of CAHC products manufactured, the overall median ***waste generation rate*** may be estimated from the aggregated 1997 RCRA Section 3007 survey data at 1.7 metric tons manufacturing waste generated, per 1.0 metric ton of CAHC product manufactured (i.e. 11.6 million/6.9 million metric tons).

As displayed in a table below, there are five sources and physical forms of these wastestreams, most of which (98%) are in liquid form as wastewaters, and only a relatively minor fraction (<2%) of the 109 wastestreams are in solid form:

Summary of Wastes Generated by CAHC Manufacturing Facilities in the US (Source: USEPA-OSW 1997 Industry Section 3007 Survey)			
Item	Types of Waste Generated	Annual Quantity Generated (mill metric tons)	% of Total Waste
A. Liquid Forms (wastewaters):			
1	Untreated process wastewater (acid, caustic or neutral)	8.258	72%
2	Spent scrubber liquid (aqueous and/or organic)	2.179	19%
3	Miscellaneous wastewaters from equipment washdown, boiler blowdown, and/or other non-process wastewaters	0.803	7%
	Liquids Subtotal =	11.470	98%
B. Semi-Solid Forms (sludges):			
4	Wastewater treatment sludges (biological or other)	0.177	<2%
5	Solids from treatment of other wastes/residuals	0.003	<1%
	Solids Subtotal =	0.180	<2%
6	Other waste not specified in survey	0.068	<1%
	Total =	11.651	100%

In addition to the possible (unwanted or unintentional) presence of the CAHCs as **by-product constituents** in wastestreams generated by these industrial processes, the survey facilities reported generation of non-CAHC chemicals as constituents in the CAHC wastestreams (refer to the *Risk Analysis Background Document* for a listing of non-CAHC constituents).

Some wastestreams are managed as "**dedicated" (segregated) wastes**, whereas others are **comingled (non-dedicated) wastes** with other types of wastes generated from other industrial operations at the same facility. Because of the fact that some facilities comingle wastestreams from CAHC production units with other wastestreams generated by other industrial operations at the same facility, other constituents not inherently associated with (i.e. generated by) the CAHC manufacturing process may also be present in CAHC manufacturing wastes.

VI.D. How Are CAHC Manufacturing Waste Currently Managed by Facilities Surveyed?

As displayed in a table below, the **109 wastestreams** generated by the 23 CAHC manufacturing facilities included in the scope of this study, are managed primarily using waste treatment ***tank systems*** (data on 58 tanks provided by 15 of the 23 survey facilities) and ***containers*** (17 wastestreams generated by 13 of the 23 facilities).

These two primary WMUs (i.e. tanks + containers), in addition to waste piles, handle over 94% of the quantity of these wastestreams, while two types of secondary WMUs handle 48% of wastestream quantities, and less than 2% of all wastestream quantities are handled using a single type of tertiary WMU. Ultimate, final destination of all wastestreams are handled by eight types of WMUs. All together, eleven different types of WMUs manage these 109 wastestreams at different steps in the ***waste management train*** (i.e. between point of generation and point of final disposal onsite or offsite).

In conjunction with the 11 types of WMUs currently used for handling wastestreams generated by these 23 facilities, there are 15 different types of reported ***waste treatment technologies*** also currently used to manage wastes. From a waste management "train" or sequencing perspective, 12 of the treatment technologies are applied as primary steps, five are applied both as primary and secondary steps, and three are applied as only secondary treatment steps. As displayed below in a table below, seven of these 15 treatment technologies (i.e. aqueous treatment technologies) correspond to managing wastestreams in tanks, four involve "other" waste treatment methods, two involve waste incineration, one involves sludge dewatering, and one involves waste recovery:

Industrial Process Waste Treatment Technologies Used by CAHC Manufacturing Facilities				
Item	Treatment Category	Nr. of Treatment Methods	Annual Quantity Generated & Treated (million metric tons)	% of All Waste Generated
1	Aqueous treatment	7	10.944	94%
2	"Other" assorted treatment	4	4.514	39%
3	Sludge dewatering	1	0.102	1%
4	Incineration	2	0.070	<1%
5	Recovery	1	0.004	<1%
	Column totals =	15	11.651	100%

The majority (n=72) of the 109 wastestreams are managed in part of whole onsite, using WMUs located at the same facility, while 37 wastestreams are managed in part or whole at offsite TSDFs (including PrOTWs and POTWs), located at a median distance of **26 miles** away from the generating facility, in **16 different cities** in **six states** (see waste transport data table below).

In relation to the list of eight states in which the CAHC manufacturing facilities are located, wastes are transported offsite to two other states (Arkansas and Oklahoma) as displayed in the table below. Some facilities ship wastes to offsite WMUs located in cities in the same state as the CAHC manufacturing facility, while other CAHC manufacturing facilities ship wastes to other states.

State Destinations for Offsite Transport of CAHC Manufacturing Wastes (Source: Non-CBI Data from USEPA 1997 Industry Survey)			
Item	Destination State	Annual Quantity Transported (metric tons)	% of Total Transported
1	Arkansas	10	<1%
2	Louisiana	10,054	<2%
3	Kentucky	CBI	CBI
4	Michigan	24,500	3%
5	Oklahoma	442	<1%
6	Texas	699,276	96%
	Total (not including CBI data) =	734,282	100%

USEPA 1999 CHLORINATED ALIPHATIC LISTING PROPOSAL
SUMMARY OF FACILITY CHARACTERIZATION SURVEY DATA COLLECTED FROM
23 CAHC-PRODUCING FACILITIES IN THE USA
USEPA-OSW'S 1997 RCRA SECTION 3007 SURVEY (1996 DATA YEAR; ALL CBI DATA MASKED)*

		1997 SURVEY SUMMARY STATISTICS				
	INDUSTRY SECTOR CHARACTERISTICS	MEDIAN	SIMPLE MEAN	STANDARD DEVIATION	TOTAL ALL FACILITIES	DATA POINTS
A.	**FACILITY LOCATION/SIZE:**					
A1	CAHC facility location=	NA	NA	NA	8 states	23
A2	Number CAHC manufacturing facility employees=	476	825	1,025	18,970	23
B.	**FACILITY CAHC PRODUCTION:**					
B1	Number CAHC products manufactured**=	1.0	2.6	3.0	22	23
B2	Number CAHC by-products from CAHC manufacturing process=	0.0	0.0	0.2		23
B3	Number CAHC intermediates formed in CAHC manufacturing process=	1.0	1.1	1.5		23
B4	Number non-CAHC by-products from CAHC manufacturing process=	0.0	0.0	0.2		23
B5	Average annual quantity CAHC product (Mtons/yr)=	288,776	315,246	308,140	6,935,417	22
C.	**FACILITY WASTE PRODUCTION & MANAGEMENT:**					
C1	Number CAHC manufacturing process wastestreams***=	5.0	4.7	2.2	109	23
C2	Number of CAHC wastestreams managed as hazardous=	0.0	0.9	1.8	20	23
C3	Number of waste management steps per CAHC wastestream+=	2.0	2.2	0.6	51	23
C4	Number of CAHC mfg. wastestreams managed on-site=	3.0	3.2	2.5	70	22
C5	Total liquid/gas waste quantity reported (MTons/yr)=	403,900	498,709	449,479	11,470,307	23
C6	Total sludge/solids quantity reported (MTons/yr)=	563	7,845	20,833	180,427	23
C7	Total annual waste quantity C5+C6 (MTons/yr)****=	406,925	506,554	449,910	**11,650,733**	23
C8	Worksheet-derived tons waste per ton CAHC product (C7/B5)=	1.7	8.6	19.8		22
D.	**FACILITY OFF-SITE WASTE MANAGEMENT:**					
D1	Number of CAHC-manufacturing wastestreams managed off-site=	1.0	1.7	1.7	37	23
D2	Number of offsite waste management unit locations used=	1.0	1.0	1.0	16	23
D3	One-way road distance to offsite waste management unit (miles)++=	26	137	221		13

Explanatory Notes:

(a) Data points = Number of 1997 Section 3007 survey facilities reporting data for each datafield.
(b) Average nr. employees per 212 facilities in LA+TX for SIC 2821+2869 = 260 (source: 1995 County Bus.Patterns).
(c) Survey responses reflect industry conditions in data year 1996; not necessarily representative of current conditions.
(d) * OMB Information Collection Request (survey) clearance no. 2050-0042, expired 31 Jan 1994.
(e) ** Does not include quantities of intermediate CAHCs (chlorinated aliphatic hydrocarbon compounds) manufactured. "Product" defined as CAHCs which exit the facility; intermediate defined as CAHC's consumed within the facility. In many cases, CAHC-manufacturing facilities may have other non-CAHC manufacturing operations at the same facility; information on other chemical products not collected in the USEPA 1996 Section 3007 survey.
(f) *** Number of process waste generation and subsequent on-site treatment residual streams per facility.
(g) **** USEPA-OSW standardized waste quantities reported in the Section 3007 survey to metric tons (1 MT= 2,205 lbs).
(h) +Waste management "steps" refer to the number of sequential onsite storage/treatment/disposal steps, plus any off-site transfer per wastestream (but does not include off-site management steps if applicable). Management train steps defined in the survey according to USEPA-TRI reporting codes (i.e. Cxx, Mxx and Txxx).
(i) ++ Refer to companion worksheet for supporting offsite transport distance data (non-CBI) extracted from the Section 3007 survey.
(j) The US-average truck haul distance for chemicals is reportedly 260 miles (OTA, July 1986, p.22).
(k) For explanation of the five statistical indicators (columns) summarized above, refer to text of the Economics Background Document.

Summary of Industrial Waste Management Methods Used by CAHC Manufacturers in the US
(Source: USEPA-OSW'S 1997 Industry Mail Survey)

Item	Survey code	Description of Method/Technology	Annual Quantity (metric tons)	% of waste
A. TYPE OF WASTE MANAGEMENT UNITS (ONSITE & OFFSITE):				
	A1. Primary Waste Management Unit			
1	M1	Storage in tanks, containers, and/or waste piles	CBI protected	CBI
2	M2	Treatment**	CBI protected	CBI
3	M8	Onsite wastewater treatment***	CBI protected	CBI
		Column subtotal =	**10,983,358**	**94%**
	A2. Secondary Waste Management Unit			
1	M4	Recovery/reclamation/reuse	CBI protected	CBI
2	M8	Onsite wastewater treatment***	CBI protected	CBI
		Column subtotal =	**5,545,354**	**48%**
	A3. Tertiary Waste Management Unit			
1	M8	Onsite wastewater treatment***	CBI protected	CBI
		Column subtotal =	CBI protected	CBI
	A4. Quaternary Waste Management Unit			
1	M4	Recovery/reclamation/reuse	CBI protected	CBI
2	M5	Incineration	CBI protected	CBI
3	M6	Landfill	CBI protected	CBI
4	M7	Underground injection	CBI protected	CBI
5	M9	Discharge to publicly-owned wastewater treatment unit	CBI protected	CBI
6	M10	Discharge to surface water under NPDES	CBI protected	CBI
7	M11	Discharge to offsite privately-owned treatment unit	CBI protected	CBI
8	M15	Land treatment/application (landfarming)	CBI protected	CBI
		Column subtotal =	**11,651,297**	**100%**
B. TYPE OF WASTE TREATMENT TECHNOLOGY (ONSITE & OFFSITE):				
	B1. Primary Waste Treatment Technology			
1	T039	Other recovery	CBI protected	CBI
2	T042	Incineration (sludges)	CBI protected	CBI
3	T043	Incineration (solids)	CBI protected	CBI
4	T077	Aqueous inorganic treatment (chemical precipitation)	CBI protected	CBI
5	T081	Aqueous organic treatment (biological treatment)	CBI protected	CBI
6	T082	Aqueous organic treatment (carbon adsorption)	CBI protected	CBI
7	T083	Aqueous organic treatment (air/steam stripping)	CBI protected	CBI
8	T091	Aqueous organic & inorganic (chem.prec.+ bio.trtmnt)	CBI protected	CBI
9	T094	Aqueous organic & inorganic treatment (other n.e.c.)	CBI protected	CBI
10	T101	Sludge treatment (dewatering)	CBI protected	CBI
11	T121	Other treatment (neutralization only)	CBI protected	CBI
12	T125	Other treatment (n.e.c.)	CBI protected	CBI
		Column subtotal =	**10,284,645**	**88%**
	B2. Secondary Waste Treatment Technology			
1	T081	Aqueous organic treatment (biological treatment)	CBI protected	CBI
2	T082	Aqueous organic treatment (carbon adsorption)	CBI protected	CBI
3	T083	Aqueous organic treatment (air/steam stripping)	CBI protected	CBI
4	T085	Aqueous organic treatment (n.e.c.)	CBI protected	CBI
5	T121	Other (neutralization only)	CBI protected	CBI
6	T123,T124	Other (settling/clarification + phase separation)	CBI protected	CBI
7	T125	Other n.e.c.	CBI protected	CBI
		Column subtotal =	**5,349,314**	**46%**

Explanatory Notes:
(a) * Wastewaters from equipment washdown, boiler blowdown, and/or other non-process wastewater.
(b) ** Treatment in tanks, containers, surface impoundments, waste piles and/or other unit(s).
(c) *** Wastewater treatment in tanks, surface impoundment, containers and/or other unit(s).
(d) Note: This spreadsheet table is contained within a USEPA-OSW, CBI-controlled electronic file.

Onsite Waste Management Profile of CAHC-producing Facilities
Responding to USEPA-OSW's 1997 Industry Survey
Waste Management Related to CAHC Production Only

Item	Type of Onsite Waste Management Unit(s) Used for Handling CAHC Manufacturing Wastes (summary statistics per-facility)	1997 SURVEY SUMMARY STATISTICS						
		YES	NO	MEDIAN	SIMPLE MEAN	STNDRD DEVTN	TOTAL ALL FACILITIES	DATA POINTS**
A.	**Tanks:**							
	Number of waste/residual tanks per facility=	15		1	2.1	3.0	58	23
	Estimated total capacity of tanks per facility+ (gals)=	NA	NA	550,000	1,469,667	2,320,728	22,045,000	15
	Implied average capacity per tank (gals)=	NA	NA	100,000	305,829	292,013		15
	Are tanks part of treatment train? (Yes/No)=	13	2	NA	NA	NA		15
	Are some tanks w/secondary roof/cover? (Yes/No)=	5	8	NA	NA	NA		13
	Are some tanks w/secondary containment? (Yes/No)=	11	5	NA	NA	NA		15
B.	**Containers:**							
	Number of wastestreams handled using containers=	13	13	1	0.7	0.7	17	23
	Total (max.) container daily quantity++ (gals)=	NA	NA	3,300	8,321	16,093	99,850	12
	Container storage area concrete base material?(Yes/No)=	11	2	NA	NA	NA		13
	Collect surface runoff from container area? (Yes/No)=	5	8	NA	NA	NA		13
C.	**Storage Piles:**							
	Number of waste piles per facility=	1	22	CBI	CBI	CBI	1	23
	Typical waste quantity managed (cubic yards)=	1	22	CBI	CBI	CBI	CBI	1
	Storage pile(s) under roofed structure? (Yes/No)=	CBI	CBI	CBI	CBI	CBI	CBI	1
	Storage pile(s) w/leachate/runoff containment? (Yes/No)=	CBI	CBI	CBI	CBI	CBI	CBI	1
	Storage pile(s) with synthetic liner base? (Yes/No)=	CBI	CBI	CBI	CBI	CBI	CBI	1
D.	**Boiler/Kiln/Furnace:**							
	Nr. of waste boilers/kilns/furnaces***=	1	22	CBI	CBI	CBI	1	23
	Total capacity (ton/yr)=	NA	NA	CBI	CBI	CBI	CBI	1
E.	**Incineration:**							
	Number of waste incinerators per facility=	1	22	CBI	CBI	CBI	1	23
	Total incinerator capacity per facility (ton/yr)=	NA	NA	CBI	CBI	CBI	CBI	1
F.	**Land Application (Landfarming):**							
	Number of land application units per facility=	2	21	CBI	CBI	CBI	2	23
	Total land application size per facility (acres)=	CBI	CBI	CBI	CBI	CBI	CBI	2
	Collect surface water runoff from landfarming? (Yes/No)=	CBI	CBI	CBI	CBI	CBI	CBI	2
G.	**Surface Impoundments:**							
	Number of surface impoundments per facility=	1	22	NA	NA	NA	0	23
	Total daily capacity (gals)=	??	NA	NA	NA	NA		NA
	Total impoundment size (acres)=	4	NA	NA	NA	NA		NA
	Synthetic liner? (Yes/No)=	??	NA	NA	NA	NA		NA
	Clay liner? (Yes/No)=	??	NA	NA	NA	NA		NA
	Leachate collection system? (Yes/No)=	??	NA	NA	NA	NA		NA
H.	**Landfills (on-site):**							
	Number of waste landfills per facility=	3	20	NA	NA	NA	5	23
	Total landfill capacity per facility (cubic yards)=	3	20	CBI	505,833	170,037	1,517,500	3
	Synthetic liner? (Yes/No)=	2	1	CBI	CBI	CBI	CBI	3
	Clay liner? (Yes/No)=	2	1	CBI	CBI	CBI	CBI	3
	Leachate collection system? (Yes/No)=	2	1	CBI	CBI	CBI	CBI	3
I.	**Underground Injection (Well):**							
	Number of injection wells per facility=	2	21	CBI	CBI	CBI	CBI	23
	Average injection well depth (feet)=	NA	NA	CBI	CBI	CBI	CBI	2

Explanatory Notes:
(a) Data points = Number of 1997 RCRA Section 3007 survey facilities reporting data for each datafield (data year= 1996).
(b) "YES", "NO" = Number of survey facilities reporting use of particular WMU.
(c) NA= Not applicable to particular summary (row/column cell).
(d) Survey responses reflect industry conditions in 1996; not necessarily representative of current conditions.
(e) * OMB Information Collection Request (survey) clearance no. 2050-0042, expired 31 Jan 1994.
(f) ** Nr. of data points may be <23 facilities because WMU not applicable or no response provided in survey.
(g) *** One facility reported use of a "thermal oxidation" treatment method not included in this table.
(h)+ Total tank capacity imputed by OSW-EMRAD using midpoint of 0-10k or 10k-100k gallon survey code ranges.
(i)++ Total container capacity imputed by EMRAD using midpoint of survey code range.
(j) Only on-site waste management practices applied to residuals of concern to listing (wastewaters, ww treatment sludges) included.

Transport of Chlorinated Aliphatic Production Process Wastes Offsite (Liquids & Solids)*
Summary of Non-CBI 1997 USEPA Industry Survey Data

Item	CAHC Manufacturing Company Name	Facility city location	State	Annual CAHC process waste (Mt)	Annual waste quantity managed offsite (MT)	Offsite waste management shipment destination City	State	Shipping distance website raw data (miles)	One-way shipment distance (miles)**
1	Borden Chemicals & Plastics	Geismar	LA	403,900	3,024.0	See 1a-1b below			
	Subtotal (1a)				2,904.0	Sorrento	LA	9	10.8
	Subtotal (1b)				120.0	Sulphur	LA	140	168.0
2	Condea Vista	Westlake	LA	696,018	18.3	Deer Park	TX	118	141.6
3	Dow Corning Corp.	Midland	MI	24,500	24,500.0	Midland	MI	5	6.0
4	DuPont-Dow Elastomers	Laplace	LA	496,991	606.0	See 4a-4b below			
	Subtotal (4a)				596.0	Orange	TX	197	236.4
	Subtotal (4b)				10.0	Eldorado	AR	493	591.6
5	Formosa Plastics Corp USA	Baton Rouge	LA	833,700	700.0	Walker	LA	16	19.2
6	Formosa Plastics Corp USA	Point Comfort	TX	CBI	CBI	CBI	CBI	CBI	CBI
7	Geon Company	LaPorte	TX	964,754	1,804.0	Houston	TX	22	26.4
8	Occidental Chemicals Corp.	Convent	LA	223,500	500.0	Sorrento	LA	12	14.4
9	Occidental Chemicals Corp.	Deer Park	TX	695,696	695,695.0	See 9a-9e below			
	Subtotal (9a)				360,349.0	Deer Park	TX	5	6.0
	Subtotal (9b)				19.0	Anahuac	TX	27	32.4
	Subtotal (9c)				60.0	Deer Park	TX	5	6.0
	Subtotal (9d)				442.0	Waynoka	OK	523	627.6
	Subtotal (9e)				334,825.0	Deer Park	TX	5	6.0
10	Occidental Chemicals Corp.	Gregory	TX	157,660	160.0	Sinton	TX	15	18.0
11	Occidental ("Oxymar")	Gregory	TX	500,077	1,445.0	See 11a-11b below			
	Subtotal (11a)				820.0	Altair	TX	124	148.8
	Subtotal (11b)				625.0	Robstown	TX	24	28.8
12	PPG Industries Inc.	Lake Charles	LA	584,101	2,200.0	Sulphur	LA	9	10.8
13	Shell Chemical Products	Norco	LA	381,125	3,630	Sorrento	LA	30	36.0
14	Vulcan Chemical Co.	Wichita	KS	CBI	CBI	Baton Rouge	LA	613	735.6
15	Westlake Monomers	Calvert City	KY	CBI	CBI	Calvert City	KY	5	6.0
Statistical Summary (non-CBI data):		Non-CBI totals=		5,962,022	734,282	16	6		
		Non-CBI median=		498,534	625				26.4
		Non-CBI mean=		496,835	38,646				137.0
		Non-CBI stnd.dvtn=		266,794	106,181				220.7
		Waste quantity weighted mean (non-CBI)=							3.6

Explanatory Notes:
(a) Mt = metric tons per year (1.0 Mt = 1,000 kilograms = 2,204.6 pounds = 1.102 short tons).
(b) * Eleven other RCRA Section 3007 survey facilities not listed above because did not report offsite shipment of either wastewaters or wastewater sludges within the waste type scope of the 1999 listing proposal (as of 1996).
(c) * OSW-EMRAD estimated one-way distances by multiplying linear distances generated using the internet website http://www.indo.com/distance/, by a non-linear actual travel route factor = 1.2.
(d) OSW-EMRAD assigned average linear miles to offsite waste management distances located within the same city=5.0.

CHAPTER VII

ESTIMATION OF REGULATORY COSTS FOR THE K174/K175 FINAL RULE

VII.A. How Many Entities Are Subject to the Requirements of the Final Rule?

Number of Entities in the US Which Generate the Wastes Described in the Final Rule					
Item	Waste code	Wastecode Descriptions (Types of Wastes Targeted by Rule)	Industrial Operation Classification* SIC	NAICS	Nr. of Entities Generating Wastes**
1	K174	Wastewater treatment sludges from the production of ethylene dichloride (EDC) or vinyl chloride monomer (VCM)	2869	325199	17
2	K175	Wastewater treatment sludges from the production of vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process	2869	325199	1
				Total =	**18**

Explanatory Notes:
(a) * USEPA assigned industry sectors by matching the type of industrial operations (at the facility level) targeted by the final rule (i.e. CAHC manufacturing). Some facilities may have subsidiary and/or parent company industrial primary codes which differ from the codes above.
(b) ** Although there are an estimated 39 facilities in the US which manufacture CAHCs (see **Attachment B**), only a subset generate the types of wastes listed in the final rule. In addition, largely because of the "conditional management" approach of the final rule, not all relevant waste generators may be cost-affected by the final rule. USEPA's facility count as of 1999 based on USEPA RCRA Section 3007 1997 industry survey, and on public comments to the USEPA RCRA Docket in response to the 25 Aug 1999 proposed K173/K174/K175 rule.

VII.B. What Types of National Costs Are Anticipated for the Final Rule?

This chapter presents USEPA estimate of national regulatory costs for the two new RCRA industrial hazardous waste listing wastecodes K174 and K175. As with most types of societal regulations, there are different types of possible effects (impacts) which have "cost" consequences to the regulated community (i.e. affected entities). There are usually different types of "benefits", which constitute the motivation, object and desired outcome of regulation.

For reason stated in the "Framework" chapter of this document, the expected "**beneficial effects**" of the K174/K175 final rule are not monetized, but are quantified in the "*Risk Assessment Background Document*". Only the "**cost effects**" of the final rule are monetized in this document.

RCRA rules are Federal rules. As such, the USEPA as a Federal regulatory agency, is required to follow the "regulatory planning and review" process and procedures set-forth in Executive Order 12866 (30 Sept 1993).

One procedural requirement of EO-12866, is that agencies must conduct a screening analysis to determine whether a particular proposed or final rule is "economically significant". OMB's 11 Jan 1996 guidance (Section III.A.7) to Federal regulatory agencies for compliance with the economic analysis requirements of Executive Order 12866, directs Federal agencies to assess both the:

- Expected "***full effects***" of regulations (e.g. monetized and non-monetized, quantified and unquantified effects), and
- Incidence and distribution of full effects on ***particular groups*** across the population and the economy.

Furthermore, OMB's guidance for compliance with EO-12866 (Section III.C.1), defines the preferred measure of **regulatory cost** as:

> "*[T]he "opportunity cost" of the resources used or the benefits foregone as a result of regulatory action. Opportunity costs include, but are not limited to, private-sector compliance costs and government administrative costs.*"

Accordingly, this document monetizes three different possible final rule **cost categories**; these are not necessarily universal categories applicable to and useful for characterizing the national costs of all Federal rules, but apply to types of effects anticipated for the K174/K175 final rule, in particular:

Typology of Effects Identified in this Document, for Purpose of Determining the Number of Potentially Affected Entities, and the Expected National Cost for the Final Rule	
Effects Category	Description of Affected Entities & Expected Costs
1. Targeted effects	The **unique class(es) of industrial facilities**, processes, operations, or units targeted by the final rule (i.e. for the K174/K175 final rule, this includes US industrial facilities which generate certain types of wastes from the production of certain types of CAHCs). In general, depending upon whether a RCRA listing rule is a "*traditional, across-the-board*" or "*conditional*" listing approach (the K174/K175 final rule is the latter), the industrial target effects are direct, and may consist of periodic information reporting, recordkeeping, and other RCRA compliance requirements, such as mandating modifications to, or specifications for, certain types of industrial processes, practices, procedures, physical plant/equipment, or other business and operating assets. The extent of potential direct effects on any particular facility or unit within the targeted industrial class(es) depends upon baseline practices concerning the targeted waste(s), compared to the RCRA requirements under the new final rule.
2. Induced effects	**Other entities which do not generate the waste regulated by the rule**, but which are likely affected by direct, indirect or secondary impacts, which are causally-related to the requirements and impacts of a rule, due to at least two reasons:
	• **Entities not targeted by the rule, but which are likely directly affected because of economic linkages to entities targeted by the rule**: Hypothetically, there may be economically inter-linked industrial and/or other types of entities located either upstream and/or downstream from entities targeted by a rule. Inter-linked entities may experience "induced direct effects" (either of net beneficial or net cost in impact). For the K174/K175 final rule, this may consist of at least three types of entities:
	• As a result of RCRA's "cradle-to-grave" statutory design, the commercial industrial waste management industry (as a type of downstream industry) are likely to experience induced direct effects, because RCRA listing rules also apply to and potentially affect industrial waste "***handlers***", as well as industrial waste "*generators*".

	• Another possible source of induced direct effects stems from RCRA's "mixture-and-derived-from" rules (MDFRs; 40 CFR 261.3(a)(2)(iii), 261.3(a)(2)(iv), and 261.3(c)(2)(i)), which may bring other wastes not targeted by a particular rule, into RCRA regulation, as a result of the mixture or treatment of the wastes which are targeted by a rule, with non-hazardous wastes.
	• In addition, one chemical manufacturer (Shell Chemicals Co., Deer Park TX) which does not produce CAHCs, accepts wastewater containing K174 sludge (in liquid suspension), for treatment in its surface impoundment. Consequently, this other type of industrial entity may experience an "induced effect", because it may become subject to RCRA waste treatment regulations, if it continues to accept OxyVinyl's K174-containing wastewater in the surface impoundment (which is only one alternative regulatory response option for this case).
	• **Entities which are likely directly affected by other generic provisions associated with the rule's RCRA authorizing statute**: For example, in lieu of the Federal RCRA program, states may administer their own "*at least as stringent*" hazardous waste program, after receiving approval "*authorization*" from the USEPA (40 CFR 271 Subpart A). States with such authorized programs (49 as of 1999), must modify their programs within one year by 01 July each year, to reflect all changes to the Federal RCRA base program (40 CFR 271.21(e)), consisting of any final rule amendments to 40 CFR 124, 270, 260-266 or 268. The final rule addition of K174/K175 to the list of RCRA hazardous wastes, amends 40 CFR 261, among other parts of 40 CFR.
3. Incidental effects	**Entities not targeted by the rule, but which are likely to exhibit voluntarily actions, or incur consequential costs**, in response to the issuance (promulgation) of a rule. For the K174/K175 final rule, "*incidental effects*" may consist of at least two elements:
	• **Entities not targeted by the rule, but which are likely to incur administrative costs for propagating/ publicizing, or otherwise monitoring the rule**: Voluntarily-incurred administrative costs to read/assimilate the new rule by entities not subject to the rule's requirements, but are economic stakeholders or other interested parties. For the K174/KL175 final rule, USEPA anticipates incidental admnistrative costs will be incurred voluntarily by at least: • One other Federal agency (USDOT for purpose of monitoring waste transport issues), • 12 industry trade associations and other non-governmental organizations which monitor RCRA rulemaking activity (as evidenced by public comments received for the 25 Aug 1999 K173/K174/K175 proposed rule), and • Other CAHC manufacturers not subject to the rule's requirements (e.g. chlorofluorocarbon manufacturers).

	• **Entities targeted or otherwise affected by the rule which are likely to incur private costs not considered national economic costs (e.g. regional costs or regional economic transfers**). For one facility (OxyVinyl, Deer Park TX), cost of possible temporary shutdown of the CAHC manufacturing unit, to modify plant/equipment and industrial operations (under alternative regulatory response options), in line with the waste management practices required under the final rule. This incidental cost element represents a "private cost" but not a national economic "opportunity cost", because it is expected that other CAHC manufacturers will temporarily increase output to offset for the possible temporary shutdown.[18]

For purpose of ***screening analysis*** to comply with EO-12866, as well as with three other Federal economic analysis requirements relevant to the K174/K175 final rule (as described in the last chapter of this document), assessment of all three categories of costs are not required, as indicated in the checklist table below. In order to simplify the presentation of the national cost estimate in this document, and for purpose of assessing all likely effects, not just net effects on the national economy, ***all three cost categories are aggregated in the estimated national cost of the final rule***.

Checklist of Regulatory Cost Categories Required for *Screening Analysis* Compliance with Federal Regulatory Economic Analysis Requirements

Item	Federal Regulatory Economic Analysis Requirement	Focus & Scope of Economic Analysis	Regulatory Effect Category		
			Targeted	Induced	Incidental
1	1980 Regulatory Flexibility Act (as amended by the 1996 SBREFA)	Economic impacts on small entities subject to a rule's requirements	✔		
2	1993 Executive Order 12866 (Regulatory Planning & Review)	Annual effect* of a rule on the national economy	✔	✔	✔
3	1995 Unfunded Mandates Reform Act (UMRA)	Expenditures* by state, local and tribal governments, and the private sector, caused by a mandated rule	✔	✔	
4	1999 Executive Order 13132 (Federalism)	Substantial direct compliance costs by state and local governments	✔	✔	

Explanatory Notes:
(a) * Under both EO-12866 and UMRA, once a rule is determined (by screening analysis) to potentially have anticipated national economic or direct expenditure effects, respectively, of $100 million or more on state, local and/or tribal governments, or on the private sector, the regulatory economic analysis requirement expands to include a broader benefit-cost analysis on the rule.
(b) In order to simplify the presentation of the national cost estimate in this document, all three cost categories are aggregated in the estimate of national cost for the final rule.

VII.C. How Many Entities Are Expected to Incur Costs for the Final Rule?

Any assessment of the number of entities affected by a regulation, depends upon how the assessment defines "effects". Based on the three **effect/cost categories** defined above, the two following tables presents USEPA's estimate of (a) the number of entities ***potentially affected*** by the final rule, and (b) the number of entities which are expected to ***incur regulatory costs***.

[18] In general, from a "national perspective" as befitting Federal agencies, economic effects may be classified as either "national" or "regional". *Regional economic impacts* are localized opportunity costs and/or benefits, which may represent economic "*transfers*" from other regions (i.e. localities). *National economic impacts* represent the aggregate net effect of regional impacts.

As displayed in the first table, there are a total **116 entities** which USEPA estimates are potentially affected by the final rule, including 18 entities targeted by the rule as generators of K174 and K175 wastes, as well as 64 entities likely subject to potential induced effects (including four K174/K175 waste handlers), and 34 entities likely subject to potential incidental effects.

As displayed in the second table, the final rule is expected to affect directly only three of the 18 targeted waste generators, which are expected to incur private costs for modifying their current waste management practices, to conform with the waste management requirements of the final rule. Consequently, although the first table indicates that 18 entities are potentially affected as targeted entities, the second table indicates that only 3 of these entities are expected to incur targeted costs, and that the 15 remainder entities (18-3= 15), are expected to incur incidental costs.

Summary of Entities Potentially Affected by the RCRA K174/K175 Final Rule According to Sector Classification Codes							
	Economic Sector Classification			Number Entities Potentially Affected			
Item	SIC	NAICS	Description	Targeted Effects	Induced Effects	Incidental Effects	Total
1	2869	32511	Industrial organic chemical manufacturers* (waste generators)	18	0	21	39
2	4953	562211	Hazardous waste treatment & disposal (waste handlers)	0	4	0	4
3	9511	92411	State government environmental departments (public administration)	0	49	0	49
4	9511 9611 9621	92411 92611 92612	Federal government offices (environmental, economic & transportation public administration)	0	11	1	12
5	8742	54161	Management consulting services (non-govrmntl organizations)	0	0	12	12
			Total entities =	18	64	34	**116**

Explanatory Notes:
(a) Not all entities “potentially affected” are expected to incur the same categories of regulatory costs (see next table).
(b) * Note: Parent company codes may differ from the codes associated with the facility units targeted by the rule.
(c) This list of sector classification codes for “induced effect” entities may not be exhaustive for at least two reasons:

- Non-hazardous and hazardous industrial waste collection transporters (SIC 4212, 4953; NAICS 562111, 562112) may be affected, depending upon whether waste collected from K174/K175 generators is transported by waste treatment/disposal facilities, or by separate, unaffiliated transporter companies.
- If waste remediation is required (e.g. see item 4 in next table), such entities may be affected (SIC 4959, NAICS 56291).

Summary of US Economic Sectors & Entities Expected to be Cost-Impacted by the USEPA's RCRA K174/K175 Final Rule					
		Number of Entities Potentially Incurring Costs			
Item	Types of Economic Sectors & Entities	Targeted Effects	Induced Effects	Incidental Effects	Row Totals
CAHC manufacturing industry:					
1	K174 generators not currently landfilling WW sludge: • Oxy Vinyls LP, Deer Park, TX (surface impoundment) • Georgia Gulf Corp, Plaquemine LA (land treatment)	2	0	0	2
2	K175 generators (only one facility in US): • Borden Chemicals & Plastics Ltd, Geismar, LA	1	0	0	1
3	Other CAHC producers*	0	0	39-3 = 36	36
Industrial waste management industry:					
4	Industrial chemical producer which is accepting K174 WW into offsite industrial chemical waste treatment surface impoundment, from K174 generator not currently landfilling • Shell Chemical Co, Deer Park TX	0	1	0	1
5	POTW which may begin accepting the K174 generator's WW which becomes diverted from the treatment surface impoundment • Possibly: Gulf Coast Waste Disposal Authority (TX)	0	1	0	1
6	Landfill owner/operator which begins accepting K174 sludge in lieu of land treatment (possibly in LA)**	0	1	0	1
7	Landfill owner/operator accepting K175 sludge	0	1	0	1
Non-Federal governments:					
8	State governments with authorized RCRA programs	0	49	0	49
Other Federal government agencies:					
9	USEPA regional offices (10), plus 2 other agencies***	0	10+1=11	1	12
Other miscellaneous entities:					
10	Non-governmental organizations****	0	0	12	12
	Column Totals =	**3**	64	49	**116**

Explanatory Notes:
(a) Targeted effect = Class of industrial facilities targeted by the final rule (i.e. generators of certain types of wastes).
(b) Induced effect = Entities directly affected by collateral impacts stemming from economic linkage to targeted entities.
(c) Incidental effect = Entities which are expected to exhibit voluntarily actions in response to the final rule.
(d) * Count of 39 total CAHC producers includes US chemical manufacturing facilities which produce other types of CAHCs not covered by the K174/K175 final rule listing description, but are likely to read the final rule to determine its scope and applicability to these industrial operations.
(e) ** In this case, USEPA expects the landfill owner to realize a net benefit (profit) from beginning to receive K174 sludge as an induced effect of the rule; the associated K174 generator is expected to incur the landfill's operating cost.
(f) *** At least two other Federal agencies consisting of: (1) OMB for its required review of the final rule, and (2) USDOT for its likely reading of the final rule (one feature of the final rule addresses hazardous waste transport manifesting).
(g) **** Count of 12 NGOs based on the number of NGO's which voluntarily provided public comments to the USEPA RCRA Docket, in response to the USEPA's 25 Aug 1999 proposed K173/K174/K175 listing rule (i.e. 6 chemical industry associations + 1 chemical industry task force + 3 waste industry associations + 1 environmental NGO + 1 other type of industrial manufacturer).

Because of the fact that the K174/K175 final rule:

- Contains a **"*conditional*" listing approach**, rather than a traditional, "across-the-board" or straight listing approach, and
- Is based on ***risk analysis***,

the aggregate, economic impact of this final rule is substantially less than what it otherwise would be if all 18 EDC/VCM manufacturers (or all 39 CAHC manufacturers) had to comply with full RCRA Subtitle C regulatory requirements for all volumes of wastewaters and wastewater treatment sludges generated.

Furthermore, regulatory compliance costs are ***incremental*** in the sense that most all CAHC manufacturing facilities are currently regulated under RCRA (i.e. as chlorinated aliphatic manufacturers via the existing RCRA F024 & F025 wastecodes), and some facilities currently manage most or all of their CAHC manufacturing wastes as hazardous:

- **Currently Regulated by RCRA**: Many of the companies potentially affected by the K174/K175 listing rule are large companies, and may have other types of chemical manufacturing and processing operations at the same chlorinated aliphatics facility, or at other facilities, which are currently subject to RCRA regulations, from prior RCRA listings for chlorinated aliphatic manufacturing and/or prior RCRA listings directed at other chemicals or industrial processes.
- **Currently Managed as Hazardous**: Based on the survey findings, some chlorinated aliphatic manufacturers already manage some or all of the wastestreams from their chlorinated aliphatic production processes, in waste management units designed and operated according to RCRA Subtitle C standards. Consequently, this subset of CAHC manufacturers are only incrementally less affected by the K174/K175 listing, particularly as a result of the "conditional management" approach of the K174 listing.

Consequently, this listing proposal will not have a full **incremental impact** on affected facilities, and the marginal impact on existing industrial operations in relation to current RCRA compliance and hazardous waste handling practices, may be less than it otherwise would be if these companies and facilities did not have experience with baseline RCRA waste management practices.

VII.D. How Much Industrial Waste is Affected by the Final Rule?

The table below summarizes the number of waste generating facilities, the waste physical forms, and the annual waste quantities (based on 1997 industry survey data), affected by the K174 and K175 listing final rule. Although there are an estimated 18 facilities in the US which manufacturing the two types of CAHCs (i.e. EDC and VCM) subject to the listing descriptions, USEPA anticipates that only three of the 18 subject manufacturing facilities will be incrementally affected by the rule, largely because of the final rule's "conditional management" approach.

Summary of CAHC Manufacturing Wastes Potentially Affected by the Final Rule					
Item	Waste code Listing	Waste Generator Company Name & Facility Location	Annual Quantity of Waste (metric tons*)	Waste Physical Form	Standardized Annual Quantity (short tons*)
1	K174	Georgia Gulf Corp (Plaquemine LA)	1,750	Sludge	1,930
2	K174	Oxy Vinyl LP (Deer Park TX)	695,255	Waste-water**	766,520

3	K175	Borden Chemicals (Geismar LA)	120	Sludge	132
		Column totals =	697,125		768,582

Explanatory Notes:
(a) * Metric ton = 2,205 pounds; Short ton = 2,000 pounds; multiply metric tons by 1.102 to convert to short tons.
Waste quantities are standardized to short tons, because most waste treatment unit costs are expressed in $ per short ton.
(b) ** Although the K174 final listing applies to wastewater "sludges", the larger, precursor quantity of Oxy Vinyl wastewater is shown above, because the wastewater contains the affected K174 sludge held in suspension in the water, which is currently placed by the generator in an offsite surface impoundment.

VII.E. Which Components of the Final Rule Are Expected to Have National Costs?

The table below summarizes the components and features of the final rule which are expected to have potential economic impacts, which in this case, are primarily in the form of industry regulatory compliance costs (i.e. meeting RCRA hazardous waste management program requirements), and secondarily in the form of regional/state government administrative costs (e.g. paperwork, monitoring, enforcement).

The second table below presents USEPAs assumptions and estimates of expected regulatory costs. Although there are an assortment of different types of costs, many of the cost components are estimated by applying the following **basic cost estimation algorithm**:

Regulatory cost = [Annual waste quantity affected] x [incremental unit cost for RCRA]

The third table below presents subtotal costs – both initial lump-sum costs and recurring annual costs – separately for both the K174 and K175 listing, as well as total cost for the entire final rule.

Synopsis of Components of the Final Rule Which Have Potential National Costs			
Item	Component	Brief Description of Components	Entities with Expected Cost Impacts
A. K174 Final Listing:			
1	Waste treatment	Treatment of K174 sludges prior to disposal not required	No added cost impact
2		Add 5 dioxin/furan constituents in K174 to RCRA LDR UTS table	No impact likely; CMBST is specified as an option for each, which is identical to the LDR UTSs for the 12 other K174 dioxin/furan congeners
3	Waste disposal	K174 sludges must be disposed in either a hazardous or non-hazardous state-permitted or licensed landfill (on- or off-site)	One facility (Georgia Gulf Corp, Plaquemine LA) does not currently dispose K174 sludge in a landfill (it disposes its K174 sludge in a land application unit)
4		K174 sludges may not be placed on the land prior to final disposal in a landfill	One facility (Oxy Vinyls LP, Deer Park TX) currently pipes its K174 precursor wastewater to an off-site surface impoundment for treatment, before disposal
5	Record-keeping	Facilities must demonstrate that K174 sludges are disposed in landfills (on- or off-site), by maintaining normal business records as documentation	No added cost impact; although all EDC/VCM facilities will have to maintain this documentation, it is based on normal business records
6	Mixture & Derived From Rule (MDFR) waste	By regulatory extension may affect other wastes/handlers (i.e. waste mixtures, waste residuals, contaminated debris, contaminated soil)	One MDFR case identified in the public comments to the 1999 proposed rule (involving K174 at one facility currently managed in a surface impoundment)
7		Add 5 dioxin/furan congener K174 constituents to RCRA hazardous wastecode F039 list of constituents	No impact; current treatment methods for F039 leachate containing existing listed dioxin/furan congeners are reportedly effective in treating the 5 congeners
B. K175 Final Listing:			
8	Waste treatment	Maintain or treat K175 sludge to 0.025 mg/L TCLP mercury	One facility (Borden Chemicals, Geismar LA) currently generates K175 sludge
9		Maintain or treat K175 sludge to pH below 6.0	One facility (Borden Chemicals, Geismar LA) currently generates K175 sludge
10	Waste disposal	Macroencapsulation (enclosure) of K175 sludge in HDPE vault	One landfill facility (Borden's current landfill indicates it may accept K175 sludge)
11	Record-keeping	RCRA recordkeeping by generator & TSDF (i.e. pre-transport packaged waste labeling, manifesting, biennial reporting, 3-year records retention)	One facility (Borden Chemicals, Geismar LA) currently generates K175 sludge. One landfill facility likely will receive K175 sludge for macroencapsulation disposal
12	MDFR waste	By regulatory extension may affect other wastes/handlers	No impact likely because only one K175 generator & one K175 handler expected
C. Other Features Associated with Final Rule:			
13	Admini-strative	Up-front administrative burden of reading the new final rule	All CAHC facilities, other interested entities, & RCRA auth states likely read rule
14		Prepare & submit state RCRA authorization program modification to EPA	Applies to all states with authorized RCRA programs (49 states as of 1999)
15		Waives waste handler notification if already have EPA ID nr.	All existing K174 & K175 generators and subsequent handlers likely have IDs
16	Enforcement	Listing adds to existing Agency/state RCRA enforcement burden	Currently applies to four states with affected EDC/VCM manufacturing facilities
17	Emergency Response	Adds 18 chemical constituents found in K174 & K175 sludges, as reportable quantities to CERCLA substances for EPCRA emergency notification.	Facilities which release RQ wastes must immediately call the Natl Response Center, and state/local emergency response team

USEPA's Estimation of Expected National Costs of the Final Rule			
Item	Component	Description of Cost Component	Regulatory Cost Assumptions & Cost Estimates
A. K174 Final Listing:			
1	Waste treatment	Treatment of K174 sludges prior to landfill disposal not required.	• Industry cost = $0 No cost because final rule allows landfilling K174 sludges without treatment.
2		Add 5 dioxin/furan congeners K174 constituents to the LDR UTS table.	• Industry cost = $0 No cost because current combustion treatment methods applied to other dioxin/furan congeners already listed in the LDR UTS table are reportedly adequate to meet these additional 5 congeners.
3	Waste disposal	K174 sludges must be disposed in either a hazardous or non-hazardous state-permitted or licensed landfill (on- or off-site).	• Nr. entities impacted: • 17 of the 18 total known EDC/VCM manufacturers in the US are subject to the K174 final rule requirements (as of 1999); the remaining facility is subject to K175 (see next section of this table below). • One of the 17 facilities currently places K174 sludge in a land application unit (Georgia Gulf, Plaquemine LA).
			• Affected waste volume = 1,750 metric tons sludge (1,930 short-tons) per year.
			• Expected impact = One facility expected to switch from current land application unit to off-site landfill disposal.
			• Unit cost = Difference between landfill cost and land application unit cost: • Landfill cost: • RCRA Subtitle C hazardous commercial landfill (bulk w/out treatment) = $50 to $175 per ton (Source: Environmental Technology Council Jan 200 national survey http://www.etc.org/costsurvey3.cfm) • Non-hazardous commercial industrial landfill = $21 to $67 per ton (Source: Waste Age magazine April 2000 national survey) • Land application unit cost (on-site, no offsite transport required) = $13 per ton (Source: In absence of data, USEPA estimate = 25% of $50/ton average unit cost for non-haz landfill; land treatment is reportedly less energy and equipment intensive than alternative treatment systems, Loehr, 1984, p.292) • Incremental cost = ($21/ton to $175/ton) - ($13/ton) = $8 to $162 per ton • Waste truck transport to offsite landfill = $7.3/ton (25 miles) to $115.8/ton (500 miles) (Source: Table 5-1 in USEPA-OSW RCRA Benefits report, Sept 1997)
			• Industry cost: • Landfill incremental cost = ($8/ton to $162/ton) x (1,930 tons/yr) = $0.016 to $0.313 million/yr • Transportation cost = ($7.3/ton to $115.9/ton) x (1,930 tons/yr) = $0.014 to $0.224 million/yr • Total cost = **$0.030 to $0.537 million/yr**
4		K174 sludges may not be placed on the land prior to final disposal in a landfill.	• Nr. entities impacted = One facility (Oxy Vinyls, Deer Park TX) currently sends K174-containing wastewater off-site to a treatment surface impoundment, where K174 sludge precipitates to the bottom.
			• Affected waste volume = 695,255 metric tons per year, which is equivalent to: • 1.533 billion pounds per year [(695,255 metric tons) x (2,205 lbs/metric ton)] •183.81 million gallons per year [(1.533E9 lbs) x (1gallon per 8.34 lbs)] • 525,170 gallons per day [(183.81E6 gals) / (350 operating days per year)] • 21,900 gallons per hour [(525,170 GPD) / (24 operating hours per operating day)] • 365 gallons per minute [(21,900 GPH) / (60 minutes per operating hour)]

			• Expected impact: Three possible industry response outcomes: • POTW: Divert K174 wastewater to offsite public-owned treatment works (POTW) in OxyVinyl Deer Park TX vicinity (most likely scenario because is least cost option, compared to WWTU option). Dredge surface impoundment one-time to remove existing bottom sludge and place in landfill. • WWTU: Divert K174 wastewater to a newly installed (or an expanded existing) industrial wastewater treatment tank (WWTU) unit onsite or near the OxyVinyl facility. Dredge the surface impoundment one-time to remove existing bottom sludge and place dredged sludge in landfill. • Retrofit: A third hypothetical option is for a possible "induced-affect" on the Shell Chemical Company facility – which owns/operates the Deer Park TX industrial wastewater surface impoundment used by OxyVinyl – to retrofit the surface impoundment to meet RCRA hazardous waste management requirements. This "retrofit" option is identified in the final rule preamble as continuing management after up to 4-years deferred compliance with RCRA Subtitle C surface impoundment regulations for liner design/installation (40 CFR 264/265 Subpart K, and 40 CFR 268.4). However, according to the Shell Chemical Company (23 Nov 1999 CALP-00011 letter to the RCRA Docket), the OxyVinyl K174-containing wastewater comprises only 7.5% of the total wastewater influent to the surface impoundment. Other wastewaters generated at the Shell complex comprise the remaining 92.5%, and would become RCRA hazardous ("induced effect") upon mixture with the K-174 wastewater because of the RCRA listed waste "mixture rule" (40 CFR 261.3(a)(2)(iv)).
			• Possible additional impact: Regardless of scenario (i.e. POTW or WWTU), Section 3010(b) of RCRA Subtitle C requires that hazardous waste regulations take effect six months after final rule promulgation. This 6-month effective date make create additional cost impacts: • POTW: • Under this scenario, the POTW which plans to accept OxyVinyl's wastewater will need to modify its existing USEPA Clean Water Act "NPDES" discharge permit, before accepting OxyVinyl's industrial wastewater (containing suspended K174 sludge). As of 1999, there was a nationwide NPDES permit processing backlog (http://www.epa.gov/owm/permits/backlog), for new NPDES permits, permit renewals after 5-year expiration, and permit modifications. • Permit applications are to be submitted 6 months prior to planned discharge (or permit expiration), and if not issued/reissued by 6 months, become "backlogged", but may be "administratively continued" after expiration. • As NPDES permits have a maximum term of five years, an average of 20% of all permits will expire during a calendar year. A backlog of 10% represents approximately a 6-month backlog. USEPA Region 6 (includes TX) has a 20% backlog as of Dec 1999, which represents a 12-month backlog. However, USEPA regional offices may prioritize NPDES permit applications to accommodate special circumstances. (source: see "regional backlog trends charts" at http://www.epa.gov/owm/permits/backlog/charts.htm). • If not processed within the RCRA 6-month effective date, it is hypothetically possible that OxyVinyl may have to temporarily truck transport its K174 containing wastewater offsite to commercial waste treatment facility, to avoid shutdown of its chemical operating unit. • WWTU: The construction period needed for a new (or expanded) WWTU may exceed the 6-month effective date after the final rule is published in the Federal Register; temporary trucking of wastewater may also be needed under this option (see **Attachment E** for time schedule data for WWTU construction). • Retrofit: Surface impoundment may be unable to receive OxyVinyl's wastewater during draining and installation of liner, unless liner installation is sequenced so that separate surface impoundment cells may continue to operate (Shell's 4-acre surface impoundment consists of 3 activated sludge aggressive biological treatment cells and 3 secondary clarifiers operating in parallel, according to Shell's 23 Nov 1999 "CALP-00011" comments to the RCRA Docket on USEPA's K173/ K174/ K175 1999 proposed rule). If not, OxyVinyl may have to temporarily truck its wastewater under this option.

- POTW Option Cost:
  - Pipe Distance Required:
    - POTW collection lines within 0.5 to 6 mile distance of OxyVinyl (Deer Park TX area)

      USEPA-OSW does not have detailed information about these sewer lines -- a USEPA Region 6 contact (Lee Bohme, 04 May 2000) reported that most of the industrial wastewater lines to Gulf Coast (over 60 petrochemical plants in the area) are privately owned, so municipal public works authorities do not have sewer line maps in this instance, according to the R6 contact . The R6 contact stated that the closest Gulf Coast POTW is located +/-6 miles from OxyVinyl, so 6 miles [used in the pipe cost estimate computations below] represents a "worst case" [high-end] pipe distance assumption, in absence of detailed info on sewer lines layout. For purpose of creating a low-end cost estimate, an alternative pipe purchase/installation distance of 0.5 miles is also presented below.
    - Two GCWDA POTW facilities near Deer Park ("Washburn" & "Bayport") (See http://www.gcwda.com)
    - Both treat industrial wastewaters
    - Both have current excess capacity (per EPA Region 6 staff):
      - Washburn: (60 MGD design) - (40 MGD used) = 20 MGD excess.
      - Bayport: (25 MGD design) - (18 MGD used) = 7 MGD excess.
    - Add +50% to distance to account for non-linear pipe distance =
      - (0.5 to 6 miles) x (1.5 non-linear factor) = 0.75 to 9 miles
      - (0.75 to 9 miles) x (5,280 feet/mile) = 3,960 to 47,520 feet
  - Pipe Purchase Cost:
    - 8-inch diameter pipe required for 365 GPM (Source: 08 March 2000 DuPont Dow Elastomers LLC letter to USEPA-OSW)
    - 8" PVC water pipe cost = $5.28/foot
    - 8" ductile iron pipe cost = $10.13/foot

      (Source: 08 May 2000 ENR index US avg price; see http://www.enr.com/coneco/)
    - Pipe purchase cost = ($5.28/ft to $10.13/ft) x (3,960 to 47,520 ft) = $0.021 to $0.482 million
  - Pipe Installation Cost (from USEPA-OW "Detailed Costing Document for the Centralized Waste Treatment Industry", EPA-821-R-98-016, Dec 1998) :
    - Engineering planning = +15% of pipe purchase cost
    - Engineering contingency = +15% of pipe purchase cost
    - Installation = +25% to +55% of pipe purchase cost
    - Retro fitting existing equipment & pumps = +20% of pipe purchase cost
    - Taxes, shipping, insurance = +8% of pipe purchase cost
    - Total for installation = +83% to +113% of pipe purchase cost
      - = ($0.021 x 83%) to ($0.482 x 113%) million = $0.018 to $ 0.545 million

			• Pipe Annual Maintenance Cost (USEPA-OW Costing Document, Dec 1998): • Annual maintenance = 4% of pipe purchase + installation cost. = [($0.039 x 4%) to ($1.027 x 4%) million] = $0.002 to $0.041 million/yr • Pretreatment cost before piping to POTW: • May likely require equalization or neutralization tank (sized for 0.5mgd wastewater flow rate). • Cost estimate (source: USEPA-OW, Dec 1998. Sections 2.3 & Table 5-4): • Equalization/neutralization tank initial cost = $0 to $0.161 million • Tank land cost (actual or opportunity cost @0.15 acres) = [(0.15 acres) x (43,560SF/acre) x ($3.5/SF Houston) = $0 to $0.023 million • Tank annual O&M cost = $0 to $0.131 million/yr • POTW NPDES discharge permit modification costs (if similar to RCRA significant mod cost): • One-time labor cost to POTW = 126 burden hours = $0.007 million • One-time fee charged by state authority = $0.002 million • One-time labor cost to EPA/state= 62 burden hours = $0.003 million Total permit modification cost = $0.012 million • POTW Annual Operating Cost: • POTW costs vary according to types of WW treatment technologies provided. • For 0.5 MGD wastewater influent flow rate, USEPA-OW Dec 1998 Costing Document provides following annual wastewater treatment O&M costs: • Biological wastewater treatment = $0.368 million/year • (If necessary) Wastewater treatment sludge filtration =$0.147 million/year • WW sludge filter cake transport & disposal = $0.115 million/year • Total POTW cost with all 3 treatment steps = $0.630 million/year • Price charged OxyVinyl, if POTW adds 50% to 150% to operating cost for overhead: = $0.945 to $1.575 million/yr • POTW cost to OxyVinyl is not fully incremental as a cost for the final rule; need to subtract Oxy Vinyl's current annual payments to Shell Chemical for the surface impoundment waste treatment service: In absence of this payment data, it is reasonable to assert that Shell may charge OxyVinyl up to an alternative market rate for this service, which may equal the POTW operating cost, for purpose of bounding this cost item • Resultant POTW cost range: $0 to $1.575 million/yr • Cost for one-time dredge of surface impoundment: • See Cost Item 6 below ("mixture & derived-from rule" (MDFR) wastes). Costed as a MDFR waste because EDC/VCM wastewater constitutes only 7.5% of total wastewater influent to the surface impoundment (see Nov 1999 Shell Company CALP-00011 public comment to 1999 listing proposal).

- Possible additional costs for POTW option:
  - Temporary offsite transport of WW to commercial treatment facility during conversion to POTW:
    - Possible 6-month compliance delay because of USEPA Region 6 (which includes TX) 12-month NPDES review backlog as of Dec 1999 (http:/www.epa.gov/owm/permits/backlog/charts.htm). According to the Texas Natural Resource Conservation Commission (TNRCC) which administers industrial wastewater disposal/discharge permits, Texas' NPDES permit process includes a 45-review period by USEPA Region 6 (http://www.tnrcc.state.tx.us/water/quality/wwpermits).
    - Because this possible cost may be avoided (e.g. if TNRCC & Region 6 are able to expedite permit review to accommodate special circumstances), no additional cost may be incurred.
    - Monthly wastewater volume affected:
      695,255 metric tons/year of K174 wastewater is about 15.318 million gallons/mo
      [(695,255 met.tons/yr) x (1yr/12mos)] x [(2,205lbs/met.ton) x (1gal/8.34lbs)]
    - Necessary number of monthly truckloads @6,000 gallons/truckload = 2,550 truckloads/mo
    - Two temporary offsite options are possible:
      - Industrial wastewater privately-owned treatment works (PrOTW):
        - As of 1996 there are four PrOTWs 5 to 238 miles from Deer Park TX
        - Truck transport unit cost = $160 to $575/truckload (6,000 gal/truckload)
        - Monthly cost = $0.408 to $1.466 million/mo
      - Commercial deepwell injection:
        - As of 1996 two commercial deepwells 5 and 190 miles from Deer Park TX
        - Truck transport unit cost = $160 to $350/truckload (6,000 gal/truckload)
        - Monthly cost = $0.408 to $0.893 million/mo
    - Implied cost range= ($0 if 0 mos) to ($1.466 mill x 6 mos) = $0 to $8.796 million
  - In addition to truck transport, additional monthly incremental cost for temporary waste treatment provided by the offsite commercial facility, may be incurred by OxyVinyl (no incremental cost assigned – likely equal to baseline cost)
  - Temporary shutdown cost for OxyVinyl's EDC/VCM unit during conversion to POTW:
    - Up to 2-week shutdown likely to hookup to POTW pipe system after its installation
    - Cost defined as loss of OxyVinyl's profit on EDC/VCM output market value during shutdown:
      - OxyVinyl EDC/VCM annual production value (**Attachment B**)= $463.9 million
      - Chemical industry profit rate (+/-1 stnd.dev about median **Attachment F**) = 2.5% to 8.1%
      - % of annual profit loss (0 to 2 weeks) = 0/52 to 2/52 = 0% to 3.8%
      - (0 to 3.8%) x (2.5 to 8.1% profit) x ($463.9 million/yr)= $0 to $1.428 million
      - Note: This is an incidental private cost, not a national cost, because temporary production loss at one facility likely supplied to market by temporary increased output by competing facility
    - Resultant cost range for possible additional cost = $0 to $10.224 million

- K174 POTW option total cost:
  - Total initial cost = **$0.051 to $11.447 million**
  - Annual recurring total cost = **$0.002 to $1.747 million/yr**

			• WWTU Option Cost: • Cost data source: USEPA-OW Dec 1998 "Detailed Costing Document for the Centralized Waste Treatment Industry, EPA-821-R-98-016). • Purchase, installation, annual O&M costs for a new biological wastewater treatment "sequencing batch reactor" system, consisting of SBR tank (for equalization, biological floc aeration, clarification), sludge handling equipment, feed system & controls, pumps, piping, blowers and valves. • System size based on 0.5 million gallons day (MGD) wastewater flow rate (184 million gallons/yr). • Initial costs (including engineering planning, engineering contingency, and installation): • Biological treatment SBR system cost = $6.795 million • Retrofit cost for existing waste treatment train = 20% system cost = $1.359 million • SBR sludge plate & frame filtration system cost = $1.946 million Plant/equipment subtotal = $10.100 million • Land cost = [(0.3 acres) x (43,560SF/acre) x ($3.5/SF Houston)]= $0.046 million • NPDES permit modification: • One-time cost labor cost industry = 126 burden hours = $0.007 million • One-time administrative fee charged by state authority = $0.002 million • One-time labor cost to EPA/state= 62 burden hours = $0.003 million • Subtotal permit modification cost = $0.012 million • Possible additional costs for WWTU option: • According to the construction period summarized in **Attachment E** at the end of this document, the WWTU option may require 8 to 28 months construction period, which is 2 to 22 months beyond the statutory 6-month effective date required by RCRA (Section 3010(b)). • Costs (see POTW option on prior page for cost computation parameters used below): ($0.408 million x 2 mos) to ($1.466 million x 22 mos) = $0.816 to $32.3 million • Temporary shutdown cost of OxyVinyl EDC/VCM unit for hookup to installed WWTU: • Up to temporary 2-week production shutdown likely for hookup to WWTU: • Likely cost (see assumptions in POTW option above) = $0 to $1.017 million • Note: This is an incidental private cost, not a national cost, because temporary production loss at one facility likely supplied by temporary increased output by competing facility. • Annual recurring costs: • SBR system annual O&M cost = $0.515 million/yr • SBR sludge filtration system annual O&M cost = $0.206 million/yr • SBR sludge filter cake transport/disposal annual cost = Not incremental to baseline • Cost for one-time dredge of surface impoundment: • See cost Item 6 below ("mixture & derived-from rule" (MDFR) wastes). Costed as a MDFR waste because EDC/VCM wastewater constitutes only 7.5% of total wastewater influent to the surface impoundment (see Nov 1999 Shell Company CALP-00011 public comment to 1999 listing proposal).
			• K174 WWTU option total cost: • Total initial cost = **$10.974 to $43.475 million** • Annual recurring total cost = **$0.721 million/yr**

			• Surface Impoundment Retrofit Option: • Within 12-months after effective date of final rule: • Install groundwater monitoring at surface impoundment, within 12 months after final rule effective date: • Initial capital cost (Table 3-4, 1997 RCRA Benefits study)= $0.071 to $0.202 million • Annual operating cost (Table 3-4, 1997 study) = $0.008 to $0.061 million/yr • Submit RCRA permit application to USEPA (Tables 9-2, 9-3, 9-6, 1997 study): • Part A permit = $0.003 to $0.006 million • Part B permit (general facility info) = $0.027 to $0.062 million • Part B permit (surface impoundment info) = $0.012 to $0.027 million • Permit cost subtotal = $0.042 to $0.095 million • Financial assurance for closure & post-closure (Tables 10-2 to 10-9, 1997 study): $0.002 to $0.005 million • Annual liability insurance, recordkeeping BRS reporting (DPRA 1993) = $0.030 to $0.262 million/yr • Facility personnel training: • Initial training cost (Table 13-1, 1997 study) = $0.020 million • Annual training cost (Table 13-2, 1997 study) = $0.005 million/yr • Annual sludge sampling/testing (Table 3-4, 1997 study) = $0.007 to $0.013 million/yr • Minimum annual removal of sludge: • Annual sludge volume = 581 to 38,720 CY (see assumptions in cost item 6 below) • Dredge cost = (581 to 38,720 CY) x ($16.60/CY) = $0.010 to $0.643 million/yr • Management of removed sludge: • Transport dredged sludge to landfill (see transport unit cost source elsewhere): [(581 to 38,720 CY) x (0.810 to 1.215 tons/CY) x ($7.3/ton to $115.8/ton)] = $0.004 to $5.448 million/yr • Landfill disposal fee: • May likley use non-haz landfill per K174 conditional listing, but also may need to use hazardous landfill to meet RCRA chemical constituent concentration limits: • Cost = [(581 to 38,720 CY) x (0.810 to 1.215 tons/CY) x ($21 to $175/ton)]= $0.010 to $8.233 million/yr • Management subtotal cost range = $0.014 to $13.681 million/yr • Annual recordkeeping (Table 3-4, 1997 study) = $0.002 to $0.005 million/yr • Within 4-years after effective date of final rule (per RCRA Section 3005(j)(6)(A)): • Comply with 40 CFR 268.4 RCRA Subtitle C requirements for surface impoundments within 4 years: • Unless granted a USEPA waiver, drain surface impoundment and install (40 CFR 264.221): • Two or more liners +leachate collection/ removal system • Liner size = 4 acres • Surface impoundment draining, excavation (site prep): [[182,442(4 acres)^0.79) x (1.2)] = $0.655 million • Liner & leachate system purchase & installation cost: [1,059,790(4 acres)^0.79) x (1.2)] = $3.802 million •Liner/leachate system cost source: Nov 1993 DPRA Inc. unit cost memo to USEPA-OSW, updated to 2000$ using ENR Construction Cost Index multiplier ratio for years 2000/1993= 1.2 • Note: to simplify cost computations, for purpose of estimating total cost, this liner cost is assigned as an initial year capital cost, rather than discounted to reflect possible 4-year deferral. • Other RCRA-related costs: • Future closure cost (Table 10-11, 1997 study) = $0.055 to $0.111 million • Future post-closure costs (Table 10-11, 1997 study) = $0.277 to $0.554 million • Possible corrective action for surface impoundment unit = $0 to $69.600 million (The median value of this wide CA cost range is $1.440 million; source: DPRA 1993, Exh 5-11)

			• K174 retrofit option total cost: • Initial capital cost = **$4.924 to $75.044 million** • Annual operating cost = **$0.076 to $14.670 million/yr**
5	Record-keeping	Facilities must demonstrate that K174 sludges are disposed in landfills (on- or off-site), by maintaining normal business records as documentation.	• Nr. entities affected = All K174 sludge generators in the US (17 facilities as of 1999). • Industry cost = $0 No incremental cost because as described in the ICR (Nr. 1924.01, 25 May 2000), the final rule allows facilities to use existing business records for documentation.
6	MDFR Wastes	By regulatory extension, potentially affects other wastes and waste handlers.	• Nr. entities affected = One EDC/VCM producer (OxyVinyl Deer Park TX) pipes wastewater to an off-site adjacent 4-acre surface impoundment with 6 cells, operated by Shell Chemicals Deer Park TX).
			• Affected waste volume = 9.298 million metric tons (2.458 billion gallons) per year of wastewater influent to the wastewater treatment surface impoundment, consisting of 0.695 million metric tons per year of EDC/VCM wastewater from OxyVinyl (7.5% of total), and the remainder 92.5% influent from Shell Chemicals represents MDFR waste.
			• Industry impact = Final rule allows one-time dredging of entire surface impoundment to remove and dispose K174 wastewater and K174 sludge accumulated on bottom.
			• Industry cost: • Surface impoundment size: • Water surface area = (4 acres) x (4,840 SY/acre) = 19,360 SY (Source: 23 Nov 1999 Shell Chemical Company letter to the USEPA RCRA Docket) • Water depth above sludge bottom = 0.8 to 19.5 feet = 0.3 to 6.5 yards (Source: Derived from sample of impoundments represented in USEPA-OSW national survey database) • Water volume = (19,360SY) x (0.3 to 6.5Y) x (202 gal/CY) = 1.173 to 25.420 mill. gals • Thickness of bottom sludge = 0.1 to 6.0 feet = 0.03 to 2.0 yards (Source: Derived from sample of impoundments represented in USEPA-OSW survey database) • Sludge volume = (19,360 SY) x (0.03 to 2 yards) = 581 to 38,720 CY • Cost data source: Federal Interagency Hazardous, Toxic & Radioactive Waste Environmental Restoration "Historical Cost Analysis System" for remedial action, Dec 1999, http://globe.lmi.org/lmi_hcas/ . • Dredging equipment site mobilization cost = $0.025 to $0.328 million • Dredging equipment site demobilization cost = $0.019 to $0.138 million • Pump standing wastewater = ($31 to $1,833/mill gal) x (1.173 to 25.420 mill gals) = $0.001 to $0.036 million • Transport pumped WW to POTW = (1.173 to 25.420 mill gals) x ($0.06/gal if<50 miles) = $0.070 to $1.525 million • POTW treatment of transported WW= (1.173 to 25.420 mill gals) x ($0.0031/gal)= $0.004 to $0.080 million • Dredge bottom sludge = (581 to 38,720 CY) x ($16.60/CY) = $0.010 to $0.643 million • Transport dredged sludge to non-hazardous landfill = (581 to 38,720 CY) x ($0.015 to $0.092/CY) = $0.001 to $0.004 million • Non-haz landfill fee = (581 to 38,720 CY) x (0.810 to 1.215 tons/CY) x ($21 to $31/ton) = $0.010 to $1.459 million •Subtotal cost = $0.140 to $4.213 million •Note: Incremental cost of final rule will be $0 if facility waits to conduct the allowed one-time dredging during the facility's normal maintenance dredging cycle. • Total cost = **$0 to $4.213 million**
7		Add 5 dioxin/furan congener K174 constituents to F039 list of constituents .	• Industry cost = $0 No cost because treatment technologies currently applied to F039 landfill leachate containing the other dioxin/furan congeners above current LDR limits, reportedly adequate for meeting the limits for the additional 5 congeners.

B. K175 Final Listing:

Item	Component	Description of Cost Component	Regulatory Cost Assumptions & Cost Estimates
8	Waste treatment	Maintain or treat K175 sludge to 0.025 mg/L TCLP mercury.	• Nr. entities impacted = Only one of the 18 total known EDC/VCM manufacturing facilities in the US (as of 1999) currently generates and is therefore subject to the requirements of the K175 final rule (Borden Chemicals, Geismar LA). • Affected waste volume = 120 metric tons K175 sludge (132 short-tons) per year • Industry impact = Must maintain or treat (adjust) the K175 sludge to achieve mercury concentration limit. Generator may achieve as generated with no incremental cost, or generator may need to stabilize waste to achieve mercury level, at assigned cost range of $120 to $2,300 per ton (Source: US average cost for stabilization/fixation/solidification of industrial sludges containing metals, Sept 1997 USEPA-OECA "RCRA Benefits" report, p.5-13) • Industry cost (only if stabilization found to be required): • Transport to offsite stabilizer = [(132 tons) x (1.5 volume expansion) x ($7.3/ton to $115.9/ton)] = $0.002 to $0.023 million/yr • Offsite commercial stabilization = [(132 tons) x ($0 to $2,300/ton)] = $0 to $0.304 million/yr • Subtotal cost = $0.018 to $0.327 million/yr • Total cost range (including uncertainty if no treatment required) = **$0 to $0.327 million/yr**
9		Maintain or treat K175 sludge to pH below 6.0.	• Industry cost = $0 The current K175 generator (Borden Chemicals, Geismar LA), indicated K175 sludge ranges between 3 to 6 pH as generated (19 Nov 1999 comments to RCRA public docket). Therefore, no incremental cost likely for generator to achieve required <6 pH level.
10	Waste disposal	Macroencapsulation (enclosure) of K175 sludge in HDPE vault, and disposal of vault in RCRA Subtitle C hazardous waste landfill.	• Expected impact: The single K175 generator currently transports its K175 sludge to a hazardous waste landfill. The owner/operator of this landfill (Carlyss Co.) indicated to USEPA-OSW (July 2000 phone contact) that it can provide the required macroencapsulation at the landfill facility. • Unit cost (Source: July 2000 USEPA-OSW phone contact with Carlyss Co. landfill operator): • Incremental cost for macroencapsulation charged by landfill = $150 to $200 per ton • No incremental cost for hazardous landfill, because is baseline practice $0/yr • No incremental transport cost assigned, because same landfill likely $0/yr • Industry cost: [(132 tons) x ($150 to $200/ton)] = **$0.020 to $0.027 million/yr**
11	Record-keeping	RCRA recordkeeping (i.e. waste labeling, manifesting, biennial reporting, 3-year record retention)	• Nr. entities affected = Two (K175 generator facility + landfill facility accepting K175 for macroencapsulation disposal) • Industry cost = $0 Nominal incremental cost because both facilities already maintain RCRA records for other reasons, and K175 shipped only twice per year (20 cu.yd roll-off containers).
12	MDFR Wastes	By regulatory extension, potentially affects other wastes and waste handlers (waste mixtures, residuals, contaminated soil & debris).	• Industry cost = $0 No cost because only one K175 generator known, with one offsite waste handler. Also, public comments raising the MDFR possibility in response to USEPA-OSW's 1999 proposed listing rule, did not provide any particular substantiating case or evidence of affected waste quantities.

C. Other Features Associated with Final Rule:

Item	Component	Description of Cost Component	Regulatory Cost Assumptions & Cost Estimates
13	Admini- strative	Up-front administrative burden of reading the new final rule.	• Nr. entities affected = • All 39 halogenated chemical manufacturing facilities in the US likely to read the final rule • 12 non-governmental organizations (NGOs) likely to read the rule • All 10 USEPA regional offices, and two other Fed agencies, likely to read the rule • 49 US states/territories with authorized RCRA programs likley to read the rule • National cost: • Average ½-day for average of 4 "applicable persons" to read/communicate contents of final rule in each entity (This is a different assumption than applied in the "Information Collection Request" to OMB for the final rule) • Industry cost = (39 facilities) x (4 persons/facility) x (4 hours@$90/hr) = $0.056 million • NGO cost = (12 NGOs) x (4 persons/NGO) x (4 hours@90/hr) = $0.017 million • Federal gov't cost = (12 offices/agencies) x (4 persons) x (4 hours@$90/hr) = $0.017 million • State/territory cost = (49 states/territories) x (4 persons) x (4 hours@$90/hr) = $0.071 million • Total cost = **$0.161 million**
14		Prepare & submit state RCRA authorization program modification to EPA (as required by 40 CFR 271.21(e)).	• Nr. entities affected= Applies to all states with authorized RCRA programs (49 count as of 1999). • National cost: • States must revise their RCRA authorized programs by 01 July each year to reflect all new Federal RCRA rules promulgated during the preceding 12 months from the previous 01 July (40 CFR 271.21(e)). • For year 2000, EPA expects to promulgate five new RCRA rules (source: http://ciir.cs.umass.edu/ciirdemo/ua/AgendaApril2000/web_pages/preambles/file-19.html) • The *apportioned cost* for the K174/K175 final rule is therefore one-fifth of the total cost for state program revision. • Authorized state costs =](49 states) x ($7,100/modification application)]/5 rules = $0.069 million (source: Exhibit 3 of ICR Nr.969, Dec 1998, updated to year 2000 by wage rate multiplier = 1.08) • EPA application review costs = [(49 applications) x ($11,500/application)]/5 rules = $0.112 million (source: Exhibit 6 of ICR Nr.969, Dec 1998, updated to year 2000 by wage rate multiplier = 1.08) • Total cost = **$0.182 million**
15		Waives waste handler notification for facilities with existing EPA IDs.	• National cost = $0 No cost because affected industrial entities already have USEPA RCRA ID numbers in conjunction with other prior listed wastes.
16	Enforce- ment	New listing will incrementally add to existing Agency/state RCRA enforcement burden.	• Nr. entities affected = Currently broadly applies to eight states with CAHC manufacturing facilities, but narrowly applies only to four states with 18 EDC/VCM manufacturing facilities. • National cost: • One FTE per 3 to 6 monitoring cases per year (USEPA-OSW June 2000 communication with OECA staff). • 18 relevant facilities = 18 cases per year. • (18 cases/yr) x (1 FTE per 3 to 6 cases) = 3 to 6 FTE per year equivalent. • (3 to 6 FTE/year) x ($40,000 base salary/FTE) x (2.5 overhead) = **$0.300 to $0.600 million/yr**
17	Emergency Response	Adds 18 chemical constituents in K174 & K175 wastes, as "reportable quantities" to CERCLA substances for EPCRA emergency notification.	• Expected impact = Facilities which release RCRA "reportable quantity" (RQ) wastes must immediately call the National Response Center, and the appropriate state/local emergency response team. • Nr. entities affected = One K175 generator (K174 generators & handlers are expected to become conditionally exempt), and one to three states (2 or 3 if waste is transported across state lines for disposal). • National cost = $0 Minimal average annual cost expected because of relative infrequent and small volume incidence of release events on an average annual basis, because of (a) the relatively small US national number of K174 & K175 waste generators (K174 generators are all expected to become conditionally exempt, and only n=1 K175 generator) and handlers (n=2 or 3 K175 handlers), and (b) relatively small waste quantities potentially involved (i.e. spill portions of 132 annual tons K175 sludge).

Explanatory Notes:
(a) Unit costs (both single point estimates and cost ranges) applied in this table represent USEPA-OSW's estimates of, or actual data for, US national average costs.
(b) Tons = short-tons (2,000 pounds). Metric tons = 2,205 pounds; multiply "metric tons" by 1.102 to convert to "short-ton" equivalent basis.
(c) Sludge density/volume conversion factors = (60 to 90 lbs/CF) x (27CF/CY) =1,620 to 2,430 lbs/CY = 0.810 to 1.215 tons/CY

USEPA Estimate of National Cost for the RCRA K174/K175 Waste Listing Final Rule

Item	Cost Component	Brief Description of Components	Initial Lump-Sum Costs ($ million)	Annual Recurring Costs ($ million)
A. K174 Final Listing:				
1	Waste treatment	Treatment of K174 sludges prior to disposal not required	$0	$0
2		Adds 5 dioxin/furan congener K174 constituents to the RCRA LDR UTS table	$0	$0
3	Waste disposal	K174 sludges must be disposed in either a hazardous or non-hazardous state-permitted or licensed landfill (on- or off-site).	$0	$0.030 to $0.537
4		K174 sludges may not be placed on the land prior to final disposal in a landfill: Option A: Convert to POTW	$0.051 to $11.447	$0.002 to $1.747
		Option B: Convert to WWTU	$10.974 to $43.475	$0.721
		Option C: Retrofit surface impndt	$4.924 to $75.044	$0.076 to $14.670
5	Record-keeping	Facilities must demonstrate that K174 sludges are disposed in landfills by maintaining business records as documentation	$0	$0
6	"Mixture & Derived From" (MDF) wastes	RCRA statutory extension potentially affects other wastes and waste handlers (surface impoundment one-time dredging)	$0.140 to $4.213	$0
7		Adds 5 dioxin/furan congener K174 constituents to RCRA F039 hazardous wastecode list of constituents	$0	$0
		K174 Subtotal Costs =	$0.191 to $75.044	$0.032 to $15.207
B. K175 Final Listing:				
8	Waste treatment	Maintain/adjust K175 sludge to 0.025 mg/L TCLP mercury	$0	$0 to $0.327
9		Maintain/adjust K175 sludge to pH below 6.0	$0	$0
10	Waste disposal	Macroencapsulation (enclosure) of K175 sludge in HDPE vault, and disposal of vault in RCRA Subtitle C hazardous landfill	$0	$0.020 to $0.027
11	Record-keeping	K175 generator and receiving disposal landfill must maintain RCRA recordkeeping (labeling, manifesting, biennial reporting)	$0	$0
12	MDF wastes	RCRA statutory extension potentially affects other wastes & waste handlers	$0	$0
		K175 Subtotal Costs =	$0	$0.020 to $0.354
C. Final Rule Other Costs:				
13	Admini-strative	Up-front administrative burden of reading the new final rule	$0.161	$0
14		Prepare/submit state RCRA authorization program modification	$0.182	$0
15		Waives waste handler notification for facilities with existing EPA ID numbers	$0	$0
16	Enforcement	Listing adds to USEPA/state RCRA enforcement burden	$0	$0.300 to $0.600
17	Emergency Response	Adds 18 chemicals found in K174 & K175 sludges, as CERCLA reportable quantities for EPCRA emergency notification	$0	$0
		Subtotal Other Costs =	$0.343	$0.300 to $0.600
Column Totals ($millions):				
Cost range with K174 POTW option A =			**$0.534 to $16.003**	**$0.352 to $3.238**
Cost range with K174 WWTU option B =			**$11.457 to $48.031**	**$1.071 to $2.212**
Cost range with K174 Retro option C =			**$5.267 to $75.387**	**$0.426 to $16.161**
Overall cost range (reflecting full estimation uncertainty over all K174 options) =			**$0.534 to $75.387**	**$0.352 to $16.161**

VII.C. Why Is EPA's Cost Estimate a Relatively Wide Range?

EPA's estimated (1) initial compliance costs, and (2) recurring annual compliance costs, as displayed in the previous exhibit, represent the lower- and upper-bounds of relatively wide ranges in "***possible costs***". These ranges reflect and include EPA's uncertainty concerning many of the itemized, cost-estimation parameters included in this study (as itemized in the previous section of this chapter). The table below summarizes the three largest sources of compliance cost estimation uncertainty, for K174 compliance costs associated with a single facility (OxyVinyl Company, Deer Park TX), which is currently managing EDC/VCM production wastewater, in a treatment **surface impoundment** at an adjacent facility (Shell Chemical Company, Deer Park TX):

Primary Sources of Cost Estimation Uncertainty Concerning K174 Waste Currently Managed in a Surface Impoundment	
1. Engineering Options:	There appear to be at least three alternative, engineering feasible, compliance options (i.e. "POTW", "WWTU", and "Retrofit" options), for K174 compliance involving this single facility (OxyVinyl). Because of its unknown potential for incurring future RCRA "corrective action" costs involving the surface impoundment, the "Retrofit" option drives the upper-bound of the initial cost range.
2. Final Rule Effective Date:	Because of a possible NPDES wastewater discharge permit processing backlog of 12-months, and of a possible 8 to 28-month construction period for the WWTU option, it is possible that K174 compliance for this single facility, may exceed RCRA's statutory six-month effective date (RCRA Section 3010(b)) for final rules. One possible consequence of such exceedance, is that this facility may need to temporarily truck transport the affected wastewater, to an offsite commercial waste treatment facility, until the necessary permits are approved and the selected engineering option is completed. This possible truck transport cost also contributes to the upper-bound of the cost estimate range.
3. Baseline Waste Management Cost:	The current (baseline) annual costs to OxyVinyl for Shell's surface impoundment waste treatment services. The incremental cost to OxyVinyl for K174 final rule compliance, must net-out this baseline cost. USEPA does not know this cost, so a full treatment services annual cost is included in the upper-end of the cost estimation range. (USEPA did not collect information about the surface impoundment in the 1992/1997 RCRA Section 3007 industry survey.)

If these two upper-bound, possible costs are excluded from EPA's national cost estimate, such that (a) only the lowest-cost option of the three alternative engineering options is included, and (b) the temporary trucking costs associated with exceedance of the final rule effective date are assumed avoided, then the resultant upper-bound of the estimate of national cost is reduced significantly as displayed in the following table:

Upper-Bound of EPA's Cost Estimation Range: Comparison of "Full" to "Moderated" Cost Estimation Uncertainty ($millions)				
Level of Upper-Bound Cost Uncertainty Concerning the Surface Impoundment Case	Initial Costs		Recurring Annual Costs	
	Lower-bound	Upper-bound	Lower-bound	Upper-bound
"**Full Cost Estimation Uncertainty**": • All K174 engineering options (low- & high-cost) • Temporary trucking cost during exceedance period	$0.534	$75.387	$0.352	$16.161
"**Moderated Cost Estimation Uncertainty**": • Only the lowest-cost K174 engineering option • Exceedance period avoided (no temporary trucking)	$0.534	$7.207	$0.352	$3.238

VII.D. What is the Average Annualized Cost and Present Value Cost of the Final Rule?

The national compliance costs estimated in the previous section of this document, are based on dollar values expressed in ***real or constant dollar magnitude*** (i.e. based on current year 2000 or recent year 1999 price levels), without time-discounting applied to future costs. Economic analyses are standardly accomplished using "real" or "constant-dollar" monetary values, rather than using "nominal" or "inflated-dollar" values. In contrast, financial- or accounting-type analyses often apply "inflated-dollar" values, for example, to develop and allocate actual funding for future budgets and future expenditures, which is beyond the scope and purpose of this background document.

In addition to applying constant dollar costs, it is often convenient to combine initial costs with recurring annual costs, into a single measure of cost. Two such measures are:

- **PV**: Present value equivalent cost
- **AAE**: Average annualized equivalent cost

The table below presents these cost measures according to both "full" and "moderated" cost estimation uncertainty, based on applying costs over a 30-year (years 2001-2030) future period-of-analysis (POA), and based on applying the OMB-recommended 7.00% discount rate to future regulatory costs:

Average Annualized Equivalent & Present Value of EPA's Cost Estimation Range: Comparison of "Full" to "Moderated" Cost Estimation Uncertainty ($millions)				
Level of Upper-Bound Cost Uncertainty Concerning the Surface Impoundment Case	Average Annualized Cost		Present Value Cost	
	Lower-bound	Upper-bound	Lower-bound	Upper-bound
"**Full Cost Estimation Uncertainty**": • All K174 engineering options (low- & high-cost) • Temporary trucking cost during exceedance period	$0.42	$23.37	$5.21	$289.97
"**Moderated Cost Estimation Uncertainty**": • Only the lowest-cost K174 engineering option • Exceedance period avoided (no temporary trucking)	$0.42	$4.05	$5.21	$50.20

The final two tables at the end of this chapter present the 30-year future cost streams applied for computation of AAE and PV costs.

VII.E. <u>How Does the Final Rule Cost Compare to Current Industry Expenditures on Waste Management?</u>

For purpose of **benchmarking** the estimated national costs for the final rule, it is possible to compare costs to the overall level of spending on solid waste management in the relevant industrial sector(s) associated with CAHC manufacturing facilities. There are two relevant industry sectors which may form the basis of benchmarking regulatory costs of the rule, to the industry sector:

- <u>Organic Chemicals Manufacturing Sector</u> (SIC 282; NAICS 3252)
  Represents CAHC manufacturers without consideration of possible economic linkage to other industries either upstream or downstream in in the material flow structure of the national and global economy.

- <u>Plastics & Synthetics Materials Manufacturing Sector</u> (SIC 286; NAICS 3251)
  This ancillary sector represents CAHC manufacturing facilities which are economically-linked (integrated) with downstream PVC producers, which consume over 90% of CAHCs manufactured in the US.

The table below presents descriptive statistics for these two industrial sectors, consisting of 978 companies operating 1,600 facilities, which reportedly spent a total of $160 million on solid waste expenditures annually in the 1990s, representing an average solid waste expenditure of $0.1 million annually across these two industrial sectors. Relative to this **$160 million/year** industry sector benchmark, the average annual equivalent (AAE) cost of the final K174/K175 listing rule shown in the table above (under "full cost estimation uncertainty"), represents an annual average increase in solid waste expenditures in the industry of between **0.3% to 15%**.

Descriptive Statistics for Benchmarking Final Rule Costs to Affected Industrial Sectors						
Nr. of Companies	Nr. of Facilities	Industry Sector Employees	Capacity Prod-uction Rate	Annual Sales Revenues (millions)	Annual Machinery* Expenditures (millions)	Annual Solid Waste Expenditures (millions)
282 Plastics & Synthetic Materials Manufacturing (NAICS= 3252):						
341	628	115,100	86%	$59,566.7	$3,431.6	$25.5
Per facility averages =		183	86%	$94.9	$5.5	$0.04
286 Organic Chemicals Manufacturing (NAICS= 3251):						
637	972	125,900	85%	$75,671.9	$5,732.4	$134.7
Per facility averages =		130	85%	$77.9	$5.9	$0.14
Total both sectors:						
978	1,600	241,000	86%	$135,239	$9,164	**$160**
Per facility averages =		151	86%	$84.5	$5.7	**$0.10**

Explanatory Notes:
(a) *Expenditures displayed above for machinery & equipment only, excluding buildings and other structures.
(b) Data sources:
(b1) Number of companies and facilities from 1992 Census of Manufacturers;
(b2) Number of employees, sales, and capital expenditures from the 1996 Annual Survey of Manufacturers;
(b3) production rates from 1996 Survey of Plant Capacity,
(b4) and solid waste expenditures from 1994 Pollution Abatement Costs and Expenditures;
these reports all published by the US Bureau of Census, an agency within the US Dept of Commerce.
(c) Number of employees associated only with SIC code facilities, not inclusive of all parent company affiliates/subsidiaries.
(d) Financial indicators (sales, expenditures) associated only with SIC code facilities, not with all parent company operations.

VII.F. What Are the Relative Proportions of "*Targeted*", "*Induced*" & "*Incidental*" Costs in the Estimated National Cost for the Final Rule?

Relative Proportion of "*Targeted*", "*Induced*" & "*Incidental*" Regulatory Costs in EPA's Estimated National Average Annualized Cost for the RCRA K174/K175 Final Rule ($millions)									
Item	Type of Effect	"*Moderated*" Cost Uncertainty Range				"*Full*" Cost Uncertainty Range			
		Lower-bound cost		Upper-bound cost		Lower-bound cost		Upper-bound cost	
1	Targeted	$0.06	14.7%	$3.04	75.1%	$0.06	14.7%	$0.96	4.1%
2	Induced	$0.36	84.9%	$1.01	24.9%	$0.36	84.9%	$22.41	95.9%
3	Incidental	$0.001	0.3%	$0.001	<0.1%	$0.001	0.3%	$0.001	<0.1%
	Totals =	$0.42	100%	$4.05	100%	$0.42	100%	$23.37	100%

Explanatory Notes:
(a) The maximum upper-bound of the cost range switches from "*targeted*" to "*induced*" in comparing "*moderated*" to "*full*" cost uncertainty, because the compliance cost scenario switches from the "K174 POTW option A" (lower cost), to the "K174 retro option C" (higher cost), respectively.
(b) See the four spreadsheet exhibits at end of this chapter for itemized cost assignments according to the three effect categories (i.e. targeted, induced, incidental).
(c) Costs annualized using a 7% discount rate over a 30-year future period-of-analysis (2001-2030).

VII.G. How Does the Final Rule Cost Compare to the Costs of the Listing Scenarios Considered in the 1999 Proposed Rule Economic Analysis?

As discussed in USEPA's *Federal Register* announcement, the RCRA K174/K175 final rule represents a "*novel policy*" approach: it deviates from the USEPA's standard or historic RCRA listing approach, in that the final rule is listing as hazardous, only those quantities of the waste that are managed in a manner that reflects unacceptable risks. This type of targeted, **"*conditional*" listing approach**, differs from the USEPA's **"*traditional*" approach** to listing wastes as RCRA "hazardous", in which the listing determinations may capture the entire national quantity of a class, or industrial sector of, wastestreams that pose unacceptable risks to human health and the environment, when managed in one or more particular manners. "*Traditional*" listings may also prescribe "waste incineration followed by disposal of incineration residue in a hazardous landfill" for all affected waste volume, as the RCRA waste management requirement, rather than considering the relative protectiveness of different waste management alternatives, on a waste-by-waste basis. Consequently, the regulatory cost of the "*conditional approach*" final rule, is significantly less that what it would otherwise be under a "*traditional*" approach. This is illustrated by comparison in a following table, of the final rule costs estimated in this document, with USEPA's estimated costs for other alternative listing waste management scenarios presented in the 30 July 1999 "*Economics Background Document*", which included a "*traditional*" approach for both the K174 and K175 listings, which would have resulted in a higher cost impact on the chlorinated aliphatic industry sector, if adopted in the final rule.

Comparison of K174/K175 Final Rule Costs Estimated in this Background Document,
to the USEPA's Estimated Costs for the Listing Waste Mangement Scenarios
Presented in the 30 July 1999 "*Economics Background Document*" for the 1999 Proposed K173/K174/K175 Listing Rule
(Note: USEPA did not present all waste management scenarios listed below as regulatory options in the proposed rule)

Item	Cost Estimation Scenarios in the Economic Analysis for the 1999 Proposed Rule					2000 Final Rule	
	Listing Scenarios Defined for Cost Estimation	Wastes subject to scenario: Annual met.tons	Wastes subject to scenario: Generator facilities	Prescribed RCRA waste management requirements	Estimated net incremental annual cost* ($millions)	Disposition of Scenario in Final Rule	Estimated net incremental annual cost** ($millions)
K173 (chlorinated aliphatic manufacturing wastewaters):							
1	"Conditional" approach affecting only wastewater volumes which exceed dioxin TEQ concentration "trigger level"	11.5 million	51 tanks at up to 23 facilities	If must test wastewaters + install wastewater tank covers + tank vent controls	$0.81	Not included in the final rule	Not estimated
K174 (EDC/VCM manufacturing wastewater sludges):							
2	"Traditional" approach affecting all volume of the waste class in the targeted industrial sector including co-mingled wastes	129,375	14	If must incinerate sludge + dispose residue in haz-LF	$69.58 to $115.94	Not included in the final rule	Not estimated
3	Target listing only to segregated wastes volume rather than co-mingled volume	11,926	14	If must incinerate sludge + dispose residue in haz-LF	$5.82 to $9.70	Not included in the final rule	Not estimated
4	"Conditional" listing affecting subset of facilities which do not landfill waste	1,750	1	If must incinerate sludge + dispose residue in haz-LF	$1.00 to $1.67	Not included in the final rule	Not estimated
5				If must dispose sludge in either non-haz or haz-LF	$0.03	Basis of K174 listing final rule	$0.03 to $2.44
K175 (VCM-A manufacturing wastewater sludges):							
6	"Traditional" listing approach	120	1	If must retort sludge to extract mercury + stabilize residue pH + dispose residue in haz-LF co-disposal dedicated cell	$0.17 to $0.21	Not included in the final rule	Not estimated
				Not included in proposed rule	Not estimated	Macroencapsulate sludge + dispose in haz-LF	$0.02 to $0.38
7	"Conditional" listing targeted to wastes failing mercury TC & not disposed in haz-LF			If must dispose in haz-LF with dedicated co-disposal cell	$0.08	Not included in the final rule	Not estimated

(a) "Haz-LF" = Hazardous waste lanfill which meets USEPA's RCRA "Subtitle C" landfill siting, construction design, operation and other regulatory requirements.
(b) * "Net incremental cost" = USEPA's estimated national cost for listing option, after (a) netting-out baseline (current) waste management costs (usually assumed to be non-hazardous landfilling), and (b) updating cost estimates to 1998$; cost ranges reflect either +/-10% or +/-25% uncertainty intervals applied to single point estimates.
(c) ** Final rule cost estimates ("moderate uncertainty" estimates shown above) are different from the 30 July 1999 background document because of improved detail in cost computations.

K174 & K175 RCRA LISTING FINAL RULE:
MODERATE COST ESTIMATION UNCERTAINTY

COMPUTATION OF PRESENT VALUE (PV) AND AVERAGE ANNUAL EQUIVALENT (AAE) COSTS

Row Item	POA Year	K174 National Costs: Initial Lumpsum Low-end	High-end	Recurring Annual Low-end	High-end	K175 National Costs: Initial Lumpsum Low-end	High-end	Recurring Annual Low-end	High-end	Final Rule Other Costs: Initial Lumpsum Low-end	High-end	Recurring Annual Low-end	High-end	Final Rule Total Costs: Initial Lumpsum Low-end	High-end	Recurring Annual Low-end	High-end	Initial + Annual Low-end	High-end
1	2001	$0.191	$6.864	$0.032	$2.284	$0.000	$0.000	$0.020	$0.354	$0.343	$0.343	$0.300	$0.600	$0.534	$7.207	$0.352	$3.238	$0.886	$10.445
2	2002			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
3	2003			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
4	2004			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
5	2005			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
6	2006			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
7	2007			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
8	2008			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
9	2009			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
10	2010			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
11	2011			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
12	2012			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
13	2013			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
14	2014			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
15	2015			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
16	2016			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
17	2017			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
18	2018			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
19	2019			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
20	2020			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
21	2021			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
22	2022			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
23	2023			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
24	2024			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
25	2025			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
26	2026			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
27	2027			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
28	2028			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
29	2029			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
30	2030			$0.032	$2.284			$0.020	$0.354			$0.300	$0.600	$0.000	$0.000	$0.352	$3.238	$0.352	$3.238
Present Value (PV) Costs:																			
	0.0%			$0.96	$68.52	$0.00	$0.00	$0.60	$10.62	$0.34	$0.34	$9.00	$18.00	$0.53	$7.21	$10.56	$97.14	$11.09	$104.35
	3.0%			$0.65	$46.11	$0.00	$0.00	$0.40	$7.15	$0.34	$0.34	$6.06	$12.11	$0.53	$7.21	$7.11	$65.37	$7.64	$72.58
	5.0%			$0.52	$36.87	$0.00	$0.00	$0.32	$5.71	$0.34	$0.34	$4.84	$9.68	$0.53	$7.21	$5.68	$52.26	$6.22	$59.47
OMB>	**7.0%**			$0.42	$30.33	$0.00	$0.00	$0.27	$4.70	$0.34	$0.34	$3.98	$7.97	$0.53	$7.21	$4.67	$42.99	$5.21	$50.20
	10.0%			$0.33	$23.68	$0.00	$0.00	$0.21	$3.67	$0.34	$0.34	$3.11	$6.22	$0.53	$7.21	$3.65	$33.58	$4.18	$40.78
Average Annual Equivalent (AAE) Costs:																			
	0.0%			$0.032	$2.284	$0.000	$0.000	$0.020	$0.354	$0.011	$0.011	$0.300	$0.600	$0.018	$0.240	$0.352	$3.238	$0.37	$3.48
	3.0%			$0.033	$2.353	$0.000	$0.000	$0.021	$0.365	$0.017	$0.017	$0.309	$0.618	$0.027	$0.368	$0.363	$3.335	$0.39	$3.70
	5.0%			$0.034	$2.398	$0.000	$0.000	$0.021	$0.372	$0.022	$0.022	$0.315	$0.630	$0.035	$0.469	$0.370	$3.400	$0.40	$3.87
OMB>	**7.0%**			$0.034	$2.444	$0.000	$0.000	$0.021	$0.379	$0.028	$0.028	$0.321	$0.642	$0.043	$0.581	$0.377	$3.465	$0.42	$4.05
	10.0%			$0.035	$2.512	$0.000	$0.000	$0.022	$0.389	$0.036	$0.036	$0.330	$0.660	$0.057	$0.765	$0.387	$3.562	$0.44	$4.33

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K174/K175 RCRA FINAL RULE:
COST SUBTOTALS BY COST TYPOLOGY
MODERATED COST UNCERTAINTY RANGE:

			1. TARGETED EFFECTS:				2. INDUCED EFFECTS:				3. INCIDENTAL EFFECTS:			
			Initial Costs:		Annual Costs:		Initial Costs:		Annual Costs:		Initial Costs:		Annual Costs:	
Type of cost	Feature of Rule	Cost Item	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end
Targeted	K174	1	$0.000	$0.000	$0.000	$0.000								
Induced		2	$0.000				$0.000	$0.000	$0.000	$0.000				
Targeted		3	$0.000	$0.000	$0.030	$0.537								
Targeted	Option A	4-POTW	$0.051	$2.651	$0.002	$1.747								
Targeted	Option B	4-WWTU	$10.158	$11.175	$0.721	$0.721								
Induced	Option C	4-RETRO												
Targeted		5	$0.000	$0.000	$0.000	$0.000								
Induced	Option A	6-POTW					$0.140	$4.213	$0.000	$0.000				
Induced	Option B	6-WWTU					$0.140	$4.213	$0.000	$0.000				
Induced	Option C	6-RETRO					$0.000	$0.000	$0.000	$0.000				
Induced		7					$0.000	$0.000	$0.000	$0.000				
Targeted	K175	8	$0.000	$0.000	$0.000	$0.327								
Targeted		9	$0.000	$0.000	$0.000	$0.000								
Targeted		10	$0.000	$0.000	$0.020	$0.027								
Targeted		11	$0.000	$0.000	$0.000	$0.000								
Induced		12					$0.000	$0.000	$0.000	$0.000				
Tar+Ind+Inc	Other	13	$0.026	$0.026	$0.000	$0.000	$0.118	$0.118	$0.000	$0.000	$0.017	$0.017	$0.000	$0.000
Induced		14					$0.182	$0.182	$0.000	$0.000				
Targ+Ind		15	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000				
Induced		16					$0.000	$0.000	$0.300	$0.600				
Induced		17					$0.000	$0.000	$0.000	$0.000				
			SUB-TOTAL COSTS BY TYPE OF EFFECT (MODERATED UNCERTAINTY):											
	K174	POTW	$0.051	$2.651	$0.032	$2.284	$0.140	$4.213	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
		WWTU	$10.158	$11.175	$0.751	$1.258	$0.140	$4.213	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
		RETRO												
	K175		$0.000	$0.000	$0.020	$0.354	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
	Other		$0.026	$0.026	$0.000	$0.000	$0.300	$0.300	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
			TOTAL COSTS BY TYPE OF EFFECT (MODERATED UNCERTAINTY):											
		POTW	$0.077	$2.677	$0.052	$2.638	$0.440	$4.513	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
		WWTU	$10.184	$11.201	$0.771	$1.612	$0.440	$4.513	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
		RETRO												

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MODERATED COST UNCERTAINTY RANGE:
Computation of Average Annualized Costs by Three Types of Regulatory Effects

		C1. TARGETED EFFECTS:				C2. INDUCED EFFECTS:				C3. INCIDENTAL EFFECTS:						COMPUTATION DOUBLE-CHECK			
Row	POA	Initial Costs:		Initial + Annual:		Initial Costs:		Initial + Annual:		Initial Costs:		Initial + Annual:				Initial + Annual:			
Item	Year	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end			Low-end	High-end		
1	2001	$0.077	$2.677	$0.129	$5.315	$0.440	$4.513	$0.740	$5.113	$0.017	$0.017	$0.017	$0.017			$0.886	$10.445		
2	2002			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
3	2003	Annual Costs:		$0.052	$2.638	Annual Costs:		$0.300	$0.600	Annual Costs:		$0.000	$0.000			$0.352	$3.238		
4	2004	Low-end	High-end	$0.052	$2.638	Low-end	High-end	$0.300	$0.600	Low-end	High-end	$0.000	$0.000			$0.352	$3.238		
5	2005	$0.052	$2.638	$0.052	$2.638	$0.300	$0.600	$0.300	$0.600	$0.000	$0.000	$0.000	$0.000			$0.352	$3.238		
6	2006			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
7	2007			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
8	2008			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
9	2009			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
10	2010			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
11	2011			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
12	2012			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
13	2013			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
14	2014			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
15	2015			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
16	2016			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
17	2017			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
18	2018			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
19	2019			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
20	2020			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
21	2021			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
22	2022			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
23	2023			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
24	2024			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
25	2025			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
26	2026			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
27	2027			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
28	2028			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
29	2029			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
30	2030			$0.052	$2.638			$0.300	$0.600			$0.000	$0.000			$0.352	$3.238		
Present Value (PV) Costs:																**COMPUTATION DOUBLE-CHECK:**			
	0.0%			$1.64	$81.82			$9.44	$22.51			$0.017	$0.017			$11.09	$104.35		
	3.0%			$1.13	$55.93			$6.50	$16.63			$0.017	$0.017			$7.64	$72.58		
	5.0%			$0.92	$45.26			$5.28	$14.20			$0.017	$0.017			$6.22	$59.47		
OMB>	**7.0%**			$0.77	$37.70	14.7%	75.1%	$4.42	$12.48	84.9%	24.9%	$0.017	$0.017	0.33%	0.03%	$5.21	$50.20	100.0%	100.0%
	10.0%			$0.62	$30.03			$3.55	$10.73			$0.017	$0.017			$4.18	$40.78		
Average Annual Equivalent (AAE) Costs:																			
	0.0%			$0.05	$2.73			$0.31	$0.75			$0.001	$0.001			$0.37	$3.48		
	3.0%			$0.06	$2.85			$0.33	$0.85			$0.001	$0.001			$0.39	$3.70		
	5.0%			$0.06	$2.94			$0.34	$0.92			$0.001	$0.001			$0.40	$3.87		
OMB>	**7.0%**			$0.06	$3.04	14.7%	75.1%	$0.36	$1.01	84.9%	24.9%	$0.001	$0.001	0.33%	0.03%	$0.42	$4.05	100.0%	100.0%
	10.0%			$0.07	$3.19			$0.38	$1.14			$0.002	$0.002			$0.44	$4.33		

K174/K175 RCRA FINAL RULE:
COST SUBTOTALS BY COST TYPOLOGY
FULL COST UNCERTAINTY RANGE:

			1. TARGETED EFFECTS:				2. INDUCED EFFECTS:				3. INCIDENTAL EFFECTS:			
Type of cost	Feature of Rule	Cost Item	Initial Costs: Low-end	Initial Costs: High-end	Annual Costs: Low-end	Annual Costs: High-end	Initial Costs: Low-end	Initial Costs: High-end	Annual Costs: Low-end	Annual Costs: High-end	Initial Costs: Low-end	Initial Costs: High-end	Annual Costs: Low-end	Annual Costs: High-end
Targeted	**K174**	1	$0.000	$0.000	$0.000	$0.000								
Induced		2	$0.000				$0.000	$0.000	$0.000	$0.000				
Targeted		3	$0.000	$0.000	$0.030	$0.537								
Targeted	Option A	4-POTW	$0.051	$11.447	$0.002	$1.747								
Targeted	Option B	4-WWTU	$10.974	$43.475	$0.721	$0.721								
Induced	Option C	4-RETRO					$4.924	$75.044	$0.076	$14.670				
Targeted		5	$0.000	$0.000	$0.000	$0.000								
Induced	Option A	6-POTW					$0.140	$4.213	$0.000	$0.000				
Induced	Option B	6-WWTU					$0.140	$4.213	$0.000	$0.000				
Induced	Option C	6-RETRO					$0.000	$0.000	$0.000	$0.000				
Induced		7					$0.000	$0.000	$0.000	$0.000				
Targeted	**K175**	8	$0.000	$0.000	$0.000	$0.327								
Targeted		9	$0.000	$0.000	$0.000	$0.000								
Targeted		10	$0.000	$0.000	$0.020	$0.027								
Targeted		11	$0.000	$0.000	$0.000	$0.000								
Induced		12					$0.000	$0.000	$0.000	$0.000				
Tar+Ind+Inc	**Other**	13	$0.026	$0.026	$0.000	$0.000	$0.118	$0.118	$0.000	$0.000	$0.017	$0.017	$0.000	$0.000
Induced		14					$0.182	$0.182	$0.000	$0.000				
Targ+Ind		15	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000				
Induced		16					$0.000	$0.000	$0.300	$0.600				
Induced		17					$0.000	$0.000	$0.000	$0.000				
			SUB-TOTAL COSTS BY TYPE OF EFFECT (FULL UNCERTAINTY):											
	K174	POTW	$0.051	$11.447	$0.032	$2.284	$0.140	$4.213	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
		WWTU	$10.974	$43.475	$0.751	$1.258	$0.140	$4.213	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
		RETRO	$0.000	$0.000	$0.030	$0.537	$4.924	$75.044	$0.076	$14.670	$0.000	$0.000	$0.000	$0.000
	K175		$0.000	$0.000	$0.020	$0.354	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
	Other		$0.026	$0.026	$0.000	$0.000	$0.300	$0.300	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
			TOTAL COSTS BY TYPE OF EFFECT (FULL UNCERTAINTY):											
		POTW	$0.077	$11.473	$0.052	$2.638	$0.440	$4.513	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
		WWTU	$11.000	$43.501	$0.771	$1.612	$0.440	$4.513	$0.300	$0.600	$0.017	$0.017	$0.000	$0.000
		RETRO	$0.026	$0.026	$0.050	$0.891	$5.224	$75.344	$0.376	$15.270	$0.017	$0.017	$0.000	$0.000

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FULL COST UNCERTAINTY RANGE:

Computation of Average Annualized Costs by Three Types of Regulatory Effects

		C1. TARGETED EFFECTS:				C2. INDUCED EFFECTS:				C3. INCIDENTAL EFFECTS:						COMPUTATION DOUBLE-CHECK			
Row	POA	Initial Costs:		Initial + Annual:		Initial Costs:		Initial + Annual:		Initial Costs:		Initial + Annual:				Initial + Annual:			
Item	Year	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end	Low-end	High-end			Low-end	High-end		
1	2001	$0.077	$0.026	$0.129	$0.917	$0.440	$75.344	$0.740	$90.614	$0.017	$0.017	$0.017	$0.017			$0.886	$91.548		
2	2002			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
3	2003	Annual Costs:		$0.052	$0.891	Annual Costs:		$0.300	$15.270	Annual Costs:		$0.000	$0.000			$0.352	$16.161		
4	2004	Low-end	High-end	$0.052	$0.891	Low-end	High-end	$0.300	$15.270	Low-end	High-end	$0.000	$0.000			$0.352	$16.161		
5	2005	$0.052	$0.891	$0.052	$0.891	$0.300	$15.270	$0.300	$15.270	$0.000	$0.000	$0.000	$0.000			$0.352	$16.161		
6	2006			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
7	2007			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
8	2008			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
9	2009			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
10	2010			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
11	2011			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
12	2012			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
13	2013			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
14	2014			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
15	2015			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
16	2016			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
17	2017			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
18	2018			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
19	2019			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
20	2020			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
21	2021			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
22	2022			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
23	2023			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
24	2024			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
25	2025			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
26	2026			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
27	2027			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
28	2028			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
29	2029			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
30	2030			$0.052	$0.891			$0.300	$15.270			$0.000	$0.000			$0.352	$16.161		
Present Value (PV) Costs:																COMPUTATION DOUBLE-CHECK:			
	0.0%			$1.64	$26.76			$9.44	$533.44			$0.017	$0.017			$11.09	$560.22		
	3.0%			$1.13	$18.01			$6.50	$383.62			$0.017	$0.017			$7.64	$401.65		
	5.0%			$0.92	$14.41			$5.28	$321.82			$0.017	$0.017			$6.22	$336.24		
OMB>	7.0%			$0.77	$11.86	14.7%	4.1%	$4.42	$278.09	84.9%	95.9%	$0.017	$0.017	0.33%	0.01%	$5.21	$289.97	100.0%	100.0%
	10.0%			$0.62	$9.27			$3.55	$233.69			$0.017	$0.017			$4.18	$242.97		
Average Annual Equivalent (AAE) Costs:																			
	0.0%			$0.05	$0.89			$0.31	$17.78			$0.001	$0.001			$0.37	$18.67		
	3.0%			$0.06	$0.92			$0.33	$19.57			$0.001	$0.001			$0.39	$20.49		
	5.0%			$0.06	$0.94			$0.34	$20.93			$0.001	$0.001			$0.40	$21.87		
OMB>	7.0%			$0.06	$0.96	14.7%	4.1%	$0.36	$22.41	84.9%	95.9%	$0.001	$0.001	0.33%	0.01%	$0.42	$23.37	100.0%	100.0%
	10.0%			$0.07	$0.98			$0.38	$24.79			$0.002	$0.002			$0.44	$25.77		

CHAPTER VIII

COST SENSITIVITY ANALYSIS: ALTERNATIVE DISCOUNT RATES & FUTURE COST GROWTH SCENARIOS

VIII.A. What Types of Sensitivity Analyses Are Applied in this Study?

This chapter presents EPA's estimated national cost for the final rule, at five alternative ***discount rates***, and at four alternative **future cost stream *scenarios***. Because of the fact that the CAHC manufacturing sector is dynamic (refer to discussion in prior section of this document), the future scenarios represent hypothetical increases and decreases in CAHC production, and associated waste generation volumes and resultant K174 and K175 listing compliance costs.

VIII.B. What Discount Rates Are Applied in the Sensitivity Analysis?

The Office of Management and Budget (OMB) has a "Discount Rate Policy" which requires Federal agencies to use **7.0% discount rate** for the purpose of conducting benefit-cost and cost-effectiveness, and lease-purchase studies of Federal activities and programs, as stated in OMB's 29 Oct 1992 Circular Nr. A-94 (p.9). However, OMB also specifies that such studies "should show the sensitivity of the discounted net present value and other outcomes to variations in the discount rate", including "a higher discount rate than 7 percent", which is the purpose of the other four discount rates indicated above. The **3% to 10% range in discount rates** applied in this study is identical to the range defined by the USEPA as relevant to illustrating the sensitivity of present value calculations, in its regulatory impact analysis guidelines (USEPA, March 1991 reprint, Appendix C, p.C4).

At one level of generality, lower discount rates (e.g. <5%) often are classified as **"social" or "economic" discount rates**, and higher discount rates (e.g. >7%) are often classified as **"private" or "financial" discount rates**. There are many references to the derivation, application and interpretation of discount rates in the finance, business accounting, and economics science literature. Because this study is an ***economic study*** rather than a ***financial or accounting study***, there is a rationale for applying lower discount rates; however, all are applied in this background document as a type of ***sensitivity analysis***.

VIII.C. How Many Future Years Define the Period-of-Analysis in this Study?

The alternative discount rates are all applied to a future **30-year *period-of-analysis*** (i.e. years 2001-2030 POA). In applying discount rates, initial lump-sum capital costs are annualized (i.e. spread over future years in the POA), by using the "***Equivalent Uniform Annual Cost***" (EUAC) method, in which initial costs (single year lump-sums) are converted into ***average annualized equivalents*** (AAEs), by multiplying them with a ***capital recovery factor*** CRF= [dr(1+dr)^n] / [((1+dr)^n)-1], in which dr= discount rate, and n= number of future years in period-of-analysis applied in the study.

The **30-year future *period-of-analysis*** (POA) is applied to represent a reasonable future compliance period in order to illustrate and compute the present value of future compliance costs, as an analytical supplement in this study to presenting compliance cost estimates on an **average annualized equivalent (AAE)** basis. OMB's discount rate guidelines do not specify any particular required or alternative POAs, although OMB (ibid, p.16) does identify two potential candidate POA reference periods for portraying and analyzing future cost streams for capital asset lease-purchase, which extend three or more years into the future. The **30-year** economic analysis POA applied in this study also serves as a complement to other analytic considerations, some of which are unique to the scope and topic of this background document. There are seven complementary reasons listed in the table below which explain why this document applies a 30-year POA for purpose of discounting and annualizing future national compliance costs:

Justification for 30-Year (2001-2030) Future Period-of-Analysis (POA) Applied to Future Regulatory Costs in This Study	
POA Factors	Explanation of How POA Factor Supports Applying a 30-Year POA
1. Life cycle cost POA (OMB):	The full costs of buying or constructing an asset including the asset's purchase price plus any relevant ancillary services connected with the purchase, offset by an asset's "residual value" at the end of its economic life. In this study, the 30-year POA includes both the (a) initial purchase, delivery and installation costs, plus (b) future annual O&M costs, for waste management engineering controls and other RCRA listing compliance requirements.
2. Economic life POA (OMB):	An asset's remaining physical, productive or operating lifetime, beginning when the asset is acquired and ending when the asset is retired from service (not the same as the "useful life" for tax purposes). In this study, the 30-year POA reflects a period which is inclusive of, and may exceed, the expected economic life of the engineering controls and equipment requirements of the RCRA listing rule.
3. Historical POA:	The 30-year POA mirrors the different types of historical timeseries data from the 1970s, 1980s, and 1990s, referenced in this study for the purpose of establishing CAHC industry production and other relevant economic trends.
4. Medium-term POA:	The 30-year period represents a "medium-term" economic analysis POA, compared to the range 20-year "short-term" POA, and 50-year "long-term" POA as defined by the USEPA in "Supplemental Appendix C" (pp.7,8) to its March 1991 reprinted regulatory impact analysis guidelines (which are undergoing revision in 1998-2000).
5. RCRA compliance periods	Certain types of RCRA-permitted, hazardous waste management units (land treatment, landfills, surface impoundments, waste piles) must monitor groundwater at the unit over a compliance period which extends over the unit's operating life and may extend into the unit's post-closure period. The RCRA post-closure monitoring, maintenance, and financial assurance period for post-closure care is normally 30-years.
6. Business asset class lives POA:	For income tax reporting purposes, the US Internal Revenue Service (IRS) provides a range of business asset class lives, which represent financial or accounting depreciation recovery periods, taxable lives, or guideline lives. For environmental-related business assets, the IRS specifies a relatively wide range of 10 to 50 year class lives (e.g. plant equipment asset class nr. 49.5 to handle solid waste, and water treatment asset class nr. 49.3, respectively). Thirty years represents the middle of this asset life range (IRS "Publication 946 Appendix B" class life tables http://www.irs.ustreas.gov/prod/forms_pubs/pubs/p9469901.htm
7. POA In Relation To Effects of Discounting:	Finally, a 30-year POA reflects the fact that future monetary values beyond 30-years, are diminished in dollar value when discount rates are applied, as is done in this document. Consequently, extending the number of years in a POA may not necessarily capture more future economic consequences (e.g. costs and benefits) when discounting is applied to future values. To illustrate this effect, the discounted present values (PVs) of $100 at different future years, and at the alternative discount rates applied in this study, are displayed in the table below. At 7%, future monetary values discounted 30-years to the presents have only 13% of future face value.

Illustration of Time-Discounting Effect on Future Monetary Values (decrease in $100 illustrative reference value according to alternative POAs & discount rates)						
	POA Years	Alternative Discount Rates 0%	3%	5%	7% (OMB)	10%
	10	$100	$74.4	$61.4	$50.8	$38.6
	20	$100	$55.4	$37.7	$25.8	$14.9
This study>	**30**	**$100**	**$41.2**	**$23.1**	**$13.1**	**$5.7**
	40	$100	$30.7	$14.2	$6.7	$2.2
	50	$100	$22.8	$8.7	$3.4	$0.9

VIII.D. How Does this Study Define Future Regulatory Cost Streams?

Questions have arisen in both the academic community and in regulatory agencies, concerning whether "***ex ante***" compliance cost estimates (i.e. cost estimates developed by a regulatory agency such as the USEPA, or by the affected industry, at the time a regulation is being proposed), are good predictors of subsequent regulatory compliance outlays after a rule is finalized (i.e. "***ex post***" actual costs incurred by the regulated community).[19] For purpose of explicitly acknowledging and introducing uncertainty into estimation of national regulatory costs in this study over a future compliance period-of-analysis (POA) -- this study computes present values of future K174 & K175 regulatory costs associated with five alternative future cost stream ***scenarios***. USEPA designed these scenarios to illustrate the possible effect of future changes in the annual rates of K174 and K175 waste generation in the US, on future RCRA regulatory compliance costs. These scenarios are illustrative examples, not exhaustive ***possibilities***. It is important to emphasize that these alternative scenarios do not represent ***forecasts*** or ***predictions***[20] of what USEPA

[19] There are at least three published studies which compare regulatory "ex ante" cost estimates with "ex post" actual costs. Putnam, Hayes & Bartlett (1980) in their study "Comparisons of Estimated and Actual Pollution Control Capital Expenditures for Selected Industries", examine this question for six groups of regulations in five industries: (1) water pollution controls at steam electric utilities; (2) flue gas desulfurization at electric utilities; (3) water pollution control in the pulp& paper industry; (4) water pollution control in the iron & steel industry; and (5) automobile air pollution controls. PH&B found that in these cases, both EPA and industry estimates tended to overestimate actual compliance costs. The average magnitude of compliance cost overestimation was about 110%. In other words, "ex post" actual compliance costs averaged $0.45 for every $1.00 of "ex ante" estimated cost. Refer to http://www.epa.gov/oppe/eaed/eedhmpg.htm for more information about this cost estimation study.

Based on an extensive literature survey for 12 Federal environmental regulation case studies (by EPA, OSHA, Interior, UN), a second study (Hodges, Nov 1997) concluded that "[i]n all cases except one, the early estimates were at least double the later ones, and often much greater.... In no cases did later estimates show costs to be higher than initially expected.... [T]he evidence shows a clear pattern of overestimation... [A]ny analysis of environmental policy decisions should be conducted with the understanding that ex ante estimates are often several orders of magnitude too high."

A third study (Harrington, et al., 1998) compared "ex ante" with "ex post" costs for 26 case studies of environmental and occupational safety rules (two involving CAHCs), and concluded that ex ante cost estimates tend to exceed actual (ex post) cost, which the investigators attributed to: (a) unanticipated technological innovations by affected entities, (b) errors in estimating underlying quantities for factors/parameters used in cost computations, (c) modifications to the regulation after cost estimates are prepared, (c) use of maximum rather than mean cost estimates, and (d) asymmetric error correction in responding to concerns of cost underestimation communicated by affected entities.

[20] According to Rescher (1998, p.40), "**[p]rediction** deals in indicating what the future will be (although perhaps only probably or presumably so). To indicate of what the future might be is something else again. And this means that prediction is something very different from **scenario projection**. In constructing scenarios for the future we employ the imagination to explore possibilities.... To be sure, there

expects to happen in the future, but these scenarios represent what hypothetically could happen to regulatory costs in the future, based upon alternative projections of:

- Relevant historical data trends for the US chlorinated aliphatics manufacturing industry (scenarios #1, #2 & #5), and
- Other relevant US economic and demographic factors (scenarios #3 & #4).

Five Alternative Future Industry Compliance Cost Growth Scenarios Over the 30-year Future Period-of-Analysis (POA) 2001-2030	
Scenario	Description of Future Cost Growth Scenarios
Scenario #1: "Base Case"	Constant (unchanging) uniform annual cost stream over each year of the POA. This is a simple cost stream scenario, used in this document as a "***base case***" for comparison with the other cost stream scenarios applied in this study.
Scenario #2: Statistical Regression Annual Rate Based on US CAHC Historical Production	Represents a future 30-year stream of industry costs which grow at an average annual rate of 1.95% over 2001-2030. This projected growth rate displayed in an exhibit below, is derived from the 27-year (1970-1996) historical linear regression trendline for US CAHC manufacturing. The implicit assumption is that future annual quantities of waste generated, positively correlate with future growth in US CAHC production, according to the historical US CAHC production growth trend. The largest component of projected US CAHC use, consistent with its historical growth trend, is production of PVC plastics. Recently there have been concerns about the safety of using PVC plastics in some miscellaneous uses. Three uses have come under public scrutiny largely because of concerns about health risks associated with plasticizers (phthalate esters) in PVC production: • PVC toys, • PVC medical instruments, • PVC in footwear (sources: C&EN 07 Dec 98 p.33; C&EN 12 April 99 p.12; and the website http://www.greenpeace.org.au/Releases/nike.htm ; respectively). However, the use of PVC plastics for construction materials continue to displace natural products (C&EN, 24 May 99, p.16), and may offset any decrease in miscellaneous demand.
Scenario #3: US Number of Households Growth Basis	The third scenario represents an extrapolation of industry compliance costs, based on the US Bureau of Census' projected growth in the number of US households (the Census data are presented below). This scenarios represents an average annual growth rate in compliance costs of 1.07% over the 2001-2030 POA. The implicit assumption is that future annual quantities of waste generated, positively correlate with future growth in US CAHC production, according to future demand for CAHC-based products (such as consumer products containing PVC), by a growing number of US households.

is nothing wrong with scenario construction as such; it is unquestionably an interesting and instructive venture. However, the fact remains that scenarios are a matter surveying possible courses of future developments. They are imaginative speculations about what might happen and not informative speculations attempting to preindicate what will happen. By their very nature, then, prediction and scenario construction are different sorts of enterprises."

Scenario #4: Decreasing US CAHC Waste Generation	Applied in this study to contrast with the other three cost stream scenarios. This scenario represents an illustrative hypothetical situation in which future compliance costs over the 2001-2030 POA, decrease at an average annual rate of 1.0%, relative to the base year (2001). This scenario may correspond with at least four or more hypothetical, future PVC-related industry conditions; that future annual CAHC production waste generation decreases because of: • Industrial process modifications made by CAHC manufacturers, which reduce future waste generation quantities (e.g. waste recycling, CAHC production based on "green chemistry", plant process changes); • Increase in PVC product recycling thereby reducing market demand for virgin PVC; according to a report in Chemical Engineering magazine (July 2000, p.17), a PVC recycling process will make its commercial debut in mid-2001, with a five-company joint venture, start-up plant in Italy with 8,500 metric tons/year capacity. • Decreased economic demand for CAHC-based products; and/or • Increase in global marketshare of off-shore (non-US) CAHC production.
Scenario #5: Annual Rate of Historical Production of PVC, as Surrogate Indicator for Production of CAHCs	The last scenario was recommended by the Chemical Manufacturers Association (CMA) in their 23 Nov 1999 public comments to the USEPA RCRA Docket, in response to the 1999 proposed listing rule for K173, K174, and K175 wastecodes. This scenario consists of applying the 5.2% average annual growth rate in global PVC production from 1982-1997 (see table in Chapter V of this document), as a constant annual growth rate to future annual regulatory compliance costs. The implicit assumption in support of this scenario is that global PVC demand drives the production of US CAHCs. (Note that although the CMA in its Docket comments actually computed a 5.4% average annual growth rate using an alternative, US PVC production data set for 1975-1997, this last scenario is based on the global PVC data already presented in USEPA's 30 July 1999 "*Economics Background Document*" for the proposed rule, because the USEPA's computed 5.2% is almost identical to CMA's computed 5.4%).

VIII.E. What Are the Results of the Sensitivity Analysis?

The present value (PV) cost and average annual equivalent (AAE) cost results for each of the five alternative future cost stream scenarios, and for each of the alternative discount rates applied, are displayed in the bottom rows of the final table of this chapter.

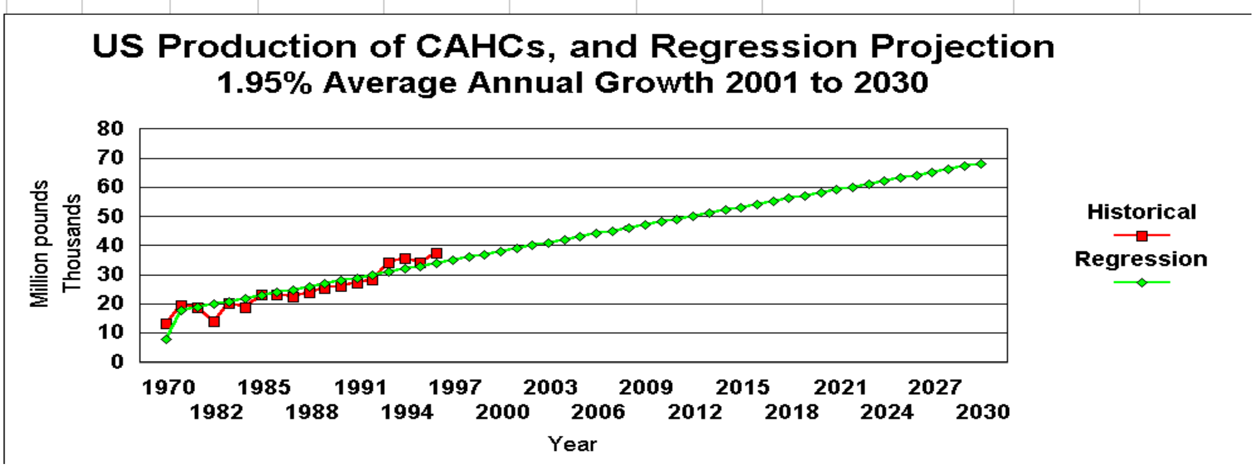
DERIVATION OF BASIS FOR FUTURE COST SCENARIO #2:
US CAHC PRODUCTION (HISTORICAL TREND 1970-1996 AND FUTURE SCENARIO#2)

			US PRODUCTION:			
Row item	30-yr POA	Year	Historical Production (mill.lbs)	Annual %delta	Linear Regression Values	Annual %delta
0		1970	13,272		7,763	
1		1980	19,618		17,843	
2		1981	18,941	-3.5%	18,851	5.65%
3		1982	14,303	-24.5%	19,859	5.35%
4		1983	20,283	41.8%	20,867	5.08%
5		1984	18,862	-7.0%	21,875	4.83%
6		1985	23,399	24.1%	22,883	4.61%
7		1986	23,386	-0.1%	23,892	4.41%
8		1987	22,423	-4.1%	24,900	4.22%
9		1988	24,040	7.2%	25,908	4.05%
10		1989	25,530	6.2%	26,916	3.89%
11		1990	26,289	3.0%	27,924	3.75%
12		1991	27,175	3.4%	28,932	3.61%
13		1992	28,545	5.0%	29,940	3.48%
14		1993	34,321	20.2%	30,948	3.37%
15		1994	35,670	3.9%	31,956	3.26%
16		1995	34,461	-3.4%	32,964	3.15%
17		1996	37,675	9.3%	33,972	3.06%
18		1997			34,980	2.97%
19		1998			35,988	2.88%
20		1999			36,996	2.80%
21		2000			38,004	2.72%
22	1	2001			39,013	2.65%
23	2	2002			40,021	2.58%
24	3	2003			41,029	2.52%
25	4	2004			42,037	2.46%
26	5	2005			43,045	2.40%
27	6	2006			44,053	2.34%
28	7	2007			45,061	2.29%
29	8	2008			46,069	2.24%
30	9	2009			47,077	2.19%
31	10	2010			48,085	2.14%
32	11	2011			49,093	2.10%
33	12	2012			50,101	2.05%
34	13	2013			51,109	2.01%
35	14	2014			52,117	1.97%
36	15	2015			53,125	1.93%
37	16	2016			54,133	1.90%
38	17	2017			55,142	1.86%
39	18	2018			56,150	1.83%
40	19	2019			57,158	1.80%
41	20	2020			58,166	1.76%
42	21	2021			59,174	1.73%
43	22	2022			60,182	1.70%
44	23	2023			61,190	1.68%
45	24	2024			62,198	1.65%
46	25	2025			63,206	1.62%
47	26	2026			64,214	1.59%
48	27	2027			65,222	1.57%
49	28	2028			66,230	1.55%
50	29	2029			67,238	1.52%
51	30	2030			68,246	1.50%
Average annual future % change (2001-2030 POA) =						**1.95%**

REGRESSION OUTPUT:
(Historical data: 1970,1980-96)

Parameter	Value
Constant	-1978124.4
Std Err of Y Est	2901.5
R Squared	0.843
No. of Observations	18
Degrees of Freedom	16
X Coefficient(s)	1008.1
Std Err of Coef.	108.6

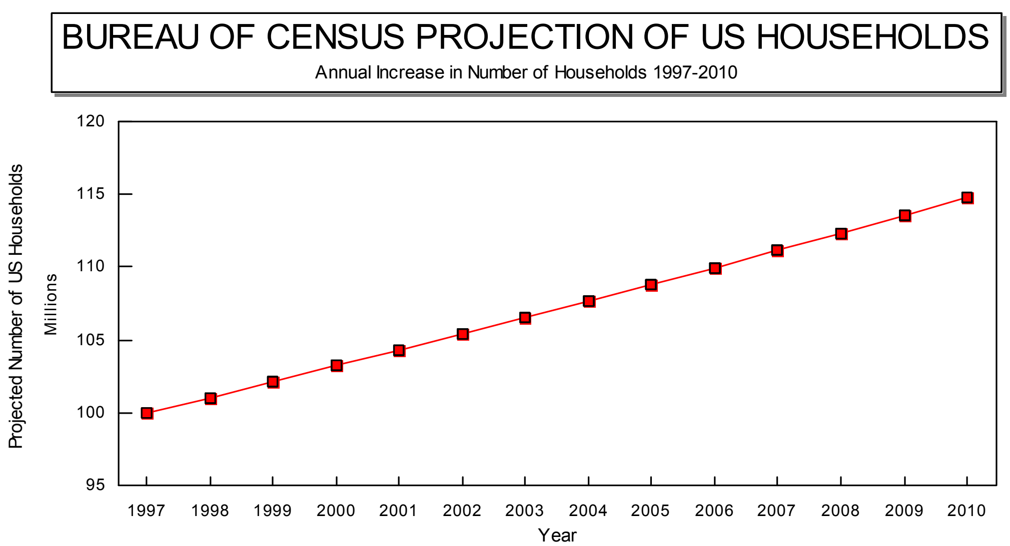
USEPA-OSW-EMRAD



CAHC LISTING PROPOSAL:
Data Basis for "Scenario#3"
Future Compliance Cost Stream
Number of US Households 1997-2010

Data Item	Year	US Census Forecasted Number of US Households	Annual Percent Change
1	1997	99,965,000	
2	1998	101,043,000	1.08%
3	1999	102,119,000	1.06%
4	2000	103,246,000	1.10%
5	2001	104,344,000	1.06%
6	2002	105,456,000	1.07%
7	2003	106,566,000	1.05%
8	2004	107,673,000	1.04%
9	2005	108,819,000	1.06%
10	2006	109,982,000	1.07%
11	2007	111,162,000	1.07%
12	2008	112,363,000	1.08%
13	2009	113,568,000	1.07%
14	2010	114,825,000	1.11%
Average annual % change =			**1.07%**

Source: US Bureau of the Census, April 1996;
Current Population Reports No. P25-1129,
Table C, "Series 1" projection, p5.
(http://www.census.gov/prod/www/abs/ap251129.html).



Source: US Bureau of Census, "Current Population Reports", Nr.P25-1129, April 1996, p.5.

K174 & K175 RCRA LISTING FINAL RULE
ESTIMATED COST RANGING OVER ALL ENGINEERING OPTIONS, AND OVER ALL CONTINGENCY COSTS
ALTERNATIVE FUTURE COMPLIANCE COST SCENARIOS

		Scenario #1:		Scenario #2:			Scenario #3:			Scenario #4:			Scenario #5:		
Row Item	POA Year	(BASE CASE)		Cost multiplier			Cost multiplier			Cost multiplier			Cost multiplier		
		Low-end	High-end	1.95%	Low-end	High-end	1.07%	Low-end	High-end	-1.00%	Low-end	High-end	5.20%	Low-end	High-end
1	2001	$0.886	$91.548	1.020	$0.903	$93.333	1.011	$0.895	$92.528	0.990	$0.877	$90.633	1.052	$0.932	$96.308
2	2002	$0.352	$16.161	1.039	$0.366	$16.791	1.021	$0.360	$16.507	0.980	$0.345	$15.838	1.104	$0.389	$17.842
3	2003	$0.352	$16.161	1.059	$0.373	$17.106	1.032	$0.363	$16.680	0.970	$0.341	$15.676	1.156	$0.407	$18.682
4	2004	$0.352	$16.161	1.078	$0.379	$17.422	1.043	$0.367	$16.853	0.960	$0.338	$15.515	1.208	$0.425	$19.522
5	2005	$0.352	$16.161	1.098	$0.386	$17.737	1.054	$0.371	$17.026	0.950	$0.334	$15.353	1.260	$0.444	$20.363
6	2006	$0.352	$16.161	1.117	$0.393	$18.052	1.064	$0.375	$17.199	0.940	$0.331	$15.191	1.312	$0.462	$21.203
7	2007	$0.352	$16.161	1.137	$0.400	$18.367	1.075	$0.378	$17.371	0.930	$0.327	$15.030	1.364	$0.480	$22.044
8	2008	$0.352	$16.161	1.156	$0.407	$18.682	1.086	$0.382	$17.544	0.920	$0.324	$14.868	1.416	$0.498	$22.884
9	2009	$0.352	$16.161	1.176	$0.414	$18.997	1.096	$0.386	$17.717	0.910	$0.320	$14.707	1.468	$0.517	$23.724
10	2010	$0.352	$16.161	1.195	$0.421	$19.312	1.107	$0.390	$17.890	0.900	$0.317	$14.545	1.520	$0.535	$24.565
11	2011	$0.352	$16.161	1.215	$0.428	$19.628	1.118	$0.393	$18.063	0.890	$0.313	$14.383	1.572	$0.553	$25.405
12	2012	$0.352	$16.161	1.234	$0.434	$19.943	1.128	$0.397	$18.236	0.880	$0.310	$14.222	1.624	$0.572	$26.245
13	2013	$0.352	$16.161	1.254	$0.441	$20.258	1.139	$0.401	$18.409	0.870	$0.306	$14.060	1.676	$0.590	$27.086
14	2014	$0.352	$16.161	1.273	$0.448	$20.573	1.150	$0.405	$18.582	0.860	$0.303	$13.898	1.728	$0.608	$27.926
15	2015	$0.352	$16.161	1.293	$0.455	$20.888	1.161	$0.408	$18.755	0.850	$0.299	$13.737	1.780	$0.627	$28.767
16	2016	$0.352	$16.161	1.312	$0.462	$21.203	1.171	$0.412	$18.928	0.840	$0.296	$13.575	1.832	$0.645	$29.607
17	2017	$0.352	$16.161	1.332	$0.469	$21.518	1.182	$0.416	$19.101	0.830	$0.292	$13.414	1.884	$0.663	$30.447
18	2018	$0.352	$16.161	1.351	$0.476	$21.834	1.193	$0.420	$19.274	0.820	$0.289	$13.252	1.936	$0.681	$31.288
19	2019	$0.352	$16.161	1.371	$0.482	$22.149	1.203	$0.424	$19.447	0.810	$0.285	$13.090	1.988	$0.700	$32.128
20	2020	$0.352	$16.161	1.390	$0.489	$22.464	1.214	$0.427	$19.619	0.800	$0.282	$12.929	2.040	$0.718	$32.968
21	2021	$0.352	$16.161	1.410	$0.496	$22.779	1.225	$0.431	$19.792	0.790	$0.278	$12.767	2.092	$0.736	$33.809
22	2022	$0.352	$16.161	1.429	$0.503	$23.094	1.235	$0.435	$19.965	0.780	$0.275	$12.606	2.144	$0.755	$34.649
23	2023	$0.352	$16.161	1.449	$0.510	$23.409	1.246	$0.439	$20.138	0.770	$0.271	$12.444	2.196	$0.773	$35.490
24	2024	$0.352	$16.161	1.468	$0.517	$23.724	1.257	$0.442	$20.311	0.760	$0.268	$12.282	2.248	$0.791	$36.330
25	2025	$0.352	$16.161	1.488	$0.524	$24.039	1.268	$0.446	$20.484	0.750	$0.264	$12.121	2.300	$0.810	$37.170
26	2026	$0.352	$16.161	1.507	$0.530	$24.355	1.278	$0.450	$20.657	0.740	$0.260	$11.959	2.352	$0.828	$38.011
27	2027	$0.352	$16.161	1.527	$0.537	$24.670	1.289	$0.454	$20.830	0.730	$0.257	$11.798	2.404	$0.846	$38.851
28	2028	$0.352	$16.161	1.546	$0.544	$24.985	1.300	$0.457	$21.003	0.720	$0.253	$11.636	2.456	$0.865	$39.691
29	2029	$0.352	$16.161	1.566	$0.551	$25.300	1.310	$0.461	$21.176	0.710	$0.250	$11.474	2.508	$0.883	$40.532
30	2030	$0.352	$16.161	1.585	$0.558	$25.615	1.321	$0.465	$21.349	0.700	$0.246	$11.313	2.560	$0.901	$41.372
Present Value (PV) Costs:															
	0.0%	$11.09	$560.22		$14.30	$708.23		$12.85	$641.43		$9.45	$484.31		$19.63	$954.91
	3.0%	$7.64	$401.65		$9.50	$487.83		$8.66	$448.94		$6.69	$357.46		$12.59	$631.46
	5.0%	$6.22	$336.24		$7.55	$398.60		$6.95	$370.46		$5.53	$304.27		$9.78	$502.52
OMB>	7.0%	$5.21	$289.97		$6.20	$336.41		$5.75	$315.45		$4.70	$266.15		$7.85	$413.82
	10.0%	$4.18	$242.97		$4.85	$274.43		$4.55	$260.23		$3.84	$226.84		$5.95	$326.85
Average Annual Equivalent (AAE) Costs:															
	0.0%	$0.37	$18.67		$0.48	$23.61		$0.43	$21.38		$0.32	$16.14		$0.65	$31.83
	3.0%	$0.39	$20.49		$0.48	$24.89		$0.44	$22.90		$0.34	$18.24		$0.64	$32.22
	5.0%	$0.40	$21.87		$0.49	$25.93		$0.45	$24.10		$0.36	$19.79		$0.64	$32.69
OMB>	7.0%	$0.42	$23.37		$0.50	$27.11		$0.46	$25.42		$0.38	$21.45		$0.63	$33.35
	10.0%	$0.44	$25.77		$0.51	$29.11		$0.48	$27.61		$0.41	$24.06		$0.63	$34.67

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CHAPTER IX

FEDERAL REGULATORY ECONOMIC ANALYSIS REQUIREMENTS

This chapter addresses the Federal regulatory economic analysis requirements set forth for Federal agencies, by the US Congress and by the White House. The relevance and applicability of four requirements are described below. This chapter is limited to only these four because of their potential applicability to economic analysis. As also explained below, other Federal regulatory analysis requirements may apply to the RCRA K174/K175 listing final rule, but only those containing economic analysis provisions listed in the table below, are addressed here.

Federal Regulatory Economic Analysis Requirements Addressed in this Chapter	
Focus	Purpose of Economic Analysis
1. 1980 Regulatory Flexibility Act (RFA Public Law 96-354), as amended by the 1996 Small Business Regulatory Enforcement Fairness Act (SBREFA Public Law 104-121)	
Small entity impacts	Recognizing that small business is a major source of competition and economic growth, Congress established a process to be followed by Federal agencies in analyzing how to design regulations that will help achieve statutory goals efficiently without harming or imposing undue burdens on small business. Requires Federal agencies to recognize differences in the scale and resources of regulated entities, and solicit ideas and comments of small businesses, small organizations, and small governmental jurisdictions, to examine the impact of proposed and existing rules on such entities, and consider ***flexible regulatory proposals***. Section 603 of the RFA requires agencies to public an *initial regulatory flexibility analysis*, and Section 604 requires agencies to publish a ***final regulatory flexibility analysis*** when an agency promulgates a final rule, containing the following components: • Need: Statement of the need for & objectives of the rule. • Comments: Summary of the significant issues raised by public comments in response to the proposed rule. • Entities: Description and estimate of the number of small entities to which the final rule will apply. • Requirement: Description of the projected reporting, recordkeeping and other compliance requirements. • Impacts: Description of the steps an agency has taken to minimize the significant [adverse] impact on small entities, including a statement of the factual, policy and legal reasons for the regulatory alternative selected in the final rule. RFA Sections 603 (IRFA) and 604 (FRFA) shall not apply to any proposed or final rule if the head of the agency certifies that the rule will not, if promulgated, have a ***significant*** [adverse] economic impact on a ***substantial*** number of small entities. The RFA does not define the words “significant” and “substantial”. The definition of small entity to be applied is the US Small Business Administration’s "**Size Standard**s" stated in either: • Number of employees (usually < 500), or • Average annual receipts (usually < $5 million sales revenues) The appropriate calculation of firm size includes employees/receipts of all affiliates.[21]

[21] In contrast to SBA’s 500 to 1,500 number of employee range for defining small business size standards according to SIC codes, the US Department of Commerce and the Chemical Manufacturers Association define four company size categories according to number of employees, for manufacturing industries in SIC codes 20xx to 39xx (source: CMA, 1997, p.87):
- Very small-size companies = 1 to 19 employees
- Small-size companies = 20 to 99 employees
- Medium-size companies = 100 to 499 employees
- Large-size companies = 500+ employees

According to these alternative size categories, all CAHC facilities potentially subject to the final rule’s requirements would not be classified as “small companies”, because they have 100 or more employees.

<table>
<tr><th colspan="2">2. Executive Order 12866: Regulatory Planning & Review (30 Sept 1993)</th></tr>
<tr><td>Annual effects on the national economy</td><td>Executive Order 12866 consists of three main sections:
• Objectives: Four regulatory process reform objectives.
• Principles: 12 regulatory principles.
• Guidelines: Three agency guidelines, one of which contains six agency procedures for development of regulatory actions.
EO-12866 sets forth the following specific philosophy directed at the design and application of economic analysis in support of Federal regulatory actions (bracketed numbers added for emphasis):
"In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including [1] the alternative of not regulating. Costs and benefits shall be understood to include both [2] quantifiable measures (to the fullest extent that these can be usefully estimated) and [3] qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that [4] maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." (EO-12866 Section 1(a)).
Section 6(a) of EO-12866 sets forth three Federal agency responsibilities, in the form of guidelines applicable to all regulatory actions (both new and existing regulations). The third guideline contains six agency procedures, three of which contain instructions to Federal agencies to perform particular types of economic analyses. For "significant" regulatory actions, provide OMB and the public with the following information:
• Assessment and quantification of anticipated benefits from regulatory action.
• Assessment and quantification of anticipated costs from regulatory action.
• Assessment of costs and benefits of feasible alternatives to the planned regulation identified by the agency or the public (including non-regulatory actions).
The expression "significant regulatory action" is defined in EO-12866 (Section 3(f)(1)) as constituting any regulatory action that is to have $100 million in annual effect on the national economy.</td></tr>
<tr><th colspan="2">3. 1995 Unfunded Mandates Reform Act (UMRA)</th></tr>
<tr><td>State, local, tribal govern-ment mandated expendi-tures in any one year</td><td>The overall philosophy of UMRA is to curb the practice of imposing unfunded Federal mandates (i.e. laws and regulations without adequate Federal funding for implementation), on States, local and tribal governments, and the private sector. UMRA's preamble contains eight purposes in line with its philosophy, two of which pertain directly to economic analysis:
• "[P]repare and consider estimates of the budgetary impact of regulations containing Federal mandates upon State, local, and tribal governments and the private sector before adopting such regulations, and ensuring that small governments are given special consideration in the process."
• "[T]o begin consideration of the effect of previously imposed Federal mandates, including the impact on State, local, and tribal governments of Federal court interpretations of Federal statutes and regulations that impose Federal intergovernmental mandates."
Title II of UMRA contains four specific procedural and analytic requirements targeted at Federal regulatory agencies, of which two are specific to economic analysis. Before proposing or finalizing a rule that may result in the expenditure by State, local and tribal governments in the aggregate, or by the private sector, greater than $100 million (adjusted annually for inflation) in any one year, the sponsoring Federal agency shall prepare a written statement containing:
• Qualitative and quantitative assessment of anticipated costs and benefits.
• Analysis of availability of Federal financial assistance to pay for costs.
• Analysis of availability of Federal resources to carry out the mandate.
• Estimates of (a) future compliance costs and (b) disproportionate budgetary effects upon regions or particular State, local or tribal governments, urban or rural or other types of communities, or private sector segments.
• Estimates of the effect on the national economy.</td></tr>
</table>

4. Executive Order 13132: Federalism (04 Aug 1999)	
State/ local govern-ment direct costs	One objective of EO-13132 is to guarantee the division of governmental responsibilities between the national government and the states. It requires Federal agencies to assess whether rulemakings are likely to have "federalism implications", by imposing "substantial direct effects" on: • States (including units of local government) • The relationship between the national government and the states • The distribution of power and responsibilities among levels of government. It establishes policymaking criteria, state law preemption requirements, and a state and local official consultation process. For rules not required by statute, that are likely to impose "substantial direct compliance costs" on state and local governments, Federal agencies must: • Provide the funds necessary to pay the direct costs, or • Prior to finalizing the rule, consult with state and local officials early in the process of developing the proposed rule. • Provide OMB with a "federalism summary impact statement". Furthermore, EO-13132 acknowledges that its objective is to fortify the objective of UMRA, which is also oriented towards assessing "direct costs". Consequently, UMRA analyses may also serve to comply with EO-13132.

Findings of Economic Analysis for Compliance with Federal Requirements			
Item	Source of Federal Requirements	Economic Analysis Questions to Be Addressed	Economic Analysis Findings & Determination
1	1980 RFA/ 1996 SBREFA (Section 605)	Determine whether a rule is likely to "*have a significant [adverse] economic impact on a substantial number of small entities*" which are *subject to the requirements* of the final rule?	**Findings:** • No small companies own the facilities subject to the rule. (see supporting data in next table)
			Determination: • Consequently, the final rule does not impact small entities.
2	1993 EO-12866 (Section 3f)	Determine whether a rule is likely to be a "*significant regulatory action" which will "have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities*"?	**Findings:** • 18 private sector (industrial) facilities subject to rule's targeted description. • Total of 116 entities likely affected: • 39 CAHC mfg facilities • 4 industrial waste handlers (3 for K174 & 1 for K175) • 49 state govt's w/RCRA authorized programs • 10 USEPA regional offices • 2 other Fed agencies • 12 NGOs • Average annualized effect on the national economy = • $0.42 to $23.37 million (estimated using OMB's 7.00% discount rate) under "full" cost uncertainty. • $0.042 to $4.05 million under "moderated" cost uncertainty.
			Determination: • The final rule is expected to have <$100 million in annualized effect. • Consequently, the final rule is not an economically "significant" action under EO-12866.

3	1995 UMRA (Section 202)	Determine whether a rule is likely to be "*significant*" in that it "*is likely to result in the expenditure by state, local and tribal governments in the aggregate, or by the private sector, greater than $100 million (adjusted annually for inflation) in any one year*"?	**Findings:** • State/local/tribal govts not subject to topic area of rule • 49 state gov'ts impacted from RCRA statutory "induced effects" • State/local/tribal government expenditure in any one year: • Read rule= $0.071 mill • NPDES review=$0.005 mill • RCRA auth mod= $0.069 mill • Enforcement=$0.3 to $0.6 mill Total= $0.445 to $0.745 mill • Private sector expenditure in any one year: • Initial costs: • K174 opts ("full" cost uncertainty range) = $0.19 to $75.0 mill • K175 = $0 • Read rule (industry + NGOs) = = ($0.056+$0.017 mill) = $0.073 mill • First year of annual recurring costs: • K174 ("full" cost uncertainty range) = $0.032 to $15.207 mill • K175= $0.020 to $0.354 mill • Total one-year cost = $0.315 to $90.6 mill
			Determination: • Expected impact <$100 million in any one year, based on aggregating anticipated costs corresponding to the first year after the final rule's effective date • Consequently, the K174/K175 final rule is not economically "significant" under UMRA
4	1999 EO-13132 (Section 6)	Determine whether a rule is likely to impose "*substantial direct compliance costs*" on state and local governments? [Note: because EO-13132 states that one of its objective is to further the policy of UMRA, USEPA interprets "substantial" to be identical to UMRA's $100 million threshold].	**Findings:** • State/local govts not targeted by waste subject area of rule • 49 state governments impacted from RCRA statutory "induced effect" • See state/local gov't cost estimate in UMRA above
			Determination: • Expected Impact on state/local gov't <$100 million in one year • Consequently, the K174/K175 final rule does not have economic federalism implications

USEPA'S RCRA K174/K175 HAZARDOUS WASTE LISTING FINAL RULE:
SMALL BUSINESS DETERMINATION USING SBA SIZE STANDARDS FOR PARENT COMPANIES
WITH FACILITIES SUBJECT TO THE RULE:
COMPANY NUMBER OF EMPLOYEES & ANNUAL SALES REVENUES

								A. EMPLOYEE TEST			B. SALES TEST								
Item	Chlorinated Aliphatics Producers Company Name (Subsidiary)	Number chlorinated aliphatic facilities subject to final rule	US-SEC Form 10-K* report filing date	Company data reference fiscal year	Company primary 4-digit SIC code	State of US incorp-oration	Company principal executive office location	Company total full-time employees	SBA "small business" threshold employees	Ratio to SBA	Company annual sales revenues (US$1000s)	SBA "small business" threshold ($1000s)	Ratio to SBA	Company annual capital expenditures (1000s)	Capital expendtrs as % of sales revenue	Company annual net income (after-tax profit) (1000s)	Net income as % of sales	Company available credit facilities** (1000s)	Credit as % of sales revenue
1	Borden Chemicals & Plastics Ltd	1	03/1998	1997	2821	DE	Geismar, LA	800	750	1.1	$737,100			$19,400	2.6%	$5,600	0.8%	$100,000	13.6%
2	Dow Chemical Company	3	03/1998	1997	2800	DE	Midland, MI	42,861	1,000	43	$20,018,000			$1,198,000	6.0%	$1,802,000	9.0%	$1,825,000	9.1%
3	Formosa Plastics Corp. USA***	2	None	1997	2821	???	Livingston, NJ	3,000	750	4	$1,500,000			???	???	???	???	???	???
4	Geon Company	1+0.5	03/1998	1997	2821	DE	Avon Lake, OH	2,000	750	3	$1,250,000			$50,900	4.1%	$22,500	1.8%	$193,000	15.4%
5	Georgia Gulf Corp.	1+0.5	03/1997	1996	2810	DE	Atlanta, GA	1,030	1,000	1.03	$896,200			$177,000	19.8%	$71,600	8.0%	$49,400	5.5%
6	Marubeni Corp of Japan	0.5	None	1999	???	N/A	Tokyo & Osaka, Japan	8,618			$98,844,273			$173,000	0.2%	$106,000	0.1%	???	???
	(Marubeni Chemicals Group, joint venture w/Occidental as "OxyMar")		None		2800				1,000	8.6									
7	Occidental Petroleum Corp.	2+0.5+0.5	03/1999	1998	1311	DE	Los Angeles, CA	9,190	500	18	$6,596,000			$1,074,000	16.3%	$363,000	5.5%	$1,500,000	22.7%
	(Occdntl. Chemical Corp.)				2800			5,850	1,000	6	$2,975,000			$321,000	10.8%	$266,000	8.9%	???	0.0%
8	PPG Industries Inc.	1+0.5	02/1999	1998	2851	PA	Pittsburg, PA	32,500	500	65	$7,510,000			$877,000	11.7%	$801,000	10.7%	$748,000	10.0%
9	RWE-DEA Chemicals	1	None	1998	2800	N/A	Hamburg, Germany	8,900	1,000	9	$1,921,000			???	???	???	???	???	???
	(Condea Vista Company***)		None		2800		Houston, TX	1,400	1,000	1.4	???			???	???	???	???	???	???
10	Vulcan Materials Company	2	03/1998	1997	1400	NJ	Birmingham, AL	5,399	See sales		$1,678,600	$500,000	3.4	$173,300	10.3%	$213,400	12.7%	$130,000	7.7%
	(Chemicals Segment)		None		2800			1,619	1,000	1.6	$627,600			???	???	???	???	???	???
11	Westlake Group***	1	None	1998	2295	???	Houston TX	1,445	1,000	1.4	$191,700			???	???	???	???	???	???
	(Westlake Monomers Corp.***)		None		2821		Calvert City, KY	190			???			???	???	???	???	???	???
Summary of Company Data Above:																			
	Mean (non-duplicative+) =							10,522			$12,831,170			$467,825		$423,138		$649,343	
	Median (non-duplicative+) =							5,399			$1,678,600			$175,150		$159,700		$193,000	
	Total (non-duplicative+) =	18						115,743			$141,142,873			$3,742,600	2.7%	$3,385,100	2.4%	$4,545,400	3.2%

Explanatory Notes:
(a) "0.5" facilities represent partnerships in joint venture facilities owned by two companies.
(b) Data source: US Securities & Exchange Commission (SEC) website http://www.sec.gov/Archives/edgar/data/
The US Small Business Administration (SBA) provides unique size standard by economic sector classification codes: http://www.sba.gov/size .
The SBA does not assign an employee threshold to 2-digit SIC codes; for the 2-digit codes above (e.g. 28xx), OSW-EMRAD assigned the largest 4-digit level employees within the 2-digit sector.
(c) * "Form 10-K" is an annual report which most companies supply to the SEC; it presents a comprehensive overview of the business operations and financial conditions of a company.
(d) **Available credit facilities= working capital and/or revolving credit (internal company sources and/or external borrowing sources within the US or abroad).
Credit facilities may include short-term debt supplied by unsecured financial instruments at variable borrowing interest rates, or highly liquid investment cash equivalents.
(e) *** Financial and employee data for some companies are not available from the SEC database because they are privately-held companies or otherwise not required to register business information with the SEC.
USEPA attempted to collect business data for privately-held companies, and for foreign companies not reporting to SEC, from (a) company internet websites, or (b) company telephone contacts listed below:
Formosa Plastics Corp. USA: http://www.fpcusa.com/ Westlake Group: Chris Gaines, Environmental & Regulatory Affairs (713-585-2816).
RWE-DEA Chemicals: http://www.condea.com/overview.html Marubeni Corp: http://www.marubeni.co.jp/home/english/ar99
(f) + Non-duplicative column summaries exclude the company subsidiary information row items (which are already included (rolled-up) in the parent company row items).

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Reader note: The references listed below consist of those discovered during the initial research and literature search in support of USEPA's 25 Aug 1999 K173/K174/K174 proposed rule, as well as new items discovered in preparing this final rule background document. However, not all references listed below are cited in this final rule document. This broader set of references is retained below to provide the reader with a bibliography of other information sources related to the subject matter of the final rule, and to this background document.

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ATTACHMENTS

A: Public Comments on the USEPA's Economic Analysis for the 1999 RCRA K173/K174/K175 Proposed Rule

B: Five Alternative Lists of Companies Which Manufacture Chlorinated Aliphatic Hydrocarbon Chemicals (CAHCs) in the US

C: Quantities of Three Classes of Chlorinated Aliphatic Chemicals Reported as Constituents in US Industrial Wastes (TRI Data)

D: Supporting Data for Surface Impoundment Size/volume Dimensions Used in Estimating One-time Dredging Cost: Survey Sample Data from USEPA-OSW Surface Impoundment National Database

E: Summary of NPDES Permit Review Process Time Period Requirements, and of Construction Time Period Requirements for Industrial Wastewater Treatment Systems

F: US Industrial Chemicals & Synthetics Manufacturing Sector Profit Data

ATTACHMENT A:

PUBLIC COMMENTS
ON THE
USEPA'S ECONOMIC ANALYSIS
FOR THE
1999 RCRA K173/K174/K175 LISTING
PROPOSED RULE

ATTACHMENT A

PUBLIC COMMENTS ON THE USEPA's ECONOMIC ANALYSIS FOR THE 1999 RCRA K173/K174/I175 LISTING PROPOSED RULE

Introductory note: USEPA's RCRA Docket Information Center (800-424-9346) received a total of **20 sets** of public comments by the **90-day** deadline of **23 Nov 1999**, as specified in the 25 August 1999 *Federal Register* announcement of the proposed rule. The RCRA Docket assigned ID numbers (CALP-00001 to CALP-00020) to each set of comments. A total of **61 comments** contained within **14 of the 20** comment sets, address USEPA's economic analysis, and are reproduced below in ascending order by Docket ID number (original comment format features may have been lost below in electronic transfer). USEPA's responses to these comments are contained in the "*Response to Public Comment Background Document*", which is available to the public from the RCRA Docket.

1
DCN CALP-00001
COMMENTER DuPont Dow Elastomers LLC (LaPlace, LA)
SUBJECT ECON
SCOPE K173
Promulgating the K173 Listing Rule will cause wastewaters from this production process to be listed K173 hazardous wastes with no risk reduction to the offsite population since the wastewaters contain no hazardous constituents in toxic quantities and they will continue to be managed in the same manner as previously. There will be a significant negative cost impact on DuPont Dow, however, to meet the stringent requirements of the K173 Listing Rule.

2
DCN CALP-00001
COMMENTER DuPont Dow Elastomers LLC (LaPlace, LA)
SUBJECT ECON
SCOPE K173
The USEPA economic analysis for the proposed K173 Listing Rule is inaccurate and should be adjusted upward. The economic impact on the two affected DuPont Dow facilities is at least $11,000,000 in captial costs with annual recurring costs of approximately $17,000,000 per year. This is significantly greater than the USEPA projected costs of $1,320,000 initial capital costs and $766,900 annual recurring costs for the entire United States. In fact, the economic impact on the affected industry will probably exceed $100,000,000. This would require the USEPA to perform a cost-benefit analysis per the Unfunded Mandates Reform Act of 1995.

3
DCN CALP-00001
COMMENTER DuPont Dow Elastomers LLC (LaPlace, LA)
SUBJECT ECON
SCOPE K173
DuPont Dow Neoprene operations will be impacted significantly by the K173 Listing Rule as currently proposed. Capital costs that DuPont Dow Neoprene operations would spend to meet the K173 Listing Rule as proposed would be at least $11,000,000 while annual recurring costs would be approximately $17,000,000 per year. These recurring costs comprise over 1.5% of 1998 annual revenues of DuPont Dow Elastomers. DuPont Dow manufactures Neoprene at its Pontchartrain Site in LaPlace, LA and at its Louisville Plant in Louisville, KY. Neoprene is the workhorse of the DuPont Dow product line and in 1998 accounted for a major percentage of the after-tax earnings of DuPont Dow. Combined the Pontchartrain Site and Louisville Plant have 547 DuPont Dow employees. Because of the significant economic impact that the K173 Listing Rule as proposed may have on its Neoprene operations, DuPont Dow has a vital interest in ensuring that the final rule regulating wastewaters from chlorinated aliphatic hydrocarbon production processes is appropriate.

4
DCN CALP-00001
COMMENTER DuPont Dow Elastomers LLC (LaPlace, LA)
SUBJECT ECON
SCOPE K173

Listing Chlorinated Aliphatics Hydrocarbon Production Wastewaters As Hazardous Wastes Will Have Significant Negative Impacts

Listing of chlorinated aliphatic hydrocarbon production wastewaters as hazardous wastes will have significant negative implications on the DuPont Dow Neoprene production operations at the Pontchartrain Site (LaPlace, LA) and the Louisville Plant (Louisville, KY). In mid-1993 Pontchartrain Site personnel implemented new reaction technology to convert from free radical-catalyzed production of chlorinated aliphatic hydrocarbons to ionic-catalyzed production of these chlorinated aliphatic hydrocarbons. This eliminated the F024 and F025 hazardous waste listings from the waste streams generated onsite - including F024 'derived-from' and mixed wastewater streams being disposed onsite by underground injection. Converting the chloroprene production process from free radical to ionic catalysis took approximately four years and costs approximately $10,000,000. Listing chlorinated aliphatic hydrocarbon production wastewaters as K173 hazardous wastes would again cause wastewaters disposed onsite by underground injection to be hazardous wastes and would negate a major driving force in the reaction technology change.

Furthermore, in 1996 the Pontchartrain Site modified its chlorinated aliphatic production technology to eliminate the corrosivity characteristic from the brine wastewater stream generated from the process and to ensure that, as generated, this stream would be non-hazardous. Installing and implementing this technology change required approximately two years and cost over $1,000,000. Listing all chlorinated aliphatic hydrocarbon production wastewaters as hazardous wastes would result in this brine wastewater stream being a K173 listed hazardous waste and would negate the results of the technology change. As generated, this brine wastewater stream meets the USEPA Region 6 concentration-dependent criteria to be delisted should it become a hazardous waste; however, delisting a hazardous waste is a costly and time-consuming regulatory process.

5
DCN CALP-00001
COMMENTER DuPont Dow Elastomers LLC (LaPlace, LA)
SUBJECT ECON
SCOPE K173

At 64 FR 46518 the USEPA estimates that the total U.S. economic costs for implementing the K173 Listing Rule as proposed for wastewaters will be $1,320,000 initial capital costs and $766,900 recurring annual operating and maintenance costs. In developing these cost estimates the USEPA considered only tank modifications and analytical costs for dioxins and furans. Other associated costs to the regulated community, such as temporary offsite disposal of wastewaters while retrofitting facilities to comply with the K173 Listing Rule, permit and 'No Migration' Petition modification costs, costs of constructing and operating new loading facilities for wastewaters and major piping modifications needed to comply with the K173 Listing Rule, were not considered. Although DuPont Dow Elastomers does not have access to information on the cost impacts for other companies affected by the K173 Listing Rule as proposed, impacts within DuPont Dow Elastomers facilities alone would far exceed the USEPA estimates of cost impacts nationwide.

The DuPont Dow Elastomers Pontchartrain Site currently disposes of approximately 450,000,000 lbs/year (95 gallons/minute) of hazardous wastewaters in three onsite hazardous waste underground injection wells. In addition, it disposes of approximately 300,000,000 lbs/year (63 gallons/minute) of non-hazardous brine wastewaters in an onsite non-hazardous waste underground injection well. All of these wastewaters would become K173 hazardous waste under the K173 Listing Rule as proposed.

If these wastewaters become K173 listed hazardous wastes and associated Land Disposal Restrictions should be subsequently promulgated, then DuPont Dow Elastomers Pontchartrain Site personnel will no longer be able to dispose of these hazardous wastewaters in the four onsite underground injection wells until significant, time-consuming permit and 'No Migration' Petition modifications are approved. For the three hazardous waste underground injection wells the USEPA must approve a revised "No Migration" Petition, the Louisiana Department of Environmental Quality (LDEQ) must issue a revised Act 803 Determination and the Louisiana Department of Natural Resources (LDNR) must issue a revised operating permit. For the non-hazardous waste underground injection well the USEPA must approve a 'No Migration' Petition, the LDEQ must issue an approved Act 803 Determination and the LDNR must issue a hazardous waste underground injection well operating permit. In addition, the site hazardous waste permit must have a Class 3 permit modification approved by the LDEQ to add the two wastewater storage tanks that feed the non-hazardous underground injection well.

Discussions with UIC personnel at the USEPA Region 6 in Dallas, TX confirm that modifying the Pontchartrain Site "No Migration" Petition will require additional modeling to include the K173 wastewater streams. In addition, the current non-hazardous underground injection well will need to be included within the revised 'No Migration' Petition. Performing the additional modeling and developing the revised "No Migration" Petition for submittal to the USEPA will require at least 12 months. The USEPA Region 6 UIC Division estimates that they will require at least 12-24 months to review the modeling and petition information and to approve the requested modification. Furthermore, the LDNR and the LDEQ will not act until the USEPA approves the revised "No Migration" Petition. Once the "No Migration" Petition is approved, the LDNR and LDEQ will require an additional 6-12 months minimum to review the submitted information, revise the site underground injection well operating permit and approve the revised Act 803 Determination to include the K173 wastewaters for the current hazardous waste injection wells and convert the current non-hazardous waste underground injection well to a hazardous waste underground injection well. The total time required from the K173 Listing Rule promulgation date to final approval of all modifications is estimated to be a minimum of 30 to 48 months. The cost is estimated to be approximately $500,000.

Additionally, preparing the Class 3 Permit Modification to add the two wastewater storage tanks to the site hazardous waste permit will require approximately four months. The LDEQ will require approximately 24 to 36 months to approve the request; therefore, the total time required for adding the two wastewater storage tanks to the site hazardous waste permit is estimated to be a minimum of 28 to 40 months. Associated costs are estimated to be approximately $40,000.

During this minimum 30 to 48 month period DuPont Dow will only be able to dispose of K173 wastewaters in the underground injection wells from the promulgation date to the effective date of the regulation – typically a period of 6 months. Thus, for at least 24 to 42 months site personnel must use an alternative, approved disposal method for the K173 wastewaters. The only feasible alternative is to transport the wastewaters to an offsite commercial underground injection well approved to accept these K173 wastewaters. At this time it is uncertain if any permitted commercial underground injection wells will be approved to accept K173 hazardous wastewaters by the effective date of the K173 Listing Rule.

Loading and transportation costs associated with disposing of the K173 hazardous wastewaters in an offsite commercial underground injection well would be significant. Using 5000-gallon capacity trucks would require one truck loaded and shipped offsite every 32 minutes (46 trucks/day), 365 days per year. The roundtrip transportation costs are estimated at approximately $1000 per truck. In addition, Dupont Dow Elastomers would need to hire dedicated operators working 24 hours per day, 365 days per year at a cost of approximately $300,000 per year to load the trucks. Loading and transporting this wastewater to the offsite commercial underground injection well would have a negative economic impact of approximately $17,000,000 per year to DuPont Dow Elastomers. This estimate does not include direct treatment and disposal costs that are assumed to be similar for onsite and offsite underground injection wells and, therefore, have been excluded from the cost calculation. Any additional treatment and disposal costs charged by the offsite commercial underground injection well facility would increase the negative economic impact on DuPont Dow.

Furthermore, during this interim period Pontchartrain Site personnel will need to construct additional loading facilities to manage the increased volume of hazardous wastewaters being shipped offsite. The cost of constructing the additional loading facilities is estimated to be approximately $1,000,000. Other unplanned capital projects may be required at the Pontchartrain Site such as additional storage and treatment facilities. It is estimated that approximately 36 months will be required at the Pontchartrain Site for planning and constructing the loading facilities and other uplanned capital projects associated with the K173 Listing Rule. Since the full scope of these projects is not known at this time, it is not possible to estimate the significant costs that the site will incur. Capital secured for projects associated with the K173 Listing Rule would compete with and potentially eliminate other business or voluntary environmental improvement projects that could offer greater overall benefit.

The DuPont Dow Elastomers Louisville Plant currently disposes of approximately 13,500,000,000 lbs/year (2850 gallons/minute) of potential K173 wastewaters to a Publicly-Owned Treatment Works (POTW) after onsite, non-biological treatment in tanks. These wastewasters, which are currently non-hazardous, consist of three small chlorinated aliphatic production wastewater streams (totaling 378,000,000 lbs/year or 80 gallons/minute) commingled with other plant wastewaters. Due to the mixture rule [40 CFR 261.3(a)(2)(iv)] the total plant wastewater stream will become hazardous waste if the K173 Listing Rule is finalized as proposed.

The Louisville Plant wastewater transport facilities to the POTW would have to be upgraded if the site wastewaters become hazardous wastes. Capital costs are estimated to be at least $10,000,000. These improvements would require a minimum of 36 months to complete. Should the POTW determine that it could no longer accept the DuPont Dow wastewaters, the Louisville Plant would need to permit and construct an onsite wastewater treatment facility with an NPDES outfall at a cost of approximately $20,000,000. The timeframe to receive a revised NPDES permit, design the wastewater treatment facility and construct it is estimated to be at least 48 to 60 months.

The costs to the two DuPont Dow Elastomers facilities impacted by the K173 Listing Rule as proposed are quite significant. Capital costs are estimated to be at least $11,000,000 and annual operating costs for the interim period of permit and "No Migration" Petition modification approval are estimated to be at least $17,000,000 per year. Should the Louisville Plant need to construct an onsite wastewater treatment facility, then significant additional annual operating costs would be incurred.

DuPont Dow owns and operates two of the 25 C_1-C_5 chlorinated aliphatic hydrocarbon production facilities in the United States. It is expected that other affected facilities will experience capital and annual recurring costs similar to the DuPont Dow facilities. The USEPA needs to further evaluate these cost estimates and revise its economic analysis on the impact of the K173 Listing Rule to the regulated community. It is anticipated that the actual economic impact of this chlorinated aliphatics rulemaking to affected facilities will exceed $100,000,000 and, therefore, will require that the USEPA perform a cost-benefit analysis under the Unfunded Mandates Reform Act of 1995. DuPont Dow Elastomers requests that the USEPA withdraw the proposed chlorinated aliphatics rulemaking until it can perform the required cost-benefit analysis under the Unfunded Mandates Reform Act of 1995.

6
DCN CALP-00002
COMMENTER American Petroleum Institute (Washington, DC)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS

Moreover, API is aware that other commenters,including the Chemical Manufacturers Association, have calculated that – based on population risk estimates – the cost of a single cancer case avoided by this proposed rule would be on the order of billions of dollars. API is also aware that comments are being submitted showing that the proposed cost of control is significantly out of line with a substantial number of other regulatory decisions. If, as API urges, EPA gives the proper weight to population risk estimates in hazardous waste listing determinations, then EPA should also factor into its determination estimates which show that costs of listing the wastes as hazardous would be grossly disproportionate to any minuscule population risk benefits.

7
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)
SUBJECT ECON
SCOPE K173

The proposal reflects an overly simplistic view of what the rule would mean in terms of retrofitting tanks, while adding layers of complication and thus compounding what would already be a significant engineering task. Many companies have performed assessments of the cost associated with covering and controlling tanks in their biological treatment plant, even though it is likely that newly constructed, dedicated systems would be installed in lieu of retrofit at a significantly greater initial capital expense.

Biological treatment systems at EDC/VCM manufacturing sites rely on aeration and mixing of wastewater to obtain proper treatment of the constituents of concern. Unlike tanks used for storage of materials, tanks used for biological treatment are often equipped with various pieces of equipment that facilitate the desired treatment *(e.g.,* clarifiers). If it were simply a matter of covering/controlling storage tanks *(i.e.,* without any equipment concerns) the required action would amount to tank retrofit and the addition of piping, albeit at significant cost due to the size of the tanks involved. However, with biological treatment tanks there are many considerations over and above tank retrofit, which render re-design efforts considerably more difficult. There is the question of how equipment repairs will be effected. The re-design must allow for safe access, as personnel would now be required to enter a confined space for routine maintenance of treatment plant equipment. This would present new hazards and would require additional monitoring to ensure against an unsafe work environment during maintenance and repair activities. Personnel would no longer be able to perform even the simplest of maintenance or repair tasks without significant effort.

Facilities would also be forced to address the issue of water management when considering repairs. Production processes are such that large quantities of water must be managed on a daily basis. Presently, operation personnel have discretion over which situations require draining of tanks for equipment maintenance/repair and which situations do not. If the rule is finalized as proposed, this discretion would be eliminated, since the tanks would have to be drained every time maintenance/repair is performed regardless of how minor the activity. Such a scenario would require either frequent plant shut down or the addition of substantial tank storage capacity. One must also consider the issue of equipment removal. There are certain instances when the removal of equipment is required. Many times, this removal cannot be accomplished through some relatively small access port. Rather, larger/heavier pieces of equipment would have to be removed by way of the top of the tank using heavy machinery. This presents the necessity of installing and using a removable top, a prospect that is impractical at best.

One key aspect of biological treatment plant operation that the proposal fails to take into account is the importance of inspection to ensuring proper operation. For certain pieces of equipment there is a visual aspect to monitoring proper operation that is as important, if not more important, than electronic monitoring of operations. Creating an enclosed space would not only hamper efforts at visual inspection of the process, it would transform a normally routine operation into a complicated procedure for vessel entry. In turn, the decreased effectiveness of visual inspection may result in an increase in wastewater NPDES difficulties and/or excursions. As mentioned, issues related to risk and the economic impact of these proposed regulations have been addressed below and by other companies/organizations. However, it appears that EPA has failed to adequately consider practical implications related to this proposal and whether the added risk of personnel exposure and possible NPDES non-compliance were outweighed by the estimated risks to the general population.

8
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)
SUBJECT ECON
SCOPE K173

The VI also did not find within EPA's economic cost analysis any indication of the time and effort necessary to obtain and operate under an air permit for these newly regulated emission sources being considered. This effort can be substantial under the Clean Air Act's Federal Title V Air Permit Program. It has been the experience of VI member companies that receiving a State Air Operating Permit can take between 8 and 18 months. Amending a Title V Air Operating Permit may take even longer.

9
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)
SUBJECT ECON
SCOPE K173

Finally, it was not apparent whether EPA considered the cost to conduct performance testing on the control devices. This effort can cost between $150,000 to more than $300,000 per control device. These costs are simply the costs associated with having a third party conduct the test and develop results - they do not account for the cost of:

operating the process at the required operating rate to indicate performance at a maximum production rate; environmental personnel to coordinate testing, escort third party testing personnel, review testing protocols, *etc.,* and results; and purchasing and contracting personnel efforts. Taking these additional efforts into account adds to the cost to demonstrate that the control device is operating as required by the RCRA Subpart CC standard.

10
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)
SUBJECT ECON
SCOPE K173

Considering the type of construction that may be required, a one year time frame is too restrictive, For example, if a company were required to cover an existing wastewater tank, as previously discussed, the tank walls and bottom would have to be strengthened prior to installing a fixed roof. EPA's Clean Air Act Maximum Achievable Control Technology (MACT) Standards provide affected facilities that may be required to, for example, enclose existing open topped tanks and install control devices, three years to complete the activity [See 40 CFR 63.6(c), 40 CFR 63.100(k)(2)(i)]. Facilities that may be required to comply with RCRA Subpart CC should also be allowed three years for compliance. Also, as it is currently written section 265.1082(c), which details when a new source must be in compliance, would have to be revised to provide for a three-year compliance period.

11
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)
SUBJECT ECON
SCOPE K174

Wastewater treatment sludges generated at EDC/VCM manufacturing site biological treatment plants are typically stored in roll-off boxes and shipped to Subtitle D landfills. All shipments are accompanied by a non-hazardous waste manifest that clearly identifies the waste, the quantity shipped, the destination landfill, and the transporter. Records of these shipments are maintained. The VI believes that documentation as described above, which is analogous to documentation for existing hazardous waste activities, should be sufficient proof of disposal in accordance with the conditions for exclusion from this hazardous waste listing. As for documentation of intent, such a concept would be difficult to prove by means of paperwork. It would seem that sufficient tracking based on a history of proper disposal would be sufficient proof of intent to landfill. Additionally, agency inspection should be more than adequate to ensure that land treatment or storage on land is not taking place. Inspectors merely have to verify that sludge is stored in containers and that there is no visual evidence of placement on land. Given that inspections are random and unannounced, the VI believes that current practices should more than adequately satisfy concerns regarding intent.

As proposed, recordkeeping requirements for non-hazardous wastes are as restrictive as if the waste were regulated. Existing RCRA regulations provide guidance for documentation of claims that materials are not solid wastes or are conditionally exempt from regulation [See 40 CFR 261.2(f)]. There is no need to establish a new or more specific set of rules or guidelines to demonstrate compliance with the contingent management option. Facilities are familiar with the current requirement to provide "appropriate documentation" (such as legally binding contracts) to demonstrate that a material is not a waste or is exempt from regulation. Any new set of standards or rules would only create unnecessary burden and confusion.

12
DCN CALP-00004
COMMENTER The Vinyl Institute, Inc. (Arlington, VA)

SUBJECT ECON
SCOPE K173
The VI believes that EPA's Table IV - 1 - Summary of Estimated Industry Compliance Costs underestimates the cost to comply with the rule as proposed). Specific details are provided below.

The VI believes that EPA did not use the true range of tanks that may be affected by the control requirements of RCRA Subpart CC. Page 40 and Exhibit D-1 of the *Economics Background Document* explain EPA's approach to characterizing tank systems and consequently developing implementation and compliance costs. In summary, EPA based its scope on information provided by 15 of the 23 surveyed facilities and then proportionally expanded the "universe" to estimate a total number of potentially affected tanks for all 23 facilities.

By summarizing the total capacity of the 58 wastewater tanks reported in the survey by the 15 facilities, EPA came up with an average tank size of 380,000 gallons. The total capacity of the 58 wastewater tanks was estimated at 22.045 million gallons, with each facility averaging six tanks per facility. EPA then developed "proxy" tank sizes ranging from 45,000 to 775,000 gallons to create a tank size distribution across a facility.

In order to estimate how many of the 58 wastewater tanks would require air emission controls under RCRA Subpart CC, EPA relied on the test results of six wastewater samples applied to the Risk Analysis. As discussed above, of the six samples wastewater treatment system influent samples tested for dioxin, all taken from a "dedicated" wastewater management systems, one exceeded the 1 ng/L dioxin concentration threshold. Hence, EPA applied the assumption that one in six wastewater streams (17%) would require air emission controls. Because survey results indicated that several facilities already operate with emission controls, EPA multiplied the affected streams by a percentage ranging from 0 to 100% to account for the likelihood that some tanks were already covered.

By leaving eight sites out of its evaluation, EPA made assumptions with regard to the unsurveyed sites that may be inaccurate. EPA does not explain why eight sites were not included in the cost analysis. For example, EPA assumes that the largest tank potentially affected by air emission controls would be 775,000 gallons.

In addition, the RCRA section 3007 Survey used to support the proposal did not request exact design capacity, but used the following codes:

A = < 10,000 gallons
B= 10,000 gallons to 100,000 gallons
C= 100,000 to 1,000,000 gallons
D= > 1,000,000 gallons

By using these broad ranges, EPA has neither an accurate estimate of the amount of wastewater handled by the industry nor a true idea of the tank sizes involved.

As per note (d) of Exhibit D-4 in the *Economic Background Document,* EPA estimated that the roof area of a 20,000 gallon tank is 293 square feet and the cost to enclose it is $11,400 (1986 dollars). Proportionally, therefore, according to EPA the cost to cover a 775,000 gallon tank with a roof area of 3,728 square feet would be $145,048 (not including sales tax and field installation). The VI believes that the cost to cover large existing tanks *(i.e.,* greater than 1,000,000 gallons), is significantly more than a simple proportion evaluation using a the cost to cover a 20,000 gallon tank, and, thus, EPA has significantly underestimated the costs associated with covering tanks as required under the proposal.

The VI believes that EPA's continual use of one sample in six will exceed the air emission control trigger is inaccurate and underestimates the number of facilities that may exceed the trigger. Using this assumption yields only nine tanks of a potential 58 requiring control. The VI believes that this number may increase as facilities begin to test wastewater streams for dioxin. Many facilities may choose to cover tanks if test results prove that EDC/VCM wastewater streams are close to the trigger level.

13
DCN CALP-00005
COMMENTER Synthetic Organic Chemical Manufacturers Association, Inc. (Washington, DC)
SUBJECT ECON
SCOPE K174
SOCMA also commends EPA for a second aspect of this contingent management option, i.e., the level and type of documentation rquired to qualify wastes as exempt under this provision. A key element of the contingent management exemption is documenting the intent to dispose and then the actual disposal of the waste in either a Subtitle C or Subtitle D landfill (depending upon the listing). In the proposed listing descriptions, EPA references "contracts between the generator and the landfill owner/operator" and "invoices documenting delivery of waste to landfill" as examples of "appropriate documentation". Proposed 40 CFR 261.32 EPA refrained from specifying a particular type of document since it acknowledged that "documentation of previous landfilling of the waste and a demonstration of a commitment to dispose of currently generated waste in a landfill may be made by several means." 64 Fed.Reg. At 46509.

In this context, EPA has sought to allow companies to rely upon standard contracts, records and other commercial documents that would be created and maintained in the ordinary course as the "adequate documentation" required by the contingent management option. This reliance on and recognition of the value of routine, commercial records as a compliance tool is an important development.

14
DCN CALP-00006
COMMENTER Borden Chemicals & Plastics (Geismar, LA)
SUBJECT ECON
SCOPE K173

BCP has performed an assessment of the cost associated with covering and controlling the tanks in its biological treatment plant, even though it is likely that a newly constructed, dedicated system would be installed in lieu of retrofit (at a significantly greater initial capital expense). A discussion of this information is provided later in these comments when BCP addresses the economic analysis performed by EPA.

If it were simply a matter of covering/controlling storage tanks (i.e. without any equipment concerns) the required action would amount to tank retrofit and the addition of piping, albeit at significant cost due to the size of the tanks involved. However, with biological treatment tanks there are many considerations over and above tank retrofit, which render re-design efforts considerably more difficult. There is the question of how equipment repairs will be effected. The re-design must allow for safe access as personnel would now be required to enter a confined space for routine maintenance of treatment plant equipment. This would present hazards and would require additional monitoring to ensure against an unsafe work environment during maintenance and repair activities. Personnel would no longer be able to perform even the simplest of maintenance or repair tasks without significant effort and increased potential for personal exposure.

Facilities would also be forced to address the issue of water management when considering repairs. Production processes are such that large quantities of water must be managed on a daily basis. Presently, operation personnel have discretion over which situations require draining of tanks for equipment maintenance/repair and which situations do not. If the rule were made final as proposed, this discretion would be eliminated, since the tanks would have to be drained every time maintenance/repair is performed regardless of how minor the activity. Such a scenario would require either frequent plant shut down or the addition of substantial tank storage capacity. One must also consider the issue of equipment removal. There are certain instances when the removal of equipment is required. Many times, this removal cannot be accomplished through some relatively small access port. Rather, larger/heavier pieces of equipment would have to be removed by way of the top of the tank using heavy machinery. This presents the necessity of installing and using a removable top, a prospect that is impractical at best.

Finally, one key aspect of biological treatment plant operation that the EPA proposed requirement fails to take into account is the importance of inspection to ensuring proper operation. For certain pieces of equipment there is a visual aspect to monitoring proper operation that is as important, if not more important, than electronic monitoring of operations. Creating an enclosed space would not only hamper efforts at visual inspection of the process; it would transform a normally routine operation into a complicated procedure for vessel entry. In turn, the decreased effectiveness of visual inspection may result in an increase in wastewater NPDES difficulties and/or excursions. As mentioned, issues related to risk and the economic impact of these proposed regulations have been addressed below and by other companies/organizations. However, it appears that EPA failed to adequately consider practical implications related to this proposed rule and whether or not the added risk of personnel exposure and possible NPDES non-compliance were outweighed by the estimated risks to the general population.

Although EPA appears to have considered some of the higher cost compliance requirements, EPA grossly underestimates both the annual costs and the initial capital costs associated with compliance. In addition, in providing an estimate for the compliance categories listed in Table IV- 1, the economic analysis fails to account for many manpower and material handling recurring costs. By approaching the proposed standards as an actual engineering project and developing costs accordingly, BCP has determined that an upgrade of our biological treatment system alone would exceed the EPA estimate of the total industry cost by over $5 million. It is important to note that BCP developed its site-specific estimate strictly on the basis of controlling biological treatment tanks. The estimate did not include control of storage tanks, etc. located upstream of the biological treatment plant and downstream of the wastewater strippers. Consequently compliance-related initial capital costs would have been even higher than the cost stated above. Clearly, the EPA understanding of the design, construction, and operating activities that this proposed rule would generate fall well short of a realistic estimation of implementation requirements and the associated costs.

15
DCN CALP-00006
COMMENTER Borden Chemicals & Plastics (Geismar, LA)
SUBJECT ECON
SCOPE K175

At various locations, throughout the preamble to this proposed rule, EPA mentions the difficulties associated with the retorting of mercuric sulfide. EPA also provides a detailed discussion of the difficulty associated with retorting mercuric sulfide wastes in its Advanced Notice of Proposed Rulemaking (ANPR) regarding potential revisions to the land disposal restrictions-treatment standards for mercury wastes (Federal Register for 5/28/99, 64 FR 28949-28963). This ANPR fully highlights the need to consider alternate treatment (including those that would allow for landfilling) for mercury wastes. This need is overlooked in the discussion for this proposed listing rule. Although overcoming this difficulty may be technically feasible, BCP's experience with this waste stream and with treatment of its mercury waste streams in general indicates that what may be possible from a technical perspective may not be possible from a logistical and practical perspective. Given the nature of its VCM-A operation BCP has had ample opportunity to interact with vendors of retort services. First, it is important to note that vendors often make claims about processing capabilities, which do not withstand further scrutiny. BCP's independent survey of these companies (through contractors) indicates an unwillingness to accept the VCM-A filter cake. The survey has even included the company referenced in the preamble to this proposed rule. In the majority of cases, the issue is not a matter of money (i.e., paying higher rates for treatment services). Rather, permit and processing considerations are the overriding concern for providers of retort services.

One of the first hurdles to overcome is the 500-ppm by weight exclusion limit on organic compounds listed in 40 CFR 261, Appendix VIII. Many, if not all, companies operate their retort units under the metals recovery exclusion of 40 CFR 266.100, which excludes a "metals recovery" unit from permit requirements, provided that the facility comply with certain operating restrictions. Consequently, retort units are usually unable to accept waste with concentrations of organic constituents in excess of 500 ppm. Another provision of the permitting exclusion is a requirement that the hazardous waste contain "recoverable" levels of metals, although the concept of recoverable metals is also an issue for permitted facilities. The regulations do not provide a definition of what constitutes a recoverable level of metals. Treatment facilities often define this concept in terms of treatment efficiency Obviously, those wastes with higher concentrations of metals can be processed for metals recovery more efficiently. A given quantity of such waste can be processed more quickly and will yield a higher quantity of the metal of interest. This in turns translates into a lower cost of operation and a lower disposal cost to the generator. A generating facility can sometimes simply pay a higher disposal rate for wastes with lower concentrations of a particular metal. However, depending on the economic value of the metal in question, treatment providers may turn down waste material with parts per million quantities of a recoverable metal due to permit-related storage capacity. In other words the facility would rather store and treat those wastes that would yield a larger quantity of a valuable metal, than to store/stockpile wastes with poor yields.

Even if a unit has obtained an operating permit (and thus can accept waste with over 500 ppm organics), the unit may still have permitting and/or operating concerns that preclude treatment of the waste in question. For example, the chloride content in BCP's mercuric chloride catalyst has often caused retort vendors to turn down the opportunity to treat this waste stream. Vendors have expressed a similar concern with respect to sulfides. BCP has also had difficulty in identifying facilities willing to accept wastes with low (in relative terms) levels of mercury. Treatment difficulties often translate to extended storage time, since the retort facility will have to campaign difficult to treat wastes and, consequently, treat them more slowly When deciding whether or not to accept a stream, treatment vendors often think in terms of percent concentrations of mercury; whereas, even the highest levels in the VCM-A wastewater treatment sludge only approach 10,000 ppm or 1%. This reluctance is related to the economic benefit of processing this material and company concerns regarding storage.

16
DCN CALP-00007
COMMENTER Chlorine Chemistry Council (Arlington, VA)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS

EPA's Estimates Show High Costs for Minimal Risk Reductions

EPA estimates the proposed rule will cost $3 million and prevent at 0.0002 cancer cases annually. Thus, the rule will cost an astounding $15 billion per cancer prevented. CCC believes that the true cost of the proposed regulations is more than double EPA's estimate (see comments by CMA and the Vinyl Institute) and, as noted above, the cancer risk is significantly lower than estimated. Therefore, the actual cost for each predicted cancer avoidance will be significantly larger, perhaps by orders of magnitude. Based on the low risk and high cost, EPA should exercise its discretion to not list these wastes.

17
DCN CALP-00009
COMMENTER Formosa Plastics Corp. USA (Livingston, NJ)
SUBJECT ECON
SCOPE K174

EPA has Neglected to Consider "Contingent Management" Overburden.

If truly exempt, why enforce that "accurate records" are kept to facilitate enforcement? This proposal is as restrictive as if the waste were regulated. (64 FR 46508). The current RCRA regulations under 40 CFR 261.2(f) already provide guidance for "Documentation of claims that materials are not solid wastes or are conditionally exempt from regulation". In our opinion, there does not appear to be any need to establish a new or more specific set of rules or guidelines to demonstrate compliance with the "Contingent Management Option". Facilities are familiar with the current requirement to provide appropriate documentation (such as legally binding contracts) to demonstrate that a material is not a waste or is exempt from regulation. Any new set of standards or rules would only create confusion.

FPC USA suggests that the conditional K174 listing be changed to apply to the waste stream when it is managed, intended for disposal, or disposed of using the method that poses the risk that warrants listing it as a hazardous waste. The proposed conditional listing would impose unnecessary compliance burdens on companies that are managing the waste stream using methods that do not pose risk that warrant listing.

18
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173

EPA is encouraging the public to provide comments and suggestions about the design, accuracy, representativeness and completeness of the *Economic Background Document* for the proposal to list wastewater's and wastewater sludges from the chlorinated aliphatic industry (64 FR 46517). FPC USA appreciates EPA request for comments on this document and has provided what we believe to be constructive input into determining the cost to comply with the K173 proposed listing.

FPC USA believes that EPA's Table IV - 1 - Summary of Estimated Industry Compliance Costs (64 FR 46518) appears to be low and underestimates the cost to comply. Specific details are provided below.

Within EPA's *Economic Background Document* (dated 30 July 1999) regarding the subject, EPA requested public comments and information relative to the baseline waste management characterization (Item 6 of page ii). Specifically, EPA requested comments on the waste management units, stating in particular, that there is uncertainty in the Section 3007 survey data regarding the applicable number and sizes of wastewater management tanks used by CAHC manufacturing facilities (64 FR 46498). EPA also requested comments on Unit Costs (Item 8 of page ii). FPC USA is providing comments as requested by EPA.

Upon review of the *Economic Background Document* and the example RCRA 3007 Survey found in *the Listing Background Document for the Chlorinated Aliphatic Listing Determination* (dated July 30, 1999), FPC USA's believes that EPA did not use the true range of tanks that may be affected by the control requirements of RCRA Subpart CC.

Page 40 and Exhibit D-1 of the *Economics Background Document* explain EPA's approach to characterizing tank systems and consequently developing implementation and compliance costs. In summary, EPA based its scope on information provided by 15 of the 23 surveyed facilities and then proportionally expanded the "universe" to estimate a total number of potentially affected tanks for all 23 facilities.

By summarizing the total capacity of the 58 wastewater tanks reported in the survey by the 15 facilities, EPA came up with an average tank size of 380,000 gallons. The total capacity of the 58 wastewater tanks was estimated at 22.045 million gallons, with each facility averaging six tanks. EPA then developed "proxy" tank sizes ranging from 45,000 to 775,000 to create a tank size distribution across a facility.

In order to estimate how many of the 58 wastewater tanks would require air emission controls under RCRA Subpart CC, EPA relied on the test results of six wastewater samples applied to the Risk Analysis (64 FR 46483 & 46503). Of the six samples tested for dioxin, all taken from a "dedicated" wastewater management systems, one exceeded the 1 ng/L dioxin concentration threshold. Hence, EPA applied the assumption that one in six wastewater streams (17%) would require air emission controls. Since survey results indicated that several facilities already operate with emission controls, EPA multiplied the affected streams by a percentage ranging from 0 to 100% to account for the likelihood that some tanks were already covered.

19
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173

FPC USA has several concerns regarding EPA's approach to characterizing tank systems. By leaving eight sites out of its evaluation, EPA made assumptions with regard to the unsurveyed sites that may not be accurate. EPA does not explain why eight sites were not included in the cost analysis. For example, EPA assumes that the largest tank potentially affected by air emission controls would be 775,000. This is not true for FPC USA, as detailed below.

In addition, *Section 8.1 Storage or Treatment in Tanks* of the RCRA Section 3007 Survey did not request exact design capacity, but used the following codes:

A = < 10,000 gallons
B = 10,000 gallons to 100,000 gallons
C = 100,000 to 1,000,000 gallons
D = > 1,000,000 gallons

By inserting a letter code, EPA does not have an accurate amount of wastewater handled by the industry, nor a true idea of the tank sizes involved, particularly tanks > 1,000,000 gallons.

In assigning "proxy" tank sizes in the range of 45,000 to 775,000, EPA ignored tanks that may be in a much higher size range. For example, FPC USA has three wastewater tanks potentially affected that are approximately 1,500,000 gallons, two that are greater than 2,000,000 and two that are greater than 3,000,000 gallons. Currently, all seven tanks are not required to have covers.

As per note (d) of Exhibit D-4 in the *Economic Background Document,* EPA estimated that the roof area of a 20,000-gallon tank is 293 sq. ft and the cost to enclose it is $11,400 (1986 price). Proportionally, therefore the cost to cover a 775,000-gallon tank with a roof area of 3,728 would be $145,048 (not including sales tax, and field installation). FPC USA believes that the cost to cover large existing tanks (i.e. greater than 1,000,000 gallons), is significantly more than a simple proportion evaluation using the cost to cover a 20,000 gallon tank.

20
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173
FPC USA reviewed EPA's method of determining the initial capital costs and the recurring annual Operating and Maintenance (O&M) costs. These costs and the methodology used are found in Table VI - 1 (64 FR 46518) of the preamble to the proposed rule and the Executive Summary for Estimated Industry Compliance Costs (page (i)) and Exhibits D-4 and D-5 of the Economics Background Document). With regard to K173 compliance costs, EPA estimated the following:

Table 1: EXECUTIVE SUMMARY OF ESTIMATE INDUSTRY COMPLIANCE COSTS

Item	Type of CAHC Facility Potentially Affected by the Proposed Rule	Nr. Of affected CAHC mfg. Processes	Initial capital costs ($ lump-sum)	Recurring annual O&M costs ($/year)
B	K173: WASTEWATER LISTING ESTIMATED COSTS:			
BI	Tank fixed roof + valve	9 tanks	$1,084,600	$81,600
B2	Tank roof vent + carbon control device	9 tanks	$150,900	$581,600
B3	Tank "Subpart CC" ancillary costs	9 tanks	$0	$23,700
B4	Initial waste testing for dioxins	51 tanks	$84,500	$0
B5	Annual waste retesting for dioxins	43 tanks	$0	$70,400
	Subtotal wastewater costs =		$1,320,000	$766,900

Using EPA's methodology of calculating compliance costs, but inserting FPC USA specific information, FPC USA has calculated initial capital costs and recurring annual O&M costs that may be incurred at its facilities. Since FPC USA has not been required to test its wastewaters for dioxin at the headworks to its wastewater treatment plants, FPC USA has assumed that its wastewater streams may meet or exceed the 1 ng/L trigger for air emission controls. Again in order to develop a potential cost impact to FPC USA, we have assumed that 10 tanks have the potential to be controlled.

Assuming that 10 tanks are affected, FPC USA calculated, using the same methodology as EPA, that its total initial capital cost would be $6,872,414 and its annual O&M costs would be $3,770,070. A spreadsheet detailing FPC USA's calculation can be found in Appendix 1. FPC USA's estimate contains several costs that were overlooked by EPA. FPC USA's total initial cost for K173 compliance only may be > $8,000,000 with an estimated annual cost of > $4,000,000. This is substantially more than the cost estimate which EPA developed ($1,320,00 initial and $766,900 annual as per Table VI).

21
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173
EPA's Cost Methodology Underestimates the Number of Tanks Potentially Affected by RCRA Subpart CC. FPC USA believes that EPA's continual use of one sample in six will exceed the air emission control trigger is inaccurate and underestimates the number of facilities that may exceed the trigger. Using this assumption yields only nine tanks of a potential 58 requiring control. FPC USA believes that this number may increase if facilities are required to test wastewater streams for dioxin. In addition, many facilities may choose to cover tanks if test results indicate that EDC/VCM wastewater streams are close to the 1 ng/L trigger.

22
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173
As detailed above, EPA has estimated that the unit cost to cover an average tank is $120,511 (Total capital cost to

cover nine tanks divided by nine). In order to determine whether EPA's estimation methodology detailed above was reasonable and to determine the potential cost for FPC USA to cover its typical tanks, FPC USA contacted several vendors to request a "ball park" estimate to cover a typical open-top tank that FPC USA believes may be affected. The vendors contacted were references used by EPA to develop its cost analysis for controlling volatile organic compounds (see page 6-33 of EPA's Control of Volatile Organic Compounds from Volatile Organic Liquid Storage in Floating and Fixed Roof Tanks - July 1992 A-90-21 IV-A-3). FPC USA requested an estimate to cover the following typical existing tank:

Capacity: 3,200,000 gallons
Height: 38 ft
Diameter: 120 ft
Materials of Construction: Carbon Steel

One vendor provided input. A rough cost to cover this typical tank was estimated by the vendor to be between $350,000 and $370,000. However, this cost did not take into account several factors such as the cost to:

Alter the walls, bottom or accessories mounted on the bottom portion of the tank (nozzles, hatches, manways, etc.) in order to support a roof;
Depending on the location and loading on the site, provide additional support to account for earthquakes or high winds;Ship the roof (taxes were not include either); and, Control emissions from the tank.

Considering the vendor's ball-park estimate along with the cost to complete Items 1 through 4 above, and assuming that 10 FPC USA tanks would be affected, the cost estimate summarized in Attachment 1 seems reasonable.

23
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173

Within EPA's economic cost and burden analysis, FPC USA did not find any consideration of the time and effort necessary to obtain and operate these potentially newly regulated emission sources (i.e., the closed vent system and control device would be considered new emission points) under an air permit. This effort can be substantial under the Clean Air Act's Federal Title V Air Permit Program. It has been FPC USA's experience that receiving a State Air Operating Permit can take between 8 and 18 months. Amending a Title V Air Operating Permit may take even longer.

In addition, it was not apparent whether EPA considered the cost to conduct performance testing on control devices for tanks potentially affected by this proposal. Again, in FPC USA experience, this effort can cost between $150,000 to more than $300, 000 per control device. This cost is the expense of having a third party conduct the test and develop results, it does not account for the cost of:

– Operating the process at the required operating rate to indicate performance at a maximum production rate;
– Environmental personnel to coordinate testing, escort third party testing personnel, review testing protocols and test results, etc.; and
– Purchasing and contracting personnel efforts.

Taking this additional effort into account adds to the cost to demonstrate that the control device is operating as required by the RCRA Subpart CC standard.

24
DCN CALP-00009
COMMENTER Formosa Plastics Corp, USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173

Table IV-1 and Page i and Exhibit D-1 of the *Economics Background Document* were reviewed by FPC USA to determine EPA's cost methodology with regard to waste testing for dioxins for K173 wastewaters streams (see Table 1 on page 11 of this document for EPA's cost summary). FPC USA agrees with the cost to test a single wastewater sample for dioxin, but believes that the total cost to demonstrate compliance with regard to dioxin testing is higher than EPA estimates.

Specifically, regarding the cost to test K173 wastewaters for dioxin, EPA estimated that the cost per test is $1,657 (Total initial cost of $84,500 divided by 51 tanks). EPA estimated that each facility would have to conduct an average on 2.2 tests (51 tanks divided by 23 facilities). Hence, EPA estimated that each facility would average $3,674 to demonstrate initial compliance. FPC USA disagrees with this estimate for the reasons detailed below.

1. Cost per Sample

FPC USA's experience with testing wastewater streams for dioxin indicates that the total (direct and indirect) cost to test one wastewater sample for dioxins is ~$1,500. The direct cost to have a Third Party conduct the analysis is $900 per sample. Taking into account the cost to maintain a "Chain of Custody" and conduct purchasing and contracting activities, based on the information on hand, FPC USA believes that EPA's cost of $1,657 per sample appears reasonable. However, due to time constraints, FPC USA was unable to fully determine whether its current testing practices (estimated to cost $1,500 per sample) would satisfy EPA's sampling and analysis requirements detailed within the August 25, 1999 proposal. For example, FPC USA's Third Party Analytical Laboratory ensures a accuracy level of between 81 to 96%. FPC USA is uncertain of the cost to ensure a "95% upper confidence level". Hence, the cost per sample may be underestimated.

2. Number of Samples per Facility

FPC USA does not agree with EPA's estimate found within the *Economics Background Document* that 51 tanks would require testing initially, and 43 tanks annually thereafter. FPC USA believes that the number of affected tanks and the number of samples required to be conducted is too low.

As per the *Economics Background Document,* using some of the same flawed assumptions detailed in Sections V B., C. And D of this document regarding compliance cost to install emission control, EPA determined that 51 tanks would be opened topped, and thus must be tested to determine whether the wastewater streams met or exceeded the 1 ng/L threshold. Based on EPA's estimation that 23 facilities are affected by the proposal, this means that each facility would average 2.2 tests. This average seems to contradict EPA's description in the permeable in that EPA expects the following:

> In designing the sampling program, the facility must consider any unexpected fluctuations in concentration over time. The sample design should be described in the waste analysis plan, which must be retained in the facility's files. The sample design must be adequate to determine that the level of TCDD TEQ in the wastewater is above or below the 1 ng/L at a 95 percent upper confidence limit around the mean.... Under this approach, EPA is not specifying a specific number of samples, because the number of samples required to demonstrate that the wastewater dioxin concentration is below 1 ng/L at the 95 percent upper confidence limit depends on how close the actual concentration is to the regulatory limit and on the variability of the waste. EPA is proposing that the samples used to demonstrate compliance be grab samples collected within a time period that will accurately account for potential variability in the wastestream, including potential variabilities associated with batch and continuous processes... (64 FR 46504)

Since EPA is requiring such a high level of confidence (i.e., 95 percent upper confidence), and emphasizing that fluctuations in the process must be accounted for, FPC USA believes that more than 2.2 tests per facility would be required. As FPC USA understands the bullet items detailed below (64 FR 46504), FPC USA envisions a sampling plan which requires at least five samples with the potential for many more to certify compliance.

It is FPC USA's understanding that EPA expects the following:

- Each wastewater treatment tank managing K173 that is not compliant with 40 CFR sections 264.1084/265.1085 of subpart CC must be assessed to determine whether dioxin levels in the influent to the tank exceed the trigger level.
- For the purposes of this listing, the headworks of the wastewater treatment system is assumed to be at a location directly after steam stripping. If a facility does not utilize steam stripping, the wastewater treatment system headworks is assumed to be the first tank in which wastewaters are combined, accumulated or treated after leaving the chlorinated aliphatics production process.
- Tanks that are fully compliant with sections 264.1084/265.1085 of 40 CFR subpart CC would not be subject to waste analysis, record keeping and notification requirements proposed in today's rule to be added to 40 CFR 265.1080(f) (1) - (5), described below.
- Once the facility has established that TCDD TEQ levels do not exceed the trigger level for a specific tank, the facility can assume that the TCDD TEQ levels for all downstream tanks also are below the trigger level.

Using FPC USA's Texas facility as an example (FPC TX), based on these bullets and the proposed language for RCRA Subpart CC, FPC USA could expect to conduct a sampling and analysis plan at FPC TX as follows:

1. Since FPC TX has wastewater strippers prior to the wastewater treatment system, it would be required to sample each EDC/VCM wastewater stream directly after stream stripping. This would be a total of 3 streams; hence at least 3 tests.
2. There are more than 50 open-topped tanks between where a wastewater stream exits the stream stripper and enters the discharge outfall. Since EPA proposed to exempt tanks that are less than < 1 ng/L from control requirements and those that are downstream from an exempt tank, FPC TX would have to attempt to estimate which one of the 50 open-topped tanks was below the 1 ng/L threshold. Hence, FPC TX would conduct another test at a tank were it could be assumed that the trigger was not exceeded.
3. If Step 2's test results indicate that the wastewater dioxin concentration was at, well above, or well below the trigger concentration, FPC TX would have to perform another test either upstream or downstream of the selected tank chosen in Step 2.
4. Step 3 would be repeated until FPC TX determined at which point in it waste treatment system the 1 ng/L concentration limitation was not triggered. Hence, additional testing would be likely.

Therefore, at a minimum, FPC TX would have to conduct 5 tests at a total EPA estimated cost of $8,285. This is higher than EPA's estimate of 2.2 tests at a cost of $3,645 per facility. However, FPC TX's initial cost would most likely exceed $8,285. Since EPA expects that the facility must consider any expected fluctuations in the concentration over time (64 FR 46504) and proposed 40 CFR 265.1080(h)(2)(vii) requires retesting after a process change that could change the TCDD TEQ level more testing would be required. Since it is not required at this time, FPC USA is currently unaware of how its commingled wastewater streams' dioxin concentration would be affected by fluctuations, hence FPC USA would most likely take significantly more than 5 test samples.

25
DCN CALP-00009
COMMENTER Formosa Plastics Corp. USA (Livingston, NJ)
SUBJECT ECON
SCOPE K173
FPC USA believes that a one year time frame is too restrictive when considering the type of construction that may be required. For example, if FPC USA were required to cover an existing wastewater tank, as previously discussed, the tank walls and bottom would have to be strengthen prior to installing a fixed roof. If it is determined that it is more cost effective for a commingled wastewater treatment stystem to become a dedicated wastewater treatment facility due to this proposal, this certainly would take more than one year to construct. EPA's Maximum Achievable Control Technology Standards (MACT) of the Clean Air Act provides affected facilities that my be required to , for example enclose existing open topped tanks and install control devices, three years to complete the activity (see 40 CFR 63.6(c)) - General Provisions for the National Emission Standards for Hazardous Air Pollutants for Source Categories and 40 CFR 63.100(k)(2)(i) - Hazardous Organic NESHAP (HON) promulgated 4/22/94). FPC USA recommends that facilities, which may be required to comply with RCRA Subpart CC, be allowed three years for compliance.

26
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK
A large number of LCA members will be substantially affected by the proposed Chlorinated Aliphatics Rule. The members who are directly affected by the proposed rule include: Borden Chemicals & Plastics Operating Limited Partnership; Dow Chemical Company; Dupont-Dow Elastomers, L.L.C.; Formosa Plastics Corp.; Georgia Gulf Corporation;* Occidental Chemical Corporation; PPG Industries, Inc.; Shell Oil Company; and Vulcan Chemicals, A Division of Vulcan Materials Company. In addition, a number of other member companies supply raw materials or purchase products from the directly affected members. Thus, any adverse financial impact on these directly affected companies may also affect their suppliers and customers. [* Footnote: Georgia Gulf Corporation recently acquired the EDC/VCM plant in Westlake, LA from CONDEA Vista Company as well as CONDEA Vista's interest in the PHH Monomers, Inc. joint venture with PPG Industries, Inc. which joint venture is operated by PPG to make VCM.]

27
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173
LCA believes that EPA failed to accurately determine the economic impact of the K173 listing, as proposed. Information supplied by several affected LCA members, which is summarized below, indicates that there were significant costs associated with the proposed rule that EPA failed to consider. LCA also believes that EPA failed to consider other safety and non-economic factors in proposing to list such wastewaters. LCA requests that EPA evaluate this information.....

EPA's Economic Analysis indicated that the estimated industry compliance costs associated with the K173 listing would be approximately $1,320,000 in initial capital costs and approximately $766,900 in recurring annual operation and maintenance costs. EPA included only the following estimates in reaching these totals:
– tank fixed roof and valve
– tank roof vent and carbon control
– tank Subpart CC ancillary costs
– initial waste testing for dioxins
LCA believes that EPA has underestimated the costs for the items it did review to a significant degree as well as failed to include other costs necessarily associated with installing controls to meet the Subpart CC requirements .

EPA assumed that only 9 tanks out of the 58 it reviewed would require controls. This estimate was based on the fact that only 1 sample out of 6 samples that EPA collected were above the 1 ng/L trigger level. As previously noted, EPA failed to test at a number of facilities. (EPA did not consider that some facilities may choose to install tank covers and control systems in order to account for potential process variability and to ensure 100% compliance.) EPA also failed to consider that some facilities may choose to install new tanks rather than cover existing tanks due to structural issues and/or the significant period of downtime that would be necessary to retrofit an existing tank which would mean lost production revenues or the need to shop wastewater off-site.

Information provided by several companies indicates that EPA's estimates for tank retrofit and annual operation and maintenance costs are unrealistically low. Bids given to Formosa Plastics indicated that the cost of retrofitting tanks of the size that they use at the Louisiana plant would cost approximately $300,000 without consideration of reconstruction of support, shipping, taxes, or emission control equipment The costs of retrofitting tanks at their Texas facility are even greater due to larger size. DuPont-Dow Elastomers has estimated that a tank retrofit costs approximately $200,000 - $300,000 depending upon the size of the tank. Borden Chemicals & Plastics has estimated that it will cost them $7,340,000 to reconstruct 11 tanks (averaging about $660,000 per tank) when considering the additional foundations, structural work, instrumentation, fans, duct systems and carbon bed filters required. Occidental Chemical has estimated that it will cost them about $6 million per facility at each of their three facilities in order to comply with the rule.

Finally, EPA did not consider the fact that it's proposed rule could pose countervailing health and safety risks to maintenance workers who will be required to inspect and perform maintenance in closed tanks rather than open tanks. LCA believes that this is certainly a factor that should be addressed pursuant to 40 CFR 261.11(a)(3)(xi). Likewise, in assuming annual operating and maintenance costs, EPA did not appear to account for the fact that such annual inspections/maintenance activities may require draining of the tanks, with associated downtime for production processes, and issues concerning water management during such periods.
that the EPA also allow generators to demonstrate that the TCDD TEQ level is below the 1 ng/L criteria through use of accepted statistical methods to determine an acceptable upper confidence limit on the mean as the value to compare to the listing criterion. This could be stated as an alternative procedure in the rule.

EPA's estimate for annual operation and maintenance costs appears to have grossly underestimated the cost of operating carbon bed systems. Formosa's Louisiana facility alone estimates the annual operating/maintenance costs to be an order of magnitude higher - in the range of $846,500 for control of three tanks, if testing shows the 1 ng/L to be exceeded.

28
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173
EPA failed to consider at all the cost to Shell Oil facilities to convert from surface impoundments to tanks - estimated by Shell to be $50 million at their Deer Park facility. Likewise, EPA failed to consider the impact to DuPont-Dow Elastomers' Louisiana facility which currently uses deepwell injection to manage wastewaters subject to this rule. The changed wastewater classification alone will require that DuPont-Dow obtain both state and federal no migration determinations, amend its UIC permits, and include two tanks in a RCRA permit - at a cost anticipated to be $500,000 to $1 million, without consideration of the costs DuPont Dow will have to meet for off-site disposal while these other administrative actions are pending. (DuPont-Dow estimated that 1 truck of wastewater would leave its site every 32 minutes during the time period it cannot use its existing system.)

29
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173
EPA did not consider the cost of title V air permit amendments for any of the facilities - although all of the facilities will require these. Neither did EPA consider the delay inherent in the permitting process which could affect the ability of facilities to comply by the deadline. It is possible that amendments to existing state or federal wastewater discharge permits will also be required and the cost of these were not considered.

30
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173
EPA did not consider the cost of performance testing control devices to demonstrate compliance with the Subpart CC standards. Some facilities have estimated that these costs can be as high as $150,000 to $300,000 per performance test.

31
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173
EPA did not consider the potential impact on hazardous waste fees that will be due to authorized states as a result of this rule nor did it consider the potential increase in hazardous waste taxes.

32
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K173

Finally, EPA did not consider the fact that it's proposed rule could pose countervailing health and safety risks to maintenance workers who will be required to inspect and perform maintenance in closed tanks rather than open tanks. LCA believes that this is certainly a factor that should be addressed pursuant to 40 CFR 261.11(a)(3)(xi). Likewise, in assuming annual operating and maintenance costs, EPA did not appear to account for the fact that such annual inspections/maintenance activities may require draining of the tanks, with associated downtime for production processes, and issues concerning water management during such periods.

33
DCN CALP-00010
COMMENTER Louisiana Chemical Association (Baton Rouge, LA)
SUBJECT ECON
SCOPE K174

The LCA supports EPA's concept of using contingent management options to preclude listing of a waste when the management option selected clearly poses no excess risk. This concept allows both regulators and regulated industries to focus their resources on addressing reduction of such potential risks without creating unnecessary economic and regulatory burdens for those facilities whose management practices do no pose any substantial risk. For this reason, EPA should extend the rule to add two additional contingent management options for K174 wastes: 1) incineration of K174 sludges or materials classified as K174 wastes by virtue of the mixture rule or derived from rule and 2) management of mixture or derived from wastewaters resulting from vessel cleanouts or equipment washing in a permitted NPDES (or state equivalent) system.* [*Footnote: LCA believes that EPA failed to consider the cost of management of such mixture/derived from wastes associated with K174 sludges in its Economic Analysis. This analysis should be revised for this reason.]

34
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston TX)
SUBJECT ECON
SCOPE OVERALL COST

We are very interested in the proposed rule because of the innovative options which are proposed and because the rule has a potentially higher significant financial impact on Shell than any other petrochemical company....

Shell previously requested the withdrawal of this rule because we believe that the overall economic impact of this rule on the regulated community will exceed $100MM - an amount that requires a cost-benefit analysis under the Unfunded Mandates Reform Act of 1995 and Executive Order 12866.

35
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston TX)
SUBJECT ECON
SCOPE K173

The "Economics Background Document" (30 July 1999) seriously underestimated the potential cost of compliance with the tank cover requirements for K173 and the requirements for other waste.

Shell maintains that the potential annual cost of this rule in the first year of construction may exceed $100 Million - an amount that exceeds the trigger for a cost-benefit analysis under the Unfunded Mandates Reform Act of 1995 and Executive Order 12866. Furthermore, Shell believes that as proposed the rule would have a significant inequitable financial impact equity on our Company. We submitted the attached request to the EPA Administrator to withdraw this rule for this reason on November 1 (the request was verbally denied on 11/18). Our estimate is based on the following known costs:

	Updated Amounts	EPA Estimate
Impact on Shell Deer Park Chemical Plant	$50,000,000	$0
CMA's PERA Critique of EPA's Economic Analysis	$7,673,000	$3,109,000
Total	$57,673,000	$3,109,000

36
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston, TX)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

The Deer Park Chemical Plant in Texas manages wastewater for the Shell Chemicals processes, a portion of the Shell Deer Park Refinery, and the Oxy Vinyls vinyl chloride monomer production facility (formally know as Occidental Chemical).. The Oxy Vinyls Plant discharges 695,255 Metric tons of wastewater per year which could be classified as a listed hazardous waste by the proposed rule. This stream comprises 7.5% of the approximate 9,298,000 Metric tons per year of the total wastewater flow through the Chemical Plant wastewater treatment system.

The wastewater flow from Oxy Vinyls enters the chemical plant sewer where it commingles with wastewater flows from the other sources described above. The combined wastewater stream is treated by activated sludge aggressive biological treatment in three impoundments and three secondary clarifiers operating in parallel. The treated wastewater is discharged under Texas Discharge Permit #00402.

An engineering review of required construction to replace the three impoundments with tanks resulted in a capital cost estimate of $50 million. This cost was developed in part from other recently completed projects of similar scope, including the replacement of two impoundments at the Equilon (formerly Shell) Wood River Refinery ($35 million). At Deer Park, the construction would be complicated, and hence more costly, since the new tanks would have to be built on the site of the existing facilities. This would increase costs of the foundation etc. (i.e. pilings, bringing in fill material) to the estimated $50 million level.

The cost for replacing this impoundment was not considered in the EPA's Economic Background Document of 30 July 1999.

37
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston, TX)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

CMA's Policy Economic and Risk Assessment ("PERA") Team reviewed and critiqued EPA's economic analysis for the proposed rule on chlorinated aliphatic compounds. PERA reviewed the Economics Background Document and identified flaws in EPA's analysis that have the effect of understating the potential cost of the proposed rule.

PERA re-estimated the potential cost of the rule by replacing some, but not all, of EPA's data/assumptions with more accurate and representative data/assumptions. Specifically, PERA assumed 38 facilities would be covered by the rule, a 5.4 % growth rate for future production, and an equipment life of 20 years. These changes alone raise EPA's "annual average equivalent" estimate from $3.109 million to $7.673 million. The present value of the total cost to regulated entities is $38.6 million in EPA's analysis; PERA estimates the cost to be at least $95 million. Note: The final PERA Critique is submitted as part of the CMA's comments.

38
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston, TX)
SUBJECT ECON
SCOPE OVERALL COST

Shell Chemicals (Shell) requests that the rule proposing the listing of chlorinated aliphatic production waste (64 FR 46476, August 25, 1999) be withdrawn. This request is being made because we believe that the overall economic impact of this rule on the regulated community as proposed will exceed $100MM - an amount that exceeds the trigger for a cost-benefit analysis under the Unfunded Mandates Reform Act of 1995.

Review of the background documents indicates that the potential impact of this rule on <u>a facility having impoundments</u> in the wastewater treatment train was not considered. As written, the rule would subject impoundments receiving proposed wastewater K173 to the Minimum Technology Requirements of RCRA. The rule would thus require the closure of 4 acres of impoundments at Shell facilities alone and their replacement with tanks. The cost for closure and replacement tanks for Shell will be in excess of $50MM. We believe that similar closures and tank installations will be required for other companies in the petroleum and petrochemical industries.

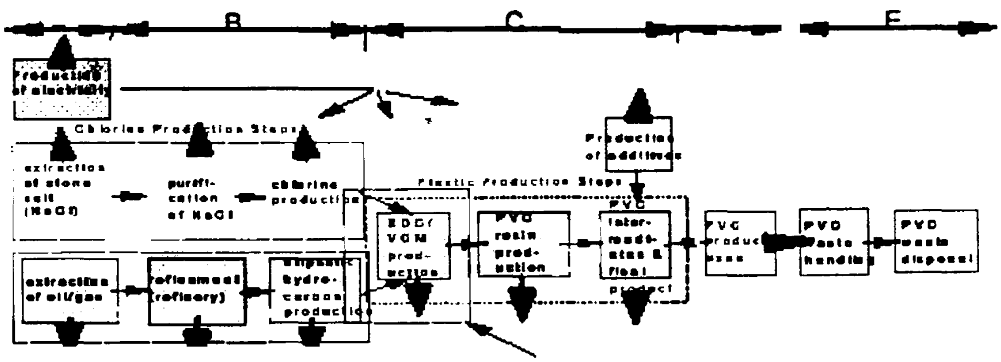
We appreciate your consideration of this request and believe the withdrawal will allow for the necessary reconsideration of the economic impact of the proposed rule.

39
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston, TX)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

Further clarification of what is meant by the “production of chlorinated aliphatic hydrocarbons” is set out in The Economic Background Document in Exhibit 13 and 14 on page 35.

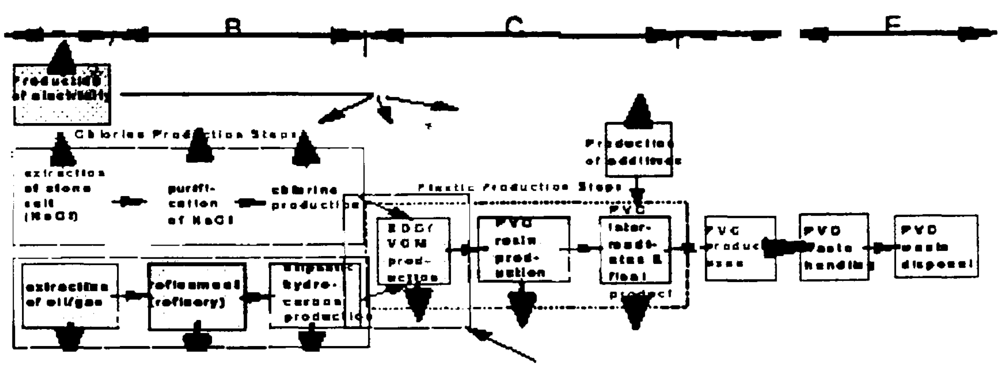
As shown in Exhibit 13 the plastic “process” from which the “listing proposal” waste is generated is the process where chlorine is added to the aliphatic hydrocarbon - the EDC/VCM production unit. Waste from the other plastic production units which include the PVC resin production unit and the PVC intermediates and final production unit are not included in the proposed listing.

EXHIBIT 13
Industrial Ecology Life Cycle Depiction of CAHC-Based Plastics Manufacturing



As shown in Exhibit 14 the solvent “process” from which the “listing proposal” waste is generated is also the process where chlorine is added to the aliphatic hydrocarbon - the apply-named Chlorination of hydrocarbons production unit. Waste from the other solvent production units which include the solvent recycling units are not included in the proposed listing.

EXHIBIT 14
Industrial Ecology Life Cycle Depiction of CAHC Solvent Manufacturing



40
DCN CALP-00011
COMMENTER Shell Chemical Company (Houston, TX)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS

EPA estimates this rule will cost $3 million per year. EPA also estimates the population risk controlled by this rule will amount to 0.0002 potential cancers per year. Thus, the proposed rule will cost $15 billion per potential cancer prevented. We believe that this is an excessive amount exceeding any previous waste listing decision not currently in litigation.

Notes:

1. We understand that the cost of the recent refinery listings was $670 billion /cancer and is in litigation.
2. We believe the actual costs of this rule are at least 10 times higher and the potential cancer risk is at least 10 times smaller -- putting the real cost of this rule at $1.5 trillion per potential cancer case prevented. (See

additional discussion in sections 1, 2 & 7 of Shell's comments.)

3. The Travis report indicates that most agencies implement controls up to $2 million/cancer.
4. EPA used a value of $4.8 million per life as the upper range estimates for its rule setting ambient air standards for ozone and particulate matter.
5. Other Agency values for a life-year have varied. FDA used a value of $8.2 million ($116,500 per life-year x 70) for its tobacco rule and $25.7 million ($368,000 per life-year x 70) in its mammography rule.

41
DCN CALP-00012
COMMENTER Dow Chemical Company (Midland, MI)
SUBJECT ECON
SCOPE K173

The recordkeeping burden for exemption from the Subpart CC requirements should be reduced, and a longer time period for compliance with these requirements should be given.

42
DCN CALP-00012
COMMENTER Dow Chemical Company (Midland, MI)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

The Economics Background Document says, "the current listing proposal only addresses the non-listed waste streams in the F024 listing," page 2. Additionally, Section V. D. (page 51) of the Economics Background Document evaluates the potential costs imposed by this proposal, saying:

> These costs are incremental in the sense that all 23 CAHC manufacturing facilities are currently regulated under RCRA (i.e. as chlorinated aliphatic manufacturers via the existing RCRA F025 & F026 wastecodes)

Note: It is assumed that EPA intended this note to state "F024 & F025 wastecodes," as F026 does not pertain to chlorinated aliphatic wastes.

Thus, EPA has neither evaluation nor consideration of any imposed costs for any scope increase beyond those of F024 and F025 processes. To avoid promulgating a rule with unconsidered costs, EPA needs to limit the scope of this rule to that of processes already regulated by F024 and F025.

43
DCN CALP-00012
COMMENTER Dow Chemical Company (Midland, MI)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

The cost estimate is similarly flawed. One can not estimate costs for matters which one did not even consider. There is no evidence in the economic analysis that any such consideration was made. There is no evidence of the fraction of these wastes which will have new obligations to meet. There is no evidence of what additional treatment will be needed. There is no evidence that the cost of this additional treatment produces any, let alone sufficient benefits to justify the imposition of these legal requirements.

44
DCN CALP-00013
COMMENTER Occidental Chemical Corp (OxyChem)
SUBJECT ECON
SCOPE OVERALL COST

OxyChem and OxyVinyls believe the Agency has severely underestimated the cost of compliance with this proposal, and urge the Agency to withdraw the proposal pending a more complete and accurate cost evaluation, as required by current Executive Order 12866. By conservative estimate, we could be expected to spend in excess of $24 million achieving compliance with the requirements of this proposal at four facilities for an average of $6 million per facility. Using the EPA's own estimate that 23 facilities will be impacted by this proposal, this gives a total cost of compliance as a minimum of $138 million, well in excess of the Executive Order's $100 million review requirement.

45
DCN CALP-00013
COMMENTER Occidental Chemical Corp (OxyChem)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS

We also believe that the RCRA goal of protecting human health and the environment from risks associated with hazardous waste is an important goal. While we understand that balancing this goal within the confines of monetary considerations is not required by RCRA, we do, however, believe Congress, the Administration and the American people expect EPA to insure that the public is not done an injustice by programs that consume excessive amounts of money to protect against non-substantial risk. OxyChem and OxyVinyls believe the proposed listing of K173 falls outside any reasonable return on risk reduced compared to cost expended. EPA estimates this rule will cost $3 million per year. EPA also estimates the population risk controlled by this rule will result in 0.0002 cancers per year. Using EPA's own figures, this rule will cost $15 billion per cancer prevented. OxyChem and OxyVinyls believe this is an amount that simply cannot be justified and urge the Agency to withdraw the proposed rule and not list as hazardous any of the wastes.

46
DCN CALP-00013
COMMENTER Occidental Chemical Corp (OxyChem)
SUBJECT ECON
SCOPE K173

The proposal reflects an overly simplistic view of what the rule would mean in terms of retrofitting tanks, while adding layers of complication and thus compounding what would already be a significant engineering task. We have performed assessments of the cost associated with covering and controlling tanks in our biological treatment plant, even though it is likely that newly constructed, dedicated systems would be installed in lieu of retrofit (at a significantly greater initial capital expense).

Biological treatment systems at EDC/VCM manufacturing sites rely on aeration and mixing of wastewater to obtain proper treatment of the constituents of concern. Unlike tanks used for storage of materials, tanks used for biological treatment are often equipped with various pieces of equipment that facilitate the desired treatment (e.g., clarifiers). If it were simply a matter of covering/controlling storage tanks (i.e., without any equipment concerns) the required action would amount to tank retrofit and the addition of piping, albeit at significant cost due to the size of the tanks involved. However, with biological treatment tanks there are many considerations over and above tank retrofit, which render re-design efforts considerably more difficult. There is the question of how equipment repairs will be effected. The re-design must allow for safe access as personnel would now be required to enter a confined space for routine maintenance of treatment plant equipment. This would present new hazards and would require additional monitoring to ensure against an unsafe work environment during maintenance and repair activities. Personnel would no longer be able to perform even the simplest of maintenance or repair tasks without significant effort.

47
DCN CALP-00013
COMMENTER Occidental Chemical Corp (OxyChem)
SUBJECT ECON
SCOPE K173

OxyChem and OxyVinyls did not find within EPA's economic cost analysis any indication of the time and effort necessary to obtain and operate under an air permit for these newly regulated emission sources being considered. This effort can be substantial under the Clean Air Act's Federal Title V Air Permit Program. It has been our experience that receiving a State Air Operating Permit can take between 8 and 18 months. Amending a Title V Air Operating Permit may take even longer. EPA's cost analysis also did take into account the cost to comply with RCRA Subpart CC's inspection, monitoring, recordkeeping and reporting requirements (see Exhibit D-6 of the Economics Background Document).

48
DCN CALP-00013
COMMENTER Occidental Chemical Corp (OxyChem)
SUBJECT ECON
SCOPE K173

Finally, it was not apparent whether EPA considered the cost to conduct performance testing on the control devices. This effort can cost between $150,000 to more than $300,000 per control device. These costs are simply the costs associated with having a third party conduct the test and develop results -they do not account for the cost of :

– operating the process at the required operating rate to indicate performance at a maximum production rate;
– environmental personnel to coordinate testing, escort third party testing personnel, review testing protocols, etc.; and results; and,
– purchasing and contracting personnel efforts.

Taking these additional efforts into account adds to the cost to demonstrate that the control device is operating as required by the RCRA Subpart CC standard.

49
DCN CALP-00016
COMMENTER Equiva Services LLC (Houston, TX)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS
As society is not blessed with unlimited resources, those resources must be effectively used to manage those risks that are clearly "substantial". EPA's own numbers show that the potential cost per theoretical cancer case avoided for this proposed rule is around $15 billion. Both Shell Chemical Company and CMA are citing other regulatory decisions showing this avoidance cost to be significantly above most other decisions to regulate.

50
DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE OVERALL COST-EFFECTIVENESS
Finally, EPA estimates the cost of complying with this rule at $38.6 million, resulting in expenditures equivalent to greater than $15 billion per cancer death avoided. CMA's estimate places the cost of regulation much higher ? $108 million or expenditures approaching $ 1 trillion per cancer death avoided. Please note that we have attached the cost analysis developed by CMA's Policy, Economics and Risk Assessment Team.

51
DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK
Critique of Economic Analysis:
The CMA Waste Team asked PERA to review and critique EPA's economic analysis for the proposed rule on chlorinated aliphatic compounds. The proposal would list certain chlorinated aliphatic production wastes as hazardous and subject to RCRA requirements. PERA reviewed the *Economics Background Document* and identified flaws in EPA's analysis that have the effect of understating the potential cost of the proposed rule. Whereas EPA estimated the present value cost of the rule to be as high as $38.6 million (Exhibit E-5, Scenario 2, 7% discount rate), PERA's changes to the EPA estimate raise the present value cost to at least $108 million. Other concerns have been identified that, if corrected, would raise the overall cost of the rule significantly.

52
DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK
EPA Methodology:
EPA based its analysis on a universe of 23 facilities that produce chlorinated aliphatic compounds. From a survey of these facilities on waste practices, EPA determined how many of thee facilities would be impacted by various components of the proposed rule, and how these impacted facilities would choose to comply with the rule. EPA used cost engineering techniques to estimate the capital and operation and maintenance costs of the rule. EPA then estimated the present value of the rule under future waste generation scenarios.

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE INDUSTRY CHARACTERIZATION
Problems with EPA's Methodology:
In the section of the economic analysis describing the regulated industry, EPA underestimated production of chlorinated aliphatic compounds (Exhibit 7). Published production data (Mannsville Chemical Products, *Chemical Products Synopsis*) for seven chlorinated aliphatic compounds shows that production is at least 39% greater than that estimated by the Agency, and sales revenue is at least 21% higher than EPA's estimate. See Table 1.

Table 1. U.S. Production of Selected Chlorinated Aliphatic Compounds.

Chemical	*Production (millions of pounds)*	*Average Year-End Price ($/lb.)*	*Sales Value ($)*
Ethylene dichloride	27,091	0.07	1,896,370,000

Methylene chloride	287	0.28	80,360,000
Chloroform	758	0.23	174,340,000
Perchloroethylene	347	0.27	93,690,000
Vinyl chloride*	15,875	0.22	3,492,500,000
Trichloroethylene	240	0.55	132,000,000
Methyl chloride**	1,060	0.30	318,000,000

Source: Mannsville Chemical Products, *Chemical Products Synopsis*.
Note: Unless otherwise noted, data reflect 1998 values.
*Data reflect 1997 values. **Data reflect 1996 values.

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE INDUSTRY CHARACTERIZATION

EPA underestimated the number of facilities that produce chlorinated aliphatic compounds. EPA estimated that 23 facilities would be covered by the proposed rule. Published data (SRI International, *1998 Directory of Chemical Producers: United States of America*) shows at least 38 facilities that produce one or more chlorinated aliphatic compounds as of spring 1998. See Table 2.

Table 2. U.S. Producers of Selected Chlorinated Aliphatic Compounds.

Company	*Facility Location*	*Chlorinated Aliphatic Compounds Produced On-Site*
Akzo Nobel	Gallipolis Ferry, WV	n-butyl chloride
Albemarle	Magnolia, AK	Bromochloromethane
Albright & Wilson	Charleston, SC	n-butyl chloride
Allied Signal	Baton Rouge	chlorodifluoromethane, trichlorotrifluoroeethane
	El Segundo, CA	1-chloro-1,1-difluoroethane, chlorodifluoromethane, 1,1,-dichloro-1-fluoroethane
ASHTA	Ashtabula, OH	Chloropicrin
Ausimont	Thoroughfare, NJ	1-chloro-1,1-difluoroethane
Borden	Geismar, LA	ethylene dichloride
Condea Vista	Lake Charles, LA	vinyl chloride, ethylene dichloride
Dow	Freeport, TX	trichloroethylene, ethylene dichloride, chloroform, methyl chloride, 3-chloropropene, ethyl chloride, vinyl trichloride, 1,3-dichloropropene, 1,2,3-trichloropropane, vinylidene chloride
	Oyster Creek,	vinyl chloride, ethylene dichloride
	Plaquemine, LA	vinyl chloride, ethylene dichloride, methylene chloride, chloroform, perchloroethylene, methyl chloride
Dow Corning	Carollton	methyl chloride
	Midland, MI	methyl chloride
DuPont	Louisville, KY	Chlorodifluoromethane
Elf Atochem	Wichita, KA	Chlorodifluoromethane
	Calvert City, KY	1-chloro-1,1-difluoroethane, 1,1,-dichloro-1-fluoroethane
Formosa	Baton Rouge, LA	vinyl chloride, ethylene dichloride
	Point Comfort	vinyl chloride, ethylene dichloride
GE Plastics	Waterford	methyl chloride
Geon	LaPorte	vinyl chloride, ethylene dichloride
Georgia Gulf	Plaquemine, LA	vinyl chloride, ethylene dichloride
Great Lakes Chemical	El Dorado, AK	Chlorotrifluoromethane
Halocarbon Products	North Augusta, SC	2-bromo-2-chloro-1,1,1-trifluoroethane
Holtrachem	Orrington, ME	Chloropicrin
LaRoche Industries	Gramercy, LA	1,1,-dichloro-1-fluoroethane
Niklor	Long Beach, CA	Chloropicrin

Oxychem	Convent	ethylene dichloride
	Corpus Christi,TX	ethylene dichloride
Oxychem	Deer Park, TX	vinyl chloride, ethylene dichloride
Oxymar	Ingleside	vinyl chloride, ethylene dichloride
PCR	Gainesville, FL	Chlorodifluoroethylene
PPG	Lake Charles, LA	vinyl chloride, trichloroethylene, ethylene dichloride, perchloroethylene, ethyl chloride, methyl chloroform, vinylidene chloride
Shell	Norco, LA	3-chloropropene
	Deer Park, TX	1,2,3-trichloropropane
Trinity Manufacturing	Hamlet, NC	Chloropicrin
Vulcan	Geismar,	ethylene dichloride, methylene chloride, chloroform, perchloroethylene, methyl chloride, carbon tetrachloride, methyl chloroform,
	Wichita, KA	ethylene dichloride, methylene chloride, chloroform, methyl chloride, carbon tetrachloride
Westlake	Calvert City, KY	vinyl chloride, ethylene dichloride
Source: SRI International, *1998 Directory of Chemical Producers: United States of America*. Note: The number of chemical producers may be greater than 38. This table only includes those chemical producers identified for the chemicals listed in the third column and included in the 1998 SRI directory.		

By missing several facilities, EPA runs the risk of misrepresenting how these facilities might comply with the rule. Some of these facilities may comply in ways not envisioned by EPA's analysis. For example, in order to comply with the rule, the Shell Deer Park facility would have to close several impoundments and install tanks. The cost for this one facility is greater than that for any facility identified by EPA in their analysis, which assumes that no facility will have to switch from impoundments to tanks. EPA should ensure that it has identified the universe of facilities affected by their proposal and survey each facility to ensure that it understands how facilities would comply.

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE INDUSTRY CHARACTERIZATION
EPA underestimated the historical production growth rate. Even though EPA states that chlorinated aliphatic production is driven by PVC demand (page 23), EPA does not use historical PVC production as a surrogate for future chlorinated aliphatic production. Instead, EPA assumed chlorinated aliphatic production would grow at the same rate as U.S. manufacturing output (1.5% per year). PERA took published data on production of PVC (Mannsville Chemical Products, *Chemical Products Synopsis*), ran a regression of the natural logarithm of production as a function of time, and concluded that the average annual growth rate for PVC production is 5.4%. See Table 3. The regression results are presented in Table 4. (The estimate of 5.4% is very similar to EPA's own estimate of 5.2% for global PVC growth, shown in Exhibit 5.)

Table 3. U.S. Production of Polyvinyl Chloride.

Year	*U.S. Production (millions of pounds)*
1975	3,695
1980	5,485
1985	6,668
1988	8,588
1990	9,363
1993	10,257
1994	10,607
1995	10,975
1996	12,100
1997	12,980
Source: Mannsville Chemical Products, *Chemical Products Synopsis*.	

Table 4. Regression Results for the Natural Log of Production as a Function of Time.			
Parameter	*Value*	*Lower 95%*	*Upper 95%*
y-intercept	8.232589	8.140849	8.324329
coefficient, *x*-variable	0.053509	0.04805	0.058967
R^2	0.984588	NA	NA
Adjusted R^2	0.982661	NA	NA
Note: Multiplying the coefficient for the x variable by 100 provides an estimate of the annual growth rate of PVC production. The 95% confidence interval for this value is between 4.8% and 5.9%.			

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK
EPA overestimated equipment life. EPA used 30 years (page 55). They should have used 20 years because that is the expected lifetime of the equipment. (Experts in cost engineering recommend using the expected equipment lifetime to amortize the cost of pollution control equipment, rather than the depreciation schedule allowed by the IRS.)

EPA based its equipment costs on relatively old (pre-1991) data (see note a in Exhibits D-4 and D-5). The Agency should survey vendors of tanks to determine the current market price of such tanks. Absent such a survey of vendors, the Agency should employ publicly available indices to extrapolate the purchase price of pre-1991 pollution control equipment to the present.

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE K173
Apparently, EPA's analysis is based on the presumption that, as a result of compliance with the wastewater provisions, spent carbon is not a RCRA waste (see note e, Exhibit D-5). If it were a RCRA hazardous waste, the operations and maintenance (O&M) cost would be more than that specified in the analysis. The Agency should clarify in the rule that such waste is not a RCRA hazardous waste. If the Agency believes the spent carbon to be RCRA hazardous, or if it has not yet made a determination, then the economic analysis should assume that the spent carbon is a RCRA hazardous waste, and EPA should include the additional cost in its O&M cost estimate.

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DCN CALP-00019
COMMENTER Chemical Manufacturers Association (Arlington, VA)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK
Revised Cost Estimate:

PERA re-estimated the potential cost of the rule by replacing some, but not all, of EPA's data/assumptions with more accurate and representative data/assumptions. Specifically, PERA assumed 38 facilities would be covered by the rule, a 5.4 % growth rate for future production, and an equipment life of 20 years. These changes alone raise EPA's "annual average equivalent" estimate from $3.109 million (Exhibit E-5, Scenario 2, 7% discount rate) to $7.673 million (7% discount rate). The present value of the total cost to regulated entities is $38.6 million in EPA's analysis (Exhibit E-5); PERA estimates the cost to be at least $108 million. EPA's total cost estimate (derived from Exhibit E-5, Scenario 2, 7% discount rate) is $95 million; the changes noted previously raise the total cost to $252 million. To generate a more accurate cost estimate, EPA should factor in the compliance cost for the Shell Deer Park facility and any other entity not represented by the facilities included in EPA's analysis. It is possible that the estimated cost in the first year of implementation would exceed $100 million, and therefore trigger analyses required by the Unfunded Mandates Reform Act.

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DCN CALP-00020
COMMENTER Vulcan Chemicals (Birmingham, AL)
SUBJECT ECON
SCOPE K173

First, removal of the exemption to manage dilute wastewaters from rulemaking under the Clean Water Act is unreasonable, and based upon unsound scientific fact. Repealing such an exemption, based upon an overestimated risk modeling scenario (e.g. CHEMDAT8), creates undue materials management and cost requirements on the chlorinated solvent industry. This is especially true when considering the Subpart CC implications that this rule, if passed in its current form, will require.

Furthermore, models such as CHEMDAT8, using unrealistic predictions of constants derived from equations such as Henry's Law, overestimates dioxin emissions from dilute wastewaters and should not require the chlorinated solvent industry to incur large capital expense to install Subpart CC controls.

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DCN CALP-00020
COMMENTER Vulcan Chemicals (Birmingham, AL)
SUBJECT ECON
SCOPE K173

Second, it is Vulcan's opinion that EPA has improperly concluded from a simple economic assessment, that implementation of these rules will cost the industry less than $100MM per year, annualized. EPA has failed to recognize many of the costs associated with Subpart CC controls, such as covering and piping wastewater storage tanks, closing surface impoundments and sumps, etc., will cost the combined, affected industries above $100MM, and thus, warrants an economic impact study by the Office of Management & Budget (OMB).

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DCN CALP-00020
COMMENTER Vulcan Chemicals (Birmingham, AL)
SUBJECT ECON
SCOPE ECONOMIC ANALYSIS FRAMEWORK

Fourth, Vulcan questions the statutory authority of the EPA to add five congeners into the existing requirements for universal treatment standards (UTS) and land disposal restrictions (LDR). EPA has a statutory requirement to consider the potential need for national capacity variances before adopting new or changed LDR rules. It has a constitutional requirement to consider the impact of new regulatory requirements before they are enacted. Vulcan does not believe that the due process requirements have been met in regards to this proposed rulemaking with respect to UTS and LDR. Based upon a review of the proposed regulations, it does not appear that the EPA has determined, what fraction of the hazardous wastes required to meet these new requirements will fail; the appropriate means of treatment (if any); and if there is sufficient national capacity to meet the newly imposed treatment burden.

APPENDIX B:

FIVE ALTERNATIVE LISTS
OF COMPANIES
WHICH MANUFACTURE CAHCs IN THE US

Company List #1 of 5: CAHC Manufacturers in the US (1994 USITC Database)		
Item	Company Name	Office Location*
1	Albright & Wilson, Americas, Inc.	Charleston SC
2	Allied Signal Inc. (Engineered Materials Sector)	Morristown NJ
3	Ausimont USA Inc.	Morristown NJ
4	BF Goodrich Company	Cleveland OH
5	Borden Chemical & Plastics Delaware Limited Partnership	Geismar LA
6	Dover Chemical Corp. (subsidiary of ICC Industries, Inc.)	Dover OH
7	Dow Chemical Company	Midland MI
8	Dow Corning Company	Midland MI
9	E.I. DuPont de Nemours & Co. Inc. (Chemicals & Pigments)	Wilmington DE
10	Elf Atochem North America Inc.	Philadelphia PA
11	Ferro Corp. (Keil Chemical Division)	Hammond IN
12	Formosa Plastics Corp. (Louisiana)	Baton Rouge LA
13	General Electric Company (Silicone Products Division)	Waterford NY
14	Geon Co.	Avon Lake OH
15	Georgia Gulf Corp. (Plaquemine Division)	Atlanta GA
16	Great Lakes Chemical Corp.	Lafayette IN
17	Holtrachem Mfg LLC	Orrington ME
18	LaRoche Industry Inc.	Baton Rouge LA
19	Niklor Chemical Co. Inc.	Long Beach CA
20	Occidental Chemical Corp. (Chemical Group)	Dallas TX
21	Occidental Chemical Corp. (Oxy Petrochemicals Inc.)	Dallas TX
22	Occidental Chemical Corp. (Polymers & Plastics Group)	Dallas TX
23	OxyMar	Ingleside TX
24	PPG Industries, Inc.	Pittsburgh PA
25	Shell Oil Company (Shell Chemical Company)	Houston TX
26	Vista Chemical Company	Houston TX
27	Vulcan Materials Company (Chemicals Division)	Birmingham AL
28	Westlake Corp.	Houston TX
29	Witco Corp.	Woodcliff Lake NJ

Explanatory Notes:
(a) Source: US International Trade Commission, 1994 Synthetic Organic Chemicals annual report, 1995
(http://www.usitc.gov:80/wais/reports/arc/W2933.HTM).
(b) *The company office location shown above may not coincide with CAHC manufacturing facility locations.

Company List #2 of 5 CAHC Manufacturers in the US (USEPA BRS 1995 Database)				
Item	Company Name	City	State	USEPA ID Number
1	BASF Corp	Wyandotte	MI	MID064197742
2	Bayer Corp	Houston	TX	TXD084972777
3	BF Goodrich	Calvert City	KY	KYD006370167
4	Borden Chemical & Plastics	Geismar	LA	LAD003913449
5	Dow Chemical	Freeport	TX	TXD008092793
6	Dow Chemical	Plaquemine	LA	LAD008187080
7	E.I. DuPont	Orange	TX	TXD008079642
8	E.I. DuPont	Victoria (#1)	TX	TXR000001016
9	E.I. DuPont	Victoria (#2)	TX	TXD008123317
10	Exxon Chemical	Houston	TX	TXD082684002
11	Formosa Plastics	Baton Rouge	LA	LAD041224932
12	Formosa Plastics	Point Comfort	TX	TXT490011293
13	Geon Company	Avon Lake	OH	OHD987053949
14	Geon Company	LaPorte	TX	TXD070133319
15	Georgia Gulf Corp	Plaquemine	LA	LAD057117434
16	Gibraltar Chem Resources	Tyler	TX	TXD000742304
17	Occidental Chemical	Belle	WV	WVD005010277
18	Occidental Chemical	Convent	LA	LAD098168206
19	Occidental Chemical	Deer Park	TX	TXD981911209
20	Occidental Chemical	Gregory	TX	TXD982286932
21	PPG Industries	Westlake	LA	LAD008086506
22	Shell Chemical	Norco	LA	LAD980622104
23	Vista Chemical	Westlake	LA	LAD086478047
24	Vulcan Chemicals	Geismar	LA	LAD092681824
25	Vulcan Chemicals	Wichita	KS	KSD007482029
26	Westlake Monomers	Calvert City	KY	KYD985072008

Company List #3 of 5 CAHC Manufacturers in the US (USEPA-OSW 1997 Mail Survey Findings)					
Facility Count	Company Count	Company Name	Facility Location		CAHC Products Manufactured
			City	State	
1	1	Borden Chemicals	Geismar	LA	VCM
2	2	Condea Vista	Westlake	LA	EDC/VCM
3	3	Dow Chemical	Freeport	TX	Mixed CAHCs
4		Dow Chemical	Plaquemine	LA	EDC/VCM
5	4	Dow Corning	Carrollton	KY	Methyl Chloride
6		Dow Corning	Midland	MI	Methyl Chloride
7	5	DuPont-Dow	LaPlace	LA	Chloroprene
8		DuPont-Dow	Louisville	KY	CBI
9	6	Formosa	Baton Rouge	LA	EDC/VCM
10		Formosa	Point Comfort	TX	EDC/VCM
11	7	FMC	Baltimore	MD	Methallyl Chloride
12	8	General Electric	Waterford	NY	Methyl Chloride
13	9	Geon	LaPorte	TX	EDC/VCM
14	10	Georgia Gulf	Plaquemine	LA	EDC/VCM
15	11	Occidental Chem Co.	Convent	LA	EDC
16		Occidental Chem Co.	Deer Park	TX	EDC/VCM
17		Occidental Chem Co. (OxyMar)	Ingleside (Gregory)	TX	EDC/VCM
18	12	PPG Industries	Lake Charles	LA	Mixed CAHCs
19	13	Shell Chemical	Norco	LA	Allyl chloride
20	14	Velsicol Chem. Corp	Memphis	TN	EDC/VCM
21	15	Vulcan Chemicals	Geismar	LA	Mixed CAHCs
22		Vulcan Chemicals	Wichita	KS	Mixed CAHCs
23	16	Westlake Monomers	Calvert City	KY	EDC/VCM

Explanatory Notes:
(a) Source: Findings from 1992 and 1997 USEPA-OSW mail surveys (RCRA Section 3007 authority) targeted at chemical companies suspected of producing CAHCs, identified from assorted research information and industry contacts.
(b) Company name shown may represent subsidiary (affiliate), not parent company name.
(c) EDC= ethylene chloride; VCM= vinyl chloride monomer; CBI= confidential business information claimed by company in USEPA RCRA Section 3007 survey.

Company List #4 of 5
CAHC Manufacturers in the US (Source: 1997 "ChemExpo Chemical Profiles")

Facility Count	Company Name	CAHC Mfg. Facility Location		Annual CAHC Production Capacity		Imputed* Annual Production (mill.lbs)	Imputed Market Value** (mill $)
		City	State	Type of CAHC	Quantity (mill.lbs)		
1	Borden	Geismar	LA	Ethylene Dichloride	745	574	$97.5
				Vinyl Chloride	950	826	$180.2
2	Condea Vista	Lake Charles	LA	Ethylene Dichloride	1,400	1,078	$183.3
				Vinyl Chloride	850	740	$161.2
3	Dow	Freeport	TX	Chloroform	200	144	$56.9
				Ethylene Dichloride	4,500	3,465	$589.0
				Methyl Chloride	55	47	$18.0
				Methylene Chloride	125	95	$40.8
				Trichloroethylene	120	71	$46.0
				Vinyl Chloride	2,200	1,914	$417.2
4		Plaquemine	LA	Chloroform	200	144	$56.9
				Ethylene Dichloride	2,300	1,771	$301.1
				Methyl Chloride	175	149	$57.3
				Methylene Chloride	125	95	$40.8
				Perchloroethylene	90	74	$24.7
				Vinyl Chloride	1,500	1,305	$284.5
5	Dow Corning	Carrolton	KY	Methyl chloride	250	212	$81.8
6		Midland	MI	Methyl chloride	50	42	$16.4
7	Formosa	Baton Rouge	LA	Ethylene Dichloride	525	404	$68.7
				Methyl Chloride	1,455	1,237	$476.1
8		Point Comfort	TX	Ethylene Dichloride	1,900	1,463	$248.7
				Methyl Chloride	875	744	$286.3
9	Geon	LaPorte	TX	Ethylene Dichloride	4,000	3,080	$523.6
				Vinyl Chloride	1,650	1,435	$312.9
10	Georgia Gulf	Plaquemine	LA	Ethylene Dichloride	1,760	1,355	$230.4
				Methyl Chloride	1,600	1,360	$523.6
11	GE Plastics	Waterford	NY	Methyl chloride	100	85	$32.7
12	OxyChem	Convent	LA	Ethylene Dichloride	1,500	1,155	$196.4
13		Deer Park	TX	Ethylene Dichloride	1,950	1,501	$255.3
				Vinyl Chloride	1,100	957	$208.6
14		Ingleside	TX	Ethylene Dichloride	1,500	1,155	$196.4
15	OxyMar	Ingleside	TX	Ethylene Dichloride	3,000	2,310	$392.7
				Vinyl Chloride	2,100	1,827	$398.3
16	PHH Monomers	Lake Charles	LA	Ethylene Dichloride	1,400	1,078	$183.3
				Vinyl Chloride	1,150	1,000	$218.1
17	PPG	Lake Charles	LA	Ethylene Dichloride	1,600	1,232	$209.4
				Perchloroethylene	125	102.5	$34.3

				Trichloroethylene	200	118	$76.7
18	Vulcan	Geismar	LA	Chloroform	160	115.2	$45.5
				Ethylene Dichloride	500	385	$65.4
				Methyl chloride	90	76.5	$29.5
				Methylene Chloride	80	60.8	$26.1
				Perchloroethylene	140	114.8	$38.5
19		Witchita	KS	Chloroform	160	115.2	$45.5
				Methyl chloride	70	60	$22.9
				Methylene Chloride	100	76	$32.7
20	Westlake	Calvert City	KY	Ethylene Dichloride	1,950	1,502	$255.3
				Vinyl Chloride	1,200	1,044	$227.6
Column Totals =					49,775	40,095	$7,989
Overall Average Capacity Utilization Rate =						81%	

Explanatory Notes:
(a) Source: Nov 1997 to Feb 1998 "ChemExpo Chemical Profiles", http://www.chemexpo.com/news/ . This source does not provide company and facility locations for other miscellaneous types of CAHCs produced in the US during the 1990s.
(b) * USEPA-OSW-EMRAD imputed capacity values using "ChemExpo" 1997 US demand ratios for each CAHC (see table in text).
(c) ** USEPA-OSW-EMRAD imputed market values using "ChemExpo" current (1997/98) US average prices for each CAHC (see table in text). Not all CAHCs manufactured in the US are sold in the chemical products market; some facilities use CAHCs (e.g. vinyl chloride & ethylene dichloride) captively as process intermediates for the manufacture of other types of chemical products (e.g. polyvinyl chloride).

Company List #5 OF 5
(Source: 23 Nov 1999 CMA Comments to RCRA Docket on 1999 Listing Proposal)

Facility Count	Company Name	CAHC Facility Location		Type of CAHCs Produced On-Site
		City	State	
1	Akzo Nobel	Gallipolis Ferry	WV	n-butyl chloride
2	Albright & Wilson	Charleston	SC	n-butyl chloride
3	Borden	Geismar	LA	ethylene dichloride
4	Condea Vista	Lake Charles	LA	vinyl chloride, ethylene dichloride
5	Dow	Freeport	TX	trichloroethylene, ethylene dichloride, chloroform, methyl chloride, 3-chloropropene, ethyl chloride, vinyl trichloride, 1,3-dichloropropene, 1,2,3-trichloropropane, vinylidene chloride
6		Oyster Creek	TX	vinyl chloride, ethylene dichloride
7		Plaquemine	LA	vinyl chloride, ethylene dichloride, methylene chloride, chloroform, perchloroethylene, methyl chloride
8	Dow Corning	Carollton	KY	methyl chloride
9		Midland	MI	methyl chloride
10	Formosa	Baton Rouge	LA	vinyl chloride, ethylene dichloride
11		Point Comfort	TX	vinyl chloride, ethylene dichloride
12	GE Plastics	Waterford	NY	methyl chloride
13	Geon	LaPorte	TX	vinyl chloride, ethylene dichloride
14	Georgia Gulf	Plaquemine	LA	vinyl chloride, ethylene dichloride
15	Oxychem	Convent	LA	ethylene dichloride
16		Corpus Christl	TX	ethylene dichloride
17		Deer Park	TX	vinyl chloride, ethylene dichloride
18	Oxymar	Ingleside	TX	vinyl chloride, ethylene dichloride
19	PPG	Lake Charles	LA	vinyl chloride, trichloroethylene, ethylene dichloride, perchloroethylene, ethyl chloride, methyl chloroform, vinylidene chloride
20	Shell	Norco	LA	3-chloropropene
21		Deer Park	TX	1,2,3-trichloropropane
22	Vulcan	Geismar	LA	ethylene dichloride, methylene chloride, chloroform, perchloroethylene, methyl chloride, carbon tetrachloride, methyl chloroform,
23		Wichita	KS	ethylene dichloride, methylene chloride, chloroform, methyl chloride, carbon tetrachloride
24	Westlake	Calvert City	KY	vinyl chloride, ethylene dichloride

Note: This table excludes 15 of the 39 facilities identified in CMA's "Table 2" of its 23 Nov 1999 comment to the RCRA Docket; the 15 facilities excluded manufacture other types of chlorinated aliphatic chemicals (e.g. containing other halogens in addition to chlorine) which are not included in the scope of the RCRA 1999 proposed or 2000 final listing rule.

ATTACHMENT C:

QUANTITIES OF THREE CLASSES OF CHLORINATED ALIPHATIC CHEMICALS AS CONSTITUENTS IN US INDUSTRIAL WASTES

EXHIBIT C-1

CAHCs Reported in USEPA's Toxic Release Inventory Database (1995 & 1996) as Constituents in Industrial Wastes Generated by Facilities in SIC codes 20-39								
Sub rank	Notations				CAHC subclass (1,2,3)	CAS number	Chemical Abstracts or IUPAC Name*	Common or Trade Name(s)
A. Chlorinated Only (subclass=1):								
1					1	107-05-1	3-Chloro-1-propane	Allyl chloride
2	Carc				1	56-23-5	Tetrachloromethane	Carbon tetrachloride
3					1	75-00-3	Chloroethane	Ethyl chloride
4	Carc				1	67-66-3	Trichloromethane	Chloroform
5					1	74-87-3	Chloromethane	Methyl chloride
6	Carc				1	563-47-3	3-Chloro-2-methyl-1-propene	
7		++			1	126-99-8	2-Chloro-1,3-butadiene	Chloroprene
8		++			1	764-41-0	1,4-Dichloro-2-butene	Dichlorobutene
9		++	+95		1	110-57-6	trans-1,4-Dichloro-2-butene	trans-Dichlorobutene
10	Carc				1	107-06-2	1,2-Dichloroethane	Ethylene dichloride (or EDC)
11					1	540-59-0	1,2-Dichloroethylene	
12	Carc				1	75-09-2	Dichloromethane	Methylene dichloride***
13					1	78-87-5	1,2-Dichloropropane	Propylene dichloride
14	Carc		+95		1	10061-02-6	trans-1,3-Dichloropropene	
15					1	78-88-6	2,3-Dichloropropene	
16	Carc				1	542-75-6	1,3-Dichloropropylene	1,3-Dichloropropene (DCP or Telone II)
17					1	75-34-3	1,1-Dichloroethane	Ethylidene dichloride
18					1	87-68-3	Hexachloro-1,3-butadiene	Hexachlorobutadiene
19				-96	1	319-84-6	alpha-Hexachlorocyclohexane	
20		++			1	77-47-4	1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene	Hexachlorocyclopentadiene
21					1	67-72-1	Hexachloroethane	
22	Carc				1	58-89-9	1,2,3,4,5,6-Hexachlorocyclohexane	Lindane
23					1	76-01-7	Pentachloroethane	Pentalin
24			+95		1	—	Designation of multiple chemicals in same class	Polychlorinated alkanes
25					1	630-20-6	1,1,1,2-Tetrachloroethane	
26					1	79-34-5	1,1,2,2-Tetrachloroethane	
27	Carc				1	127-18-4	Tetrachloroethene	Tetrachloroethylene (Perchloroethylene or PERC)
28					1	71-55-6	1,1,1-Trichloroethane	Methylchloroform (MC or 1,1,1-TCE)
29					1	79-00-5	1,1,2-Trichloroethane	
30	Carc				1	79-01-6	1,1,2-Trichloroethene	Trichloroethylene or Trichloroethene (TCE)
31	Carc		+95		1	96-18-4	1,2,3-Trichloropropane	
32	Carc				1	75-01-4	Chloroethene	Vinyl chloride (or VCM)
33					1	75-35-4	1,1-Dichloroethene	Vinylidene chloride
B. Chlorinated Plus Other Halogens (subclass=2):								
1					2	353-59-3	Bromochlorodifluoromethane	Halon 1211
2					2	75-68-3	1-Chloro-1,1-difluoroethane	HCFC-142b
3					2	75-45-6	Chlorodifluoromethane	HCFC-22
4				-96	2	63938-10-3	Chlorotetrafluoroethane	
5					2	354-25-6	1-Chloro-1,1,2,2-tetrafluoroethane	HCFC-124a
6					2	2837-89-0	2-Chloro-1,1,1,2-tetrafluoroethane	HCFC-124
7			+95		2	75-88-7	2-Chloro-1,1,1-trifluoroethane	HCFC-133a
8			+95		2	75-72-9	Chlorotrifluoromethane	CFC-13
9				-96	2	460-35-5	3-Chloro-1,1,1,-trifluoropropane	HCFC-253fb
10	Carc			-96	2	96-12-8	1,2-Dibromo-3-chloropropane	DBCP
11					2	75-27-4	Dichlorobromomethane	
12			+95		2	1649-08-7	1,2-Dichloro-1,1-difluoroethane	HCFC-132b
13					2	75-71-8	Dichlorodifluoromethane	CFC-12
14					2	1717-00-6	1,1-Dichloro-1-fluoroethane	HCFC-141b
15			+95		2	75-43-4	Dichlorofluoromethane	HCFC-21
16				-96	2	127564-92-5	Dichloropentafluoropropane	
17				-96	2	13474-88-9	1,1-Dichloro-1,2,2,3,3-pentafluoropropane	HCFC-225cc
18				-96	2	111512-56-2	1,1-Dichloro-1,2,3,3,3-pentafluoropropane	HCFC-225eb
19				-96	2	422-44-6	1,1-Dichloro-1,1,2,3,3-pentafluoropropane	HCFC-225bb
20				-96	2	431-86-7	1,1-Dichloro-1,1,3,3,3-pentafluoropropane	HCFC-225da
21			+95		2	507-55-1	1,3-Dichloro-1,1,2,2,3-pentafluoropropane	HCFC-225cb
22				-96	2	136013-79-1	1,3-Dichloro-1,1,2,3,3-pentafluoropropane	HCFC-225ea
23				-96	2	128903-21-9	1,3-Dichloro-1,1,1,3,3-pentafluoropropane	HCFC-225aa
24				-96	2	422-48-0	1,3-Dichloro-1,1,1,2,3-pentafluoropropane	HCFC-225ba
25			+95		2	422-56-0	3,3-Dichloro-1,1,1,2,2-pentafluoropropane	HCFC-225ca
26					2	76-14-2	Dichlorotetrafluoroethane	CFC-114
27					2	34077-87-7	Dichlorotrifluoroethane	
28				-96	2	90454-18-5	Dichloro-1,1,2-trifluoroethane	
29				-96	2	812-04-4	1,1-Dichloro-1,2,2-trifluoroethane	HCFC-123b
30					2	354-23-4	1,2-Dichloro-1,1,2-trifluoroethane	HCFC-123a
31					2	306-83-2	2,2-Dichloro-1,1,1-trifluoroethane	HCFC-123
32					2	76-13-1	1,1,2-Trichlorotrifluoroethane	Freon 113
33					2	76-15-3	Monochloropentafluoroethane	CFC-115
34				-96	2	354-11-0	1,1,1,2-Tetrachloro-1-fluoroethane	HCFC-121a
35			+95	-96	2	354-14-3	1,1,2,2-Tetrachloro-1-fluoroethane	HCFC-121
36					2	75-69-4	Trichlorofluoromethane	CFC-11
C. Chlorinated Plus Other Chemical Elements (Functional Groups) (subclass=3):								
1					3	111-91-1	Bis(2-chloroethoxy) methane	
2					3	111-44-4	Bis(2-chloroethyl) ether	
3	Carc				3	542-88-1	Bis(chloromethyl) ether	
4					3	108-60-1	Bis(2-chloro-1-methylethyl) ether	
5					3	79-11-8	Chloroacetic acid	
6	Carc				3	107-30-2	Chloromethyl methyl ether	
7			+95		3	76-06-2	Trichloronitromethane	Chloropicrin
8				-96	3	542-76-7	3-Chloropropionitrile	
9	Carc			-96	3	79-44-7	Dimethylcarbamyl chloride	
10					3	2524-03-0	Dimethyl chlorothiophosphate	
11					3	541-41-3	Ethyl chloroformate	
12					3	79-22-1	Methyl chlorocarbonate	
13	Carc				3	505-60-2	1,1'-thiobis[2-chloro-] ethane	Mustard gas
14	Carc			-96	3	51-75-2	2-Chloro-N-(2-chloroethyl)-N-methylethanamine	Nitrogen mustard
15					3	52-68-6	2,2,2-trichloro-1-hydroxyethyl)-dimethyl ester phosphonic acid	Trichlorfon
16					3	76-02-8	Trichloroacetyl chloride	

Explanatory Notes:
(a) CAHC subclasses: 1=chlorinated only; 2= chlorinated + other halogens; 3=chlorinated + other chemical elements (functional groups).
(b) "Carc" denotes chemicals designated as known or suspected carcinogens by the OSHA (29 CFR 1910.1200), based on IARC, NTP and OSHA criteria.
(c) "+/-95" & "+/-96" denote chemicals added to or subtracted from the TRI database by the USEPA in survey reporting years 1995 & 1996.
(d) ++ Denotes chemicals used as captive intermediates in synthesis of other compounds, for which production volumes usually not published (USEPA 1984, p.8).
(e) * The CAS and IUPAC name may be identical (e.g. dichloromethane); however when different, In most instances there are minor variations between the CAS and IUPAC naming systems (e.g. 1,3-Dichloro-1-propene (CAS), compared to 1,3-Dichloropropene (IUPAC)).
(f) ** TRI= Toxic Release Inventory survey database maintained by the USEPA on manufacturers, processors, and users of 579 TRI-listed toxic chemicals. Facilities in SIC codes 20-39 with >9 employees, which manufacture/process >25,000 lbs or use >10,000 lbs per year, must report to the TRI survey.
(g) *** Some chemicals may have more than one common and trade name (e.g. for the CAS/IUPAC name dichloromethane, there are at least four common name synonyms (methane dichloride, methylene bichloride, methylene chloride, and methylene dichloride), and at least five trade names (Aerothene MM, Narkotil, R30, Solaesthin, and Solmethine)); source WHO, 1986, p.43.
(h) CFC= chlorofluorocarbon; HCFC= hydrochlorofluorocarbon (generic designations of chemical classes).

EXHIBIT C-2

PROFILE OF CAHCs IN WASTES PRODUCED BY INDUSTRIAL MANUFACTURERS, PROCESSERS & OTHER USERS OF TRI-LISTED TOXIC CHEMICALS IN SIC CODES 20-39:
QUANTITY OF CAHC CONSTITUENTS IN WASTES BY ON-SITE AND OFF-SITE WASTE MANAGEMENT (Source: USEPA 1996 Toxic Release Inventory (TRI) Public Data Release Report Nr. 745-R-98-005; http://www.epa.gov/opptintr/tri/pdr96/drhome.htm)

	CAHC sub-class (1,2,3)	CAS** Number	Chemical name	A	B	C	D (A+B+C)	E	F	G	H	I	J (E+...+I)	K	L (D+J+K)	M	N
				ON-SITE MANAGEMENT				OFF-SITE MANAGEMENT									
				Recycled onsite (tons)	Energy recovery onsite (tons)	Treatment onsite (tons)	Total management onsite (tons)	Transfers to recycling (tons)	Transfers to energy recovery (tons)	Transfers to treatment (tons)	Transfers to POTWs (tons)	Transfers to others (tons)	Total transfers (tons)	RELEASES onsite + offsite (tons)	Total quantity constituent in production related waste (tons)	Row percent	Cumltv percent
A. Chlorinated Only (subclass=1):																	
Carc	1	75-09-2	Dichloromethane	56,032.5	2,799.5	11,603.8	70,435.7	5,900.0	1,502.8	5,951.8	320.1	907.9	14,582.7	27,150.7	111,845.5	13.66%	13.7%
Carc	1	75-01-4	Vinyl chloride	72,128.5	17,451.1	17,274.6	106,854.2	54.2	8.5	28.7	0.4	0.0	91.8	520.1	107,464.1	13.12%	26.8%
Carc	1	107-06-2	1,2-Dichloroethane	23,909.2	24,524.3	24,245.6	72,679.1	8,478.6	542.6	463.1	3.2	0.0	9,487.4	584.0	82,734.5	10.10%	36.9%
Carc	1	79-01-6	Trichloroethylene	59,260.3	1,025.4	2,679.1	62,964.8	3,334.9	380.8	803.1	43.2	0.0	4,561.9	10,686.7	78,451.2	9.58%	46.5%
Carc	1	127-18-4	Tetrachloroethylene	23,355.4	1,323.9	10,337.4	35,016.7	2,911.2	265.3	720.0	0.9	0.0	3,897.5	3,964.2	42,985.0	5.25%	51.7%
	1	79-00-5	1,1,2-Trichloroethane	11,764.5	8,417.3	10,194.1	30,375.9	6,543.5	152.7	1,411.5	0.4	0.0	8,108.0	169.8	38,642.0	4.72%	56.4%
	1	78-87-5	1,2-Dichloropropane	18,606.5	11,280.0	2,558.7	32,445.2	0.0	0.0	0.1	0.8	0.0	0.8	260.9	32,706.7	3.99%	60.4%
	1	71-55-6	1,1,1-Trichloroethane	19,764.6	430.4	592.3	20,787.3	720.8	169.4	511.7	5.2	0.0	1,407.0	4,415.0	26,462.5	3.23%	63.6%
	1	75-00-3	Chloroethane	1,954.9	6,122.1	14,494.3	22,571.3	77.9	19.9	245.4	0.4	1.0	344.5	1,276.8	24,192.1	2.95%	66.6%
Carc	1	56-23-5	Carbon tetrachloride	1,036.8	525.0	20,908.3	22,470.1	64.4	13.2	800.4	0.2	0.0	878.2	202.4	22,995.6	2.81%	69.4%
Carc	1	67-66-3	Chloroform	3,019.6	4,443.6	6,726.7	14,189.8	334.4	94.7	930.2	164.8	0.0	1,524.1	4,889.4	20,828.0	2.54%	72.0%
	1	74-87-3	Chloromethane	1,499.6	2,246.5	6,495.8	10,241.9	0.0	3.1	126.5	4.9	0.0	134.5	2,279.4	12,740.2	1.56%	73.5%
	1	79-34-5	1,1,2,2-Tetrachloroethane	2,404.0	462.0	5,512.1	8,378.1	1,190.1	0.0	124.0	0.0	0.0	1,314.2	7.8	9,700.1	1.18%	74.7%
Carc	1	542-75-6	1,3-Dichloropropylene	1,518.4	7,000.0	286.6	8,805.0	0.0	2.4	26.9	0.0	0.0	29.3	5.4	8,839.4	1.08%	75.8%
Carc	1	96-18-4	1,2,3-Trichloropropane	3,050.0	345.0	525.0	3,920.0	0.0	0.0	4,500.0	0.0	0.0	4,500.0	4.4	8,424.3	1.03%	76.8%
Carc	1	10061-02-6	trans-1,3-Dichloropropene	24.5	6,000.0	0.0	6,024.5	0.0	0.0	0.1	0.0	0.0	0.1	0.4	6,025.1	0.74%	77.5%
	1	76-01-7	Pentachloroethane	2,075.0	195.0	3,265.9	5,535.9	0.0	6.2	104.0	0.0	0.0	110.2	0.8	5,646.9	0.69%	78.2%
	1	126-99-8	Chloroprene	0.0	472.2	3,625.1	4,097.3	140.8	7.0	126.4	8.1	0.0	282.3	581.7	4,956.2	0.61%	78.8%
	1	75-35-4	Vinylidene chloride	770.0	40.5	2,972.2	3,782.7	0.0	22.6	18.1	0.0	0.0	40.7	88.7	3,959.8	0.48%	79.3%
	1	78-88-6	2,3-Dichloropropene	1,900.0	1,300.0	242.0	3,442.0	0.0	0.0	180.0	0.0	0.0	180.0	10.5	3,632.7	0.44%	79.8%
	1	87-68-3	Hexachloro-1,3-butadiene	0.0	33.0	3,053.7	3,086.7	0.0	0.0	138.8	0.0	0.0	138.8	1.9	3,227.9	0.39%	80.2%
	1	67-72-1	Hexachloroethane	0.0	469.5	2,300.4	2,769.9	0.0	35.5	60.5	0.0	0.0	96.0	2.7	2,868.1	0.35%	80.5%
	1	630-20-6	1,1,1,2-Tetrachloroethane	1,250.0	0.0	1,418.5	2,668.5	0.0	70.0	118.9	0.0	0.0	188.9	3.3	2,860.8	0.35%	80.9%
	1	764-41-0	1,4-Dichloro-2-butene	900.0	0.0	1,500.0	2,400.0	0.0	0.0	160.0	0.0	0.0	160.0	3.3	2,563.3	0.31%	81.2%
	1	540-59-0	1,2-Dichloroethylene	310.0	780.0	914.1	2,004.1	1.6	0.0	4.4	0.0	0.0	5.9	4.1	2,025.9	0.25%	81.4%
	1	75-34-3	Ethylidene dichloride	650.0	70.4	1,205.1	1,925.5	0.0	0.0	9.3	0.0	0.0	9.3	11.0	1,945.8	0.24%	81.6%
	1	107-05-1	Allyl chloride	130.0	1,150.0	252.2	1,532.2	0.0	0.2	243.7	0.0	0.0	243.9	40.1	1,820.5	0.22%	81.9%
	1	—	Polychlorinated alkanes	8.6	34.5	114.1	157.2	135.7	115.1	143.6	37.4	0.0	431.8	50.5	658.1	0.08%	82.0%
Carc	1	563-47-3	3-Chloro-2-methyl-1-propene	0.0	0.0	172.6	172.6	0.0	0.0	26.1	0.1	0.0	26.2	11.5	210.3	0.03%	82.0%
	1	77-47-4	Hexachlorocyclopentadiene	0.0	0.0	123.2	123.2	0.0	0.4	27.5	0.8	0.0	28.7	4.6	156.5	0.02%	82.0%
Carc	1	58-89-9	1,2,3,4,5,6-Hexachlorocyclohexane (Lindane)	0.2	0.0	0.0	0.2	0.0	0.0	0.7	0.0	0.0	0.7	0.5	1.0	0.00%	82.0%
	1	110-57-6	trans-1,4-Dichloro-2-butene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.00%	82.0%
			Subclass 1 column subtotals =	307,323.0	98,941.0	155,593.7	561,857.7	29,887.9	3,412.1	18,005.5	590.8	908.9	52,805.2	57,232.7	671,570.0	82.0%	
			Column subtotal percentages =	45.8%	14.7%	23.2%	83.7%	4.5%	0.5%	2.7%	0.1%	0.1%	7.9%	8.5%	100.0%		
B. Chlorinated Plus Other Halogens (subclass=2):																	
	2	76-13-1	Freon-113 (1,1,2-trichlorotrifluoroethane)	346.4	37.1	109,529.7	109,913.1	57.4	26.8	537.2	0.1	0.0	621.6	702.1	111,266.8	13.59%	95.6%
	2	75-45-6	Chlorodifluoromethane (HCFC-22)	2,323.5	0.0	278.4	2,601.9	116.4	0.4	137.9	0.0	0.0	254.6	4,916.7	7,700.8	0.94%	96.5%
	2	1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	194.9	0.0	1,034.9	1,229.8	116.3	139.9	550.8	1.5	0.0	808.4	4,701.2	6,750.5	0.82%	97.3%
	2	75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	6.6	0.0	77.4	84.0	7.0	0.0	21.4	0.0	0.0	28.4	3,124.6	3,247.8	0.40%	97.7%
	2	76-14-2	Dichlorotetrafluoroethane (CFC-114)	50.4	0.0	815.7	866.1	100.3	0.0	8.1	0.0	0.0	108.4	425.7	1,404.1	0.17%	97.9%
	2	75-71-8	Dichlorodifluoromethane (CFC-12)	270.3	0.0	8.5	278.8	211.5	0.0	21.8	0.0	0.0	233.4	665.4	1,070.5	0.13%	98.0%
	2	2837-89-0	2-Chloro-1,1,1,2-tetrafluoro-ethane (HCFC-124)	92.4	0.0	91.5	184.0	113.3	0.0	0.0	0.0	0.0	113.3	452.7	769.6	0.09%	98.1%
	2	75-69-4	Trichlorofluoromethane (CFC-11)	84.1	0.0	2.5	86.6	62.5	92.4	50.4	0.0	39.3	244.6	349.7	667.8	0.08%	98.2%
	2	34077-87-7	Dichlorotrifluoroethane	0.0	0.0	358.2	358.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	358.7	0.04%	98.3%
	2	353-59-3	Bromochlorodifluoromethane (Halon-1211)	337.3	0.0	0.0	337.3	0.0	0.0	0.0	0.0	0.0	0.0	2.3	339.7	0.04%	98.3%
	2	354-25-6	1-Chloro-1,1,2,2-tetra-fluoroethane (HCFC-124a)	0.0	0.0	16.6	16.6	0.0	0.0	0.0	0.0	0.0	0.0	298.3	314.6	0.04%	98.3%
	2	306-83-2	2,2-Dichloro-1,1,1-trifluoro-ethane (HCFC-123)	126.5	0.0	2.5	129.0	0.0	0.0	3.0	0.0	0.0	3.0	114.7	236.6	0.03%	98.4%
	2	76-15-3	Monochloropentafluoroethane (CFC-115)	55.0	0.0	34.3	89.3	0.0	0.0	7.1	0.0	0.0	7.1	36.4	132.9	0.02%	98.4%
	2	75-43-4	Dichlorofluoromethane (HCFC-21)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	78.0	76.4	0.01%	98.4%
	2	1649-08-7	1,2-Dichloro-1,1-difluoro-ethane (HCFC-132b)	0.0	0.0	48.0	48.0	0.0	0.0	18.5	0.0	0.0	18.5	0.5	67.0	0.01%	98.4%
	2	354-23-4	1,2-Dichloro-1,1,2-trifluoro-ethane (HCFC-123a)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.6	34.8	0.00%	98.4%
	2	75-88-7	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	8.3	17.1	25.4	0.00%	98.4%
	2	507-55-1	1,3-Dichloro-1,1,2,2,3-penta-fluoropropane (HCFC-225cb)	2.4	0.0	0.0	2.4	1.2	0.0	0.7	0.0	0.0	1.9	14.5	18.8	0.00%	98.4%
	2	422-56-0	3,3-Dichloro-1,1,1,2,2-penta-fluoropropane (HCFC-225ca)	2.0	0.0	0.0	2.0	1.0	0.0	0.6	0.0	0.0	1.5	12.0	15.5	0.00%	98.4%
	2	75-72-9	Chlorotrifluoromethane (CFC-13)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	0.00%	98.4%
	2	75-27-4	Dichlorobromomethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.00%	98.4%
			Subclass 2 column subtotals =	3,891.9	37.1	112,298.2	116,227.1	786.9	259.5	1,365.7	1.6	39.3	2,453.0	15,953.1	134,504.3	16.4%	
C. Chlorinated Plus Other Chemical Elements (Functional Groups) (subclass=3):																	
	3	108-60-1	Bis(2-chloro-1-methylethyl) ether	6,500.0	0.0	4,467.0	10,967.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	10,969.4	1.34%	99.8%
	3	111-44-4	Bis(2-chloroethyl) ether	0.0	286.5	480.2	766.7	90.0	203.8	17.3	1.2	0.0	312.3	1.5	1,080.4	0.13%	99.9%
	3	79-11-8	Chloroacetic acid	21.2	0.0	818.5	839.7	0.0	0.0	0.1	0.6	0.0	0.8	3.5	843.1	0.10%	100.0%
	3	76-06-2	Chloropicrin	15.0	0.0	0.2	15.1	0.0	0.0	0.2	0.0	0.0	0.2	6.0	21.3	0.00%	100.0%
	3	541-41-3	Ethyl chloroformate	0.0	0.0	5.8	5.8	0.0	0.0	0.0	0.0	0.0	0.0	2.4	8.1	0.00%	100.0%
Carc	3	107-30-2	Chloromethyl methyl ether	0.0	0.0	4.1	4.1	0.0	0.0	0.0	0.0	0.0	0.0	1.5	5.6	0.00%	100.0%
	3	111-91-1	Bis(2-chloroethoxy) methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	4.3	0.00%	100.0%
	3	79-22-1	Methyl chlorocarbonate	0.0	0.0	2.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.3	0.00%	100.0%
Carc	3	542-88-1	Bis(chloromethyl) ether	0.0	0.0	3.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.00%	100.0%
	3	2524-03-0	Dimethyl chlorothiophosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00%	100.0%
	3	76-02-8	Trichloroacetyl chloride	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00%	100.0%
Carc	3	505-60-2	Mustard gas (1,1'-thiobis[2-chloro-] ethane)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00%	100.0%
	3	52-68-6	Trichlorfon (2,2,2-trichloro-1-hydroxyethyl)-dimethyl ester phosphonic acid)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00%	100.0%
			Subclass 3 column subtotals=	6,536.2	286.5	5,781.0	12,603.7	90.0	203.8	17.7	1.8	0.0	313.3	22.6	12,938.7	1.6%	

Explanatory Notes:
(a) *USEPA's TRI contains survey data from facilities in SIC codes 20-39 with >9 full-time employees and which manufacture/process 25,000 lbs or use 10,000 lbs of TRI-listed chemicals in a year.
(b) **Cas number = Chemical Abstracts Service registry number assigned by the American Chemical Society for identification and inventory of the universe of known chemicals.
(c) "Carc" denotes chemicals designtaed as know or suspected carcinogens by the OSHA (29 CFR 1910.1200), based on IARC, NTP and OSHA criteria.

EXHIBIT C-3

FACILITY ON-SITE ENVIRONMENTAL RELEASES (1996 TONS): DATA EXTRACTION FRROM THE 1996 USEPA TRI PUBLIC REPORT

	CAHC sub-class (1,2,3)	CAS Number	Chemical Name	A Fugitive or nonpoint Air emissions (tons)	B Stack or point Air emissions (tons)	C Surface water discharges (tons)	D Underground Injection Class I	E Underground Injection	F RCRA Subtitle C landfills (tons)	G Other onsite land releases* (tons)	H (A+...+G) Total onsite releases (tons)	I Transfers offsite to disposal (tons)	J (H+I) On- and offsite releases (tons)	K Row percent	L Cumlty percent
A. Chlorinated Only (Subclass=1):															
Carc	1	75-09-2	Dichloromethane	10,760.0	15,950.3	5.0	374.8	0.0	0.0	2.5	27,092.5	58.2	**27,150.7**	37.09%	37.1%
Carc	1	79-01-6	Trichloroethylene	5,332.7	5,303.4	0.3	0.6	0.0	2.8	8.8	10,648.6	38.2	**10,686.7**	14.60%	51.7%
Carc	1	67-66-3	Chloroform	1,543.2	3,117.6	170.2	22.7	0.0	12.6	3.8	4,870.0	19.4	**4,889.4**	6.68%	58.4%
	1	71-55-6	1,1,1-Trichloroethane	2,169.7	2,214.1	0.4	0.7	0.0	2.3	10.9	4,398.0	17.0	**4,415.0**	6.03%	64.4%
Carc	1	127-18-4	Tetrachloroethylene	1,547.8	2,382.8	0.7	6.7	0.0	13.0	2.2	3,953.2	11.0	**3,964.2**	5.41%	69.8%
	1	74-87-3	Chloromethane	386.2	1,842.7	0.4	49.9	0.0	0.0	0.0	2,279.2	0.2	**2,279.4**	3.11%	72.9%
	1	75-00-3	Chloroethane	565.3	711.3	0.1	0.0	0.0	0.0	0.0	1,276.8	0.0	**1,276.8**	1.74%	74.7%
Carc	1	107-06-2	1,2-Dichloroethane	217.0	305.3	0.9	2.6	0.0	12.5	0.1	538.4	45.6	**584.0**	0.80%	75.5%
	1	126-99-8	Chloroprene	56.5	456.6	0.0	60.0	0.0	4.3	0.0	577.4	4.3	**581.7**	0.79%	76.3%
Carc	1	75-01-4	Vinyl chloride	136.5	373.4	0.2	0.2	0.0	0.0	0.0	510.2	9.8	**520.1**	0.71%	77.0%
	1	78-87-5	1,2-Dichloropropane	112.2	145.0	0.9	0.0	0.0	0.0	0.1	258.2	2.7	**260.9**	0.36%	77.3%
Carc	1	56-23-5	Carbon tetrachloride	70.3	105.2	0.1	22.3	0.0	0.0	0.0	197.8	4.6	**202.4**	0.28%	77.6%
	1	79-00-5	1,1,2-Trichloroethane	16.6	153.0	0.3	0.0	0.0	0.0	0.0	169.8	0.0	**169.8**	0.23%	77.8%
	1	75-35-4	Vinylidene chloride	41.3	47.3	0.1	0.0	0.0	0.0	0.0	88.7	0.0	**88.7**	0.12%	78.0%
	1	—	Polychlorinated alkanes	0.9	0.5	4.2	0.0	0.0	0.0	0.3	5.9	44.6	**50.5**	0.07%	78.0%
	1	107-05-1	Allyl chloride	28.0	12.1	0.0	0.0	0.0	0.0	0.0	40.1	0.0	**40.1**	0.05%	78.1%
Carc	1	563-47-3	3-Chloro-2-methyl-1-propene	0.2	11.3	0.0	0.0	0.0	0.0	0.0	11.5	0.0	**11.5**	0.02%	78.1%
	1	75-34-3	Ethylidene dichloride	3.9	7.1	0.0	0.0	0.0	0.0	0.0	11.0	0.0	**11.0**	0.01%	78.1%
	1	78-88-6	2,3-Dichloropropene	0.3	0.3	10.0	0.0	0.0	0.0	0.0	10.5	0.0	**10.5**	0.01%	78.1%
	1	79-34-5	1,1,2,2-Tetrachloroethane	6.3	1.4	0.1	0.0	0.0	0.0	0.0	7.8	0.0	**7.8**	0.01%	78.1%
Carc	1	542-75-6	1,3-Dichloropropylene	4.3	0.4	0.6	0.0	0.0	0.0	0.0	5.4	0.0	**5.4**	0.01%	78.1%
	1	77-47-4	Hexachlorocyclopentadiene	3.7	0.3	0.0	0.1	0.0	0.0	0.0	4.1	0.5	**4.6**	0.01%	78.1%
Carc	1	96-18-4	1,2,3-Trichloropropane	4.0	0.3	0.0	0.0	0.0	0.0	0.0	4.4	0.0	**4.4**	0.01%	78.2%
	1	540-59-0	1,2-Dichloroethylene	1.5	2.6	0.0	0.0	0.0	0.0	0.0	4.1	0.0	**4.1**	0.01%	78.2%
	1	630-20-6	1,1,1,2-Tetrachloroethane	2.0	1.3	0.0	0.0	0.0	0.0	0.0	3.2	0.0	**3.3**	0.00%	78.2%
	1	764-41-0	1,4-Dichloro-2-butene	0.0	1.5	0.0	1.7	0.0	0.0	0.0	3.3	0.0	**3.3**	0.00%	78.2%
	1	67-72-1	Hexachloroethane	1.1	0.4	0.0	1.0	0.0	0.0	0.0	2.5	0.2	**2.7**	0.00%	78.2%
	1	87-68-3	Hexachloro-1,3-butadiene	0.7	0.5	0.1	0.5	0.0	0.0	0.0	1.8	0.2	**1.9**	0.00%	78.2%
	1	76-01-7	Pentachloroethane	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.8	0.0	**0.8**	0.00%	78.2%
	1	58-89-9	1,2,3,4,5,6-Hexachlorocyclohexane (Lindane)	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.4	0.1	**0.5**	0.00%	78.2%
Carc	1	10061-02-6	trans-1,3-Dichloropropene	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	**0.4**	0.00%	78.2%
	1	110-57-6	trans-1,4-Dichloro-2-butene	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	**0.1**	0.00%	78.2%
			Subclass 1 column subtotals =	23,013.3	33,148.0	194.7	543.7	0.0	47.4	28.9	56,975.9	256.8	**57,232.7**	**78.2%**	
			Column subtotal percentages =	40.2%	57.9%	0.3%	0.9%	0.0%	0.1%	0.1%	99.6%	0.4%	100.0%		
B. Chlorinated Plus Other Halogens (Subclass=2):															
	2	75-45-6	Chlorodifluoromethane (HCFC-22)	2,194.0	2,694.3	1.3	0.0	0.0	0.0	0.0	4,889.6	27.1	**4,916.7**	6.72%	84.9%
	2	1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	2,668.5	1,920.6	0.3	0.0	0.0	0.0	2.9	4,592.3	108.9	**4,701.2**	6.42%	91.3%
	2	75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	338.6	2,783.3	1.4	0.0	0.0	0.0	0.0	3,123.4	1.2	**3,124.6**	4.27%	95.6%
	2	76-13-1	Freon-113 (1,1,2-trichlorotrifluoroethane)	496.2	204.9	0.4	0.0	0.0	0.0	0.0	701.5	0.6	**702.1**	0.96%	96.5%
	2	75-71-8	Dichlorodifluoromethane (CFC-12)	547.7	114.5	0.0	0.0	0.0	0.0	3.0	665.2	0.2	**665.4**	0.91%	97.5%
	2	2837-89-0	2-Chloro-1,1,1,2-tetrafluoro-ethane (HCFC-124)	119.4	332.9	0.5	0.0	0.0	0.0	0.0	452.7	0.0	**452.7**	0.62%	98.1%
	2	76-14-2	Dichlorotetrafluoroethane (CFC-114)	349.8	73.5	2.5	0.0	0.0	0.0	0.0	425.7	0.0	**425.7**	0.58%	98.7%
	2	75-69-4	Trichlorofluoromethane (CFC-11)	276.2	70.2	0.5	0.0	0.0	0.0	2.8	349.6	0.1	**349.7**	0.48%	99.1%
	2	354-25-6	1-Chloro-1,1,2,2-tetra-fluoroethane (HCFC-124a)	2.3	295.9	0.0	0.0	0.0	0.0	0.0	298.3	0.0	**298.3**	0.41%	99.5%
	2	306-83-2	2,2-Dichloro-1,1,1-trifluoro-ethane (HCFC-123)	96.8	17.8	0.1	0.0	0.0	0.0	0.0	114.7	0.0	**114.7**	0.16%	99.7%
	2	75-43-4	Dichlorofluoromethane (HCFC-21)	7.4	65.3	0.0	0.0	0.0	0.0	0.0	72.6	5.3	**78.0**	0.11%	99.8%
	2	76-15-3	Monochloropentafluoroethane (CFC-115)	33.8	1.6	1.1	0.0	0.0	0.0	0.0	36.4	0.0	**36.4**	0.05%	99.8%
	2	354-23-4	1,2-Dichloro-1,1,2-trifluoro-ethane (HCFC-123a)	33.2	1.3	0.1	0.0	0.0	0.0	0.0	34.6	0.0	**34.6**	0.05%	99.9%
	2	75-88-7	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	0.1	17.0	0.0	0.0	0.0	0.0	0.0	17.1	0.0	**17.1**	0.02%	99.9%
	2	507-55-1	1,3-Dichloro-1,1,2,2,3-penta-fluoropropane (HCFC-225cb)	14.5	0.0	0.0	0.0	0.0	0.0	0.0	14.5	0.0	**14.5**	0.02%	99.9%
	2	422-56-0	3,3-Dichloro-1,1,1,2,2-penta-fluoropropane (HCFC-225ca)	12.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	**12.0**	0.02%	100.0%
	2	75-72-9	Chlorotrifluoromethane (CFC-13)	0.9	3.8	0.1	0.0	0.0	0.0	0.0	4.8	0.0	**4.8**	0.01%	100.0%
	2	353-59-3	Bromochlorodifluoromethane (Halon-1211)	2.3	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	**2.3**	0.00%	100.0%
	2	75-27-4	Dichlorobromomethane	0.0	1.2	0.0	0.0	0.0	0.0	0.1	1.3	0.0	**1.3**	0.00%	100.0%
	2	1649-08-7	1,2-Dichloro-1,1-difluoro-ethane (HCFC-132b)	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	**0.5**	0.00%	100.0%
	2	34077-87-7	Dichlorotrifluoroethane	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	**0.5**	0.00%	100.0%
			Subclass 2 column subtotals =	7,194.5	8,597.9	8.3	0.0	0.0	0.0	8.8	15,809.6	143.6	**15,953.1**	**21.8%**	
			Column subtotal percentages =	45.1%	53.9%	0.1%	0.0%	0.0%	0.0%	0.1%	99.1%	0.9%	100.0%		
C. Chlorinated Plus Other Chemical Elements (Functional Groups) (Subclass=3):															
	3	76-06-2	Chloropicrin	2.6	3.3	0.0	0.0	0.0	0.0	0.0	5.9	0.1	**6.0**	0.01%	100.0%
	3	111-91-1	Bis(2-chloroethoxy) methane	0.7	0.0	0.0	3.3	0.0	0.3	0.0	4.3	0.0	**4.3**	0.01%	100.0%
	3	79-11-8	Chloroacetic acid	2.8	0.4	0.0	0.0	0.0	0.0	0.1	3.3	0.1	**3.5**	0.00%	100.0%
	3	541-41-3	Ethyl chloroformate	2.1	0.2	0.0	0.0	0.0	0.0	0.0	2.4	0.0	**2.4**	0.00%	100.0%
	3	108-60-1	Bis(2-chloro-1-methylethyl) ether	0.3	2.1	0.0	0.0	0.0	0.0	0.0	2.3	0.0	**2.3**	0.00%	100.0%
	3	111-44-4	Bis(2-chloroethyl) ether	0.4	1.1	0.0	0.0	0.0	0.0	0.0	1.5	0.0	**1.5**	0.00%	100.0%
Carc	3	107-30-2	Chloromethyl methyl ether	0.1	1.3	0.0	0.0	0.0	0.0	0.0	1.4	0.0	**1.5**	0.00%	100.0%
Carc	3	79-22-1	Methyl chlorocarbonate	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	**1.2**	0.00%	100.0%
	3	2524-03-0	Dimethyl chlorothiophosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.00%	100.0%
	3	76-02-8	Trichloroacetyl chloride	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.00%	100.0%
Carc	3	505-60-2	Mustard gas (1,1'-thiobis[2-chloro-] ethane)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.00%	100.0%
	3	52-68-6	Trichlorfon (2,2,2-trichloro-1-hydroxyethyl)-dimethyl ester phosphonic acid)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.00%	100.0%
Carc	3	542-88-1	Bis(chloromethyl) ether	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.00%	100.0%
			Subclass 3 column subtotals =	10.2	8.4	0.0	3.3	0.0	0.3	0.1	22.3	0.3	**22.6**	**0.03%**	
			Column subtotal percentages =	45.1%	37.0%	0.2%	14.8%	0.0%	1.2%	0.6%	98.8%	1.2%	100.0%		
			Column totals (all subclasses) =	**30,218**	**41,754**	**203**	**547**	**0**	**48**	**38**	**72,808**	**401**	**73,208**	**100%**	
			Column percents =	**41.3%**	**57.0%**	**0.3%**	**0.7%**	**0.0%**	**0.1%**	**0.1%**	**99.5%**	**0.5%**	**100%**		

Explanatory Notes: (a) *Other onsite land releases include: (a) non-RCRA landfills; (2) land treatment; (3) surface impoundment; and/or (4) spills/leadks; (b) "Carc" =chemicals designated as known or suspected carcinogens by the OSHA (29 CFR 1910.1200), based on IARC, NTP and OSHA criteria.

EXHIBIT C-4

SUMMARY OF CAHC WASTE CONSTITUENT QUANTITIES AND RELEASES FROM INDUSTRIAL PRODUCTION IN SIC CODES 20-39
(Source: 1996 USEPA Toxic Release Inventory Database)

	CAHC sub-class (1,2,3)	CAS** Number	Chemical name	Waste constituent management onsite (tons)	Constituent Transfers to offsite management (tons)	Chemical releases onsite + offsite (tons)	Total quantity constituent in production related wastes (tons)	Row percent	Cumltv percent
A. Chlorinated Only (subclass=1):									
Carc	1	75-09-2	Dichloromethane	70,435.7	14,582.7	27,150.7	**111,845.5**	13.66%	13.7%
Carc	1	75-01-4	Vinyl chloride	106,854.2	91.8	520.1	**107,464.1**	13.12%	26.8%
Carc	1	107-06-2	1,2-Dichloroethane	72,679.1	9,487.4	584.0	**82,734.5**	10.10%	36.9%
Carc	1	79-01-6	Trichloroethylene	62,964.8	4,561.9	10,686.7	**78,451.2**	9.58%	46.5%
Carc	1	127-18-4	Tetrachloroethylene	35,016.7	3,897.5	3,964.2	**42,985.0**	5.25%	51.7%
	1	79-00-5	1,1,2-Trichloroethane	30,375.9	8,108.0	169.8	**38,642.0**	4.72%	56.4%
	1	78-87-5	1,2-Dichloropropane	32,445.2	0.8	260.9	**32,706.7**	3.99%	60.4%
	1	71-55-6	1,1,1-Trichloroethane	20,787.3	1,407.0	4,415.0	**26,462.5**	3.23%	63.6%
	1	75-00-3	Chloroethane	22,571.3	344.5	1,276.8	**24,192.1**	2.95%	66.6%
Carc	1	56-23-5	Carbon tetrachloride	22,470.1	878.2	202.4	**22,995.6**	2.81%	69.4%
Carc	1	67-66-3	Chloroform	14,189.8	1,524.1	4,889.4	**20,828.0**	2.54%	72.0%
	1	74-87-3	Chloromethane	10,241.9	134.5	2,279.4	**12,740.2**	1.56%	73.5%
	1	79-34-5	1,1,2,2-Tetrachloroethane	8,378.1	1,314.2	7.8	**9,700.1**	1.18%	74.7%
Carc	1	542-75-6	1,3-Dichloropropylene	8,805.0	29.3	5.4	**8,839.4**	1.08%	75.8%
Carc	1	96-18-4	1,2,3-Trichloropropane	3,920.0	4,500.0	4.4	**8,424.3**	1.03%	76.8%
Carc	1	10061-02-6	trans-1,3-Dichloropropene	6,024.5	0.1	0.4	**6,025.1**	0.74%	77.5%
	1	76-01-7	Pentachloroethane	5,535.9	110.2	0.8	**5,646.9**	0.69%	78.2%
	1	126-99-8	Chloroprene	4,097.3	282.3	581.7	**4,956.2**	0.61%	78.8%
	1	75-35-4	Vinylidene chloride	3,782.7	40.7	88.7	**3,959.8**	0.48%	79.3%
	1	78-88-6	2,3-Dichloropropene	3,442.0	180.0	10.5	**3,632.7**	0.44%	79.8%
	1	87-68-3	Hexachloro-1,3-butadiene	3,086.7	138.8	1.9	**3,227.9**	0.39%	80.2%
	1	67-72-1	Hexachloroethane	2,769.9	96.0	2.7	**2,868.1**	0.35%	80.5%
	1	630-20-6	1,1,1,2-Tetrachloroethane	2,668.5	188.9	3.3	**2,860.8**	0.35%	80.9%
	1	764-41-0	1,4-Dichloro-2-butene	2,400.0	160.0	3.3	**2,563.3**	0.31%	81.2%
	1	540-59-0	1,2-Dichloroethylene	2,004.1	5.9	4.1	**2,025.9**	0.25%	81.4%
	1	75-34-3	Ethylidene dichloride	1,925.5	9.3	11.0	**1,945.8**	0.24%	81.6%
	1	107-05-1	Allyl chloride	1,532.2	243.9	40.1	**1,820.5**	0.22%	81.9%
	1	—	Polychlorinated alkanes	157.2	431.8	50.5	**658.1**	0.08%	82.0%
Carc	1	563-47-3	3-Chloro-2-methyl-1-propene	172.6	26.2	11.5	**210.3**	0.03%	82.0%
	1	77-47-4	Hexachlorocyclopentadiene	123.2	28.7	4.6	**156.5**	0.02%	82.0%
Carc	1	58-89-9	1,2,3,4,5,6-Hexachlorocyclohexane (Lindane)	0.2	0.7	0.5	**1.0**	0.00%	82.0%
	1	110-57-6	trans-1,4-Dichloro-2-butene	0.0	0.0	0.1	**0.1**	0.00%	82.0%
			Subclass 1 column subtotals =	561,857.7	52,805.2	57,232.7	**671,570.0**	**82.0%**	
			Column subtotal percentages =	83.7%	7.9%	8.5%	100.0%		
B. Chlorinated Plus Other Halogens (subclass=2):									
	2	76-13-1	Freon-113 (1,1,2-trichlorotrifluoroethane)	109,913.1	621.6	702.1	**111,266.8**	13.59%	95.6%
	2	75-45-6	Chlorodifluoromethane (HCFC-22)	2,601.9	254.6	4,916.7	**7,700.8**	0.94%	96.5%
	2	1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	1,229.8	808.4	4,701.2	**6,750.5**	0.82%	97.3%
	2	75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	84.0	28.4	3,124.6	**3,247.8**	0.40%	97.7%
	2	76-14-2	Dichlorotetrafluoroethane (CFC-114)	866.1	108.4	425.7	**1,404.1**	0.17%	97.9%
	2	75-71-8	Dichlorodifluoromethane (CFC-12)	278.8	233.4	665.4	**1,070.5**	0.13%	98.0%
	2	2837-89-0	2-Chloro-1,1,1,2-tetrafluoro-ethane (HCFC-124)	184.0	113.3	452.7	**769.6**	0.09%	98.1%
	2	75-69-4	Trichlorofluoromethane (CFC-11)	86.6	244.6	349.7	**667.8**	0.08%	98.2%
	2	34077-87-7	Dichlorotrifluoroethane	358.2	0.0	0.5	**358.7**	0.04%	98.3%
	2	353-59-3	Bromochlorodifluoromethane (Halon-1211)	337.3	0.0	2.3	**339.7**	0.04%	98.3%
	2	354-25-6	1-Chloro-1,1,2,2-tetra-fluoroethane (HCFC-124a)	16.6	0.0	298.3	**314.6**	0.04%	98.3%
	2	306-83-2	2,2-Dichloro-1,1,1-trifluoro-ethane (HCFC-123)	129.0	3.0	114.7	**236.6**	0.03%	98.4%
	2	76-15-3	Monochloropentafluoroethane (CFC-115)	89.3	7.1	36.4	**132.9**	0.02%	98.4%
	2	75-43-4	Dichlorofluoromethane (HCFC-21)	0.0	0.1	78.0	**76.4**	0.01%	98.4%
	2	1649-08-7	1,2-Dichloro-1,1-difluoro-ethane (HCFC-132b)	48.0	18.5	0.5	**67.0**	0.01%	98.4%
	2	354-23-4	1,2-Dichloro-1,1,2-trifluoro-ethane (HCFC-123a)	0.0	0.0	34.6	**34.8**	0.00%	98.4%
	2	75-88-7	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	0.0	8.3	17.1	**25.4**	0.00%	98.4%
	2	507-55-1	1,3-Dichloro-1,1,2,2,3-penta-fluoropropane (HCFC-225cb)	2.4	1.9	14.5	**18.8**	0.00%	98.4%
	2	422-56-0	3,3-Dichloro-1,1,1,2,2-penta-fluoropropane (HCFC-225ca)	2.0	1.5	12.0	**15.5**	0.00%	98.4%
	2	75-72-9	Chlorotrifluoromethane (CFC-13)	0.0	0.0	4.8	**4.8**	0.00%	98.4%
	2	75-27-4	Dichlorobromomethane	0.0	0.0	1.3	1.3	0.00%	98.4%
			Subclass 2 column subtotals =	116,227.1	2,453.0	15,953.1	134,504.3	16.4%	
C. Chlorinated Plus Other Chemical Elements (Functional Groups) (subclass=3):									
	3	108-60-1	Bis(2-chloro-1-methylethyl) ether	10,967.0	0.0	2.3	**10,969.4**	1.34%	99.8%
	3	111-44-4	Bis(2-chloroethyl) ether	766.7	312.3	1.5	**1,080.4**	0.13%	99.9%
	3	79-11-8	Chloroacetic acid	839.7	0.8	3.5	**843.1**	0.10%	100.0%
	3	76-06-2	Chloropicrin	15.1	0.2	6.0	**21.3**	0.00%	100.0%
	3	541-41-3	Ethyl chloroformate	5.8	0.0	2.4	**8.1**	0.00%	100.0%
Carc	3	107-30-2	Chloromethyl methyl ether	4.1	0.0	1.5	**5.6**	0.00%	100.0%
	3	111-91-1	Bis(2-chloroethoxy) methane	0.0	0.0	4.3	**4.3**	0.00%	100.0%
	3	79-22-1	Methyl chlorocarbonate	2.1	0.0	1.2	**3.3**	0.00%	100.0%
Carc	3	542-88-1	Bis(chloromethyl) ether	3.3	0.0	0.0	**3.3**	0.00%	100.0%
	3	2524-03-0	Dimethyl chlorothiophosphate	0.0	0.0	0.0	**0.0**	0.00%	100.0%
	3	76-02-8	Trichloroacetyl chloride	0.0	0.0	0.0	**0.0**	0.00%	100.0%
Carc	3	505-60-2	Mustard gas (1,1'-thiobis[2-chloro-] ethane)	0.0	0.0	0.0	**0.0**	0.00%	100.0%
	3	52-68-6	Trichlorfon (2,2,2-trichloro-1-hydroxyethyl)-dimethyl ester phosphonic acid)	0.0	0.0	0.0	**0.0**	0.00%	100.0%
			Subclass 3 column subtotals =	12,603.7	313.3	22.6	**12,938.7**	**1.6%**	
			Column subtotal percentages =	97.4%	2.4%	0.2%	100.0%		
			Column totals (all subclasses)=	690,688	55,572	73,208	819,013	100%	

Explanatory Notes:
(a) * TRI survey facilities in SIC codes 20-39 with >9 full-time employees & which manufacture/process 25,000 lbs or use 10,000 lbs of TRI-listed chemicals per year.
(b) "Carc" denotes chemicals designated as known or suspected carcinogens by the OSHA (29 CFR 1910.1200), based on IARC, NTP and OSHA criteria.

ATTACHMENT D

SUPPORTING DATA FOR
SURFACE IMPOUNDMENT SIZE/VOLUME DIMENSIONS
USED IN ESTIMATING
ONE-TIME DREDGING COST

SURVEY SAMPLE DATA
FROM USEPA-OSW
SURFACE IMPOUNDMENT NATIONAL DATABASE

USEPA-OSW SURFACE IMPOUNDMENT DATABASE

Sample of Facilities Reporting Descriptive Data on Surface Impoundments Containing Sludge:

Item	Facility database ID	Waste-water Volume	Waste-water units	Waste-water Volume acre-ft	Sludge Volume	Sludge units	Sludge Volume cu.ft.	Sludge Volume cu.yds	Sludge Volume acre-ft	Waste-water + Sludge Volume acre-ft	Surface area	Area units	Area acres	WW + Sludge Depth feet	Waste-water Depth feet	Sludge Depth feet
1	2748	38.0	MG	116.84	70,000	cu yds	1,890,000	70,000	43.39	160.22	11.0	acres	11.00	14.6	10.6	3.9
2		48.0	MG	147.58	30,000	cu yds	810,000	30,000	18.60	166.18	13.0	acres	13.00	12.8	11.4	1.4
3		36.0	MG	110.69	2,500	cu yds	67,500	2,500	1.55	112.24	12.5	acres	12.50	9.0	8.9	0.1
4	3062	125.0	MG	384.33	416,000	cu yds	11,232,000	416,000	257.85	642.18	43.0	acres	43.00	14.9	8.9	6.0
5	4961	10,320,000	gals	31.73	153,000	cu ft	153,000	5,667	3.51	35.24	255,000	sq ft	5.85	6.0	5.4	0.6
6	6340	9.5	MG	29.21	48,330	lbs	775	24	0.02	29.23	144,000	sq ft	3.31	8.8	8.8	0.0
7	7845	605,880	gals	1.86	1,817,120	gals	242,913	8,973	5.58	7.44	81,000	sq ft	1.86	4.0	1.0	3.0
8		3,475,239	gals	10.69	7,275,796	gals	972,628	35,930	22.33	33.01	566,000	sq ft	12.99	2.5	0.8	1.7
9		28,809,907	gals	88.58	3,851,032	gals	514,806	19,017	11.82	100.40	198,000	sq ft	4.55	22.1	19.5	2.6
10		74,729,033	gals	229.76	21,116,525	gals	2,822,857	104,279	64.80	294.57	4,703,000	sq ft	107.97	2.7	2.1	0.6
11	8834	24.2	MG	74.41	2,740	tons	87,821	2,706	2.02	76.42	905,175	sq ft	20.78	3.7	3.6	0.1
12		10.3	MG	31.67	162,500	cu ft	162,500	6,019	3.73	35.40	81,250	sq ft	1.87	19.0	17.0	2.0
							Mean=	58,426					Mean=	10.0	8.2	1.8
							Min =	24					Min =	2.5	0.8	0.0
							Max =	416,000					Max =	22.1	19.5	6.0

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APPENDIX E:

GENERALIZED SUMMARY OF NPDES PERMIT APPLICATION REVIEW PERIOD AND CONSTRUCTION PERIOD REQUIREMENTS FOR INDUSTRIAL WASTEWATER TREATMENT SYSTEMS

ATTACHMENT E

GENERALIZED SUMMARY
OF NPDES PERMIT APPLICATION REVIEW PERIOD
AND CONSTRUCTION PERIOD REQUIREMENTS
FOR INDUSTRIAL WASTEWATER TREATMENT SYSTEMS

This attachment summarizes the **time elements** associated with (a) the EPA's NPDES wastewater effluent discharge permit review process, and (b) construction of an industrial wastewater treatment system. These two time periods are potentially relevant to the RCRA K174/K175 listing final rule, because one hypothetical industry compliance option for one of the facility's which will be affected by the K174 final rule (OxyVinyl in Deer Park TX), involves accessing or constructing adequate capacity to treat industrial wastewater currently managed in a nearby surface impoundment. Changes to current wastewater management practices at this facility may involve modification to plant & equipment, which may involve wastewater treatment tank system construction under one scenario, and may require amending existing or acquiring a new NPDES permit.

Furthermore, because of RCRA's **statutory six-month** final rule effective date after final rule publication in the Federal Register, any such construction and NPDES permit processing must be completed within that period, to avoid RCRA legal enforcement action. Although USEPA is uncertain as to the ultimate compliance option OxyVinyl will decide to implement, this attachment serves to compare a *generalized depiction* of a wastewater treatment tank system construction period under this hypothetical compliance option, to RCRA's statutory six-month effective date for compliance with final rules. This attachment also compares the RCRA six-month statutory compliance deadline, with the various time segments associated with a *generalized depiction* of the NPDES permit application/review process.

This "*Economics Background Document*" estimates the costs associated with three hypothetical K174 compliance options, the first two of which are largely based on USEPA's May 2000 reconnaissance phone discussions with Region 6 and the Texas Natural Resource and Conservation Commission (TNRCC):

- POTW Option: Install pipe and send OxyVinyl's wastewater to a local industrial wastewater POTW (e.g. to one of Gulf Coast Waste Disposal Authority's facilities near Deer Park TX; http://www.gcwda.com).
- WWTU Option: Purchase/install adequate onsite treatment tank system capacity (at either OxyVinyl, Shell chemicals, or at another adjacent industrial facility in Deer Park TX).
- Retrofit Option: Continue using the surface impoundment and meet within fouryears, the RCRA Subtitle C hazardous waste management requirements (40 CFR 264 Subpart K, and 268.14) for the surface impoundment.

All three options require engineering design and plant/equipment construction periods, as well as time for NPDES permit[22] review (i.e. new permit application and permit amendments, respectively).

A. **NPDES Permit Review Process Time Period:**

As of December 1999, USEPA Region 6 (consisting of the five states Arkansas, Louisiana, New Mexico, Oklahoma, Texas), currently has a 12-month NPDES permit processing "backlog" (http://www.epa.gov/owm/permits/backlog/charts.htm). The Texas Natural Resource Conservation Commission (TNRCC) administers the EPA Region 6 NPDES program as the "Texas Pollutant Discharge Elimination System" (TPDES). As summarized in the table below, the NPDES permit review process consists of multiple, sequential steps.

Summary of the NPDES Industrial Wastewater Discharge Permit Review Process

Item	NPDES Permit Review Process Step	Possible Duration	
0	Applicant must prepare NPDES permit application (new permit, amended permit, or renewal of expiring permit)	(submit at least 180 days before expiration)	
1	Initial administrative review upon receipt of NPDES permit application	TNRCC* target=	10 days
		EPA limit if "new source"=	30 days
		EPA limit if "existing source"=	60 days
2	File "Notice of Receipt" & "Declaration of Administrative Completeness" with Office of Chief Clerk, and mail to applicant, potentially affected landowners, other parties	10 days	
3	In-depth technical evaluation of NPDES permit application	105 days (source: TNRCC)	
4	Send "Notice of Deficiency" asking applicant to supply additional clarifying information	30 day response deadline	
5	Applicant responds to "Notice of Deficiency"	Within 8 days (source: TNRCC)	
6	Supply copies of NPDES permit application to EPA regional office, and/or state or local government agencies for review	45 days (90 days if extended) assume occurs parallel with item 3 above	
7	Complete in-depth technical evaluation and prepare draft permit	Included in item 3	
8	Forward draft permit to applicant for comment	14 day response deadline	
9	File the application & draft permit for issuance of public notice	Assume does not add days	
10	Applicant submits proof of newspaper publication	Assume does not add days	
11	Public may request a public hearing on draft NPDES permit	Within 30 days of item 9 (source: TNRCC)	
	Total if public hearing does not occur (items 1-11) =	207 to 257 days (30 to 37 weeks) (**7 to 8.5 months**)	
		RCRA 6-month exceedance = 1 to 2.5 months	

[22] NPDES = **National Pollutant Discharge Elimination System**, as codified at **40 CFR 122 to 133**, establishes the regulatory protocol for implementing the NPDES permitting program. The Federal Water Pollution Control Act of 1972 authorized the NPDES permit program, and it procedures have been amended by the 1977 Clean Water Act, and the 1987 Water Quality Act. NPDES permits contain a variety of quantitative and qualitative conditions developed to ensure that industrial wastewater discharges meet all applicable human health and environmental protection regulations. These conditions include numeric effluent limitations to control the level of specific pollutants (biochemical oxygen demand, total suspended solids, pH, fecal coliform, and oil and grease) that are, or may be, present in a facility's discharge. These limitations may be based either on treatment technologies demonstrated to reduce pollutant discharges, or for protection of ambient water quality. NPDES permits are issued for five year terms, after which they may be renewed.

12	Public hearing scheduled, notified, and conducted (if requested by public comment)	No earlier than 30 days after item 9 (40 CFR 124.10)
13	Public comment period after hearing closure	30 to 60 days (40 CFR 124.13,124.14)
14	Final consideration by Commission, & published in Texas Register	Assume does not add days
15	Permit approved & issued (with any changes), or denied	Assume does not add days
16	Public may request an evidentiary hearing on final permit	Within 30 days after item 14 (40 CFR 124.74)
17	Decision on final permit hearing request	Within 30 days after item 15 (40 CFR 124.75)
	Total with public hearing (items 1-17) =	297 to 377 days (42 to 54 weeks) (**10 to 12.5 months**)
		RCRA 6-month exceedance = 4 to 6.5 months

Explanatory Notes:
(a) * TNRCC = Texas Natural Resource Conservation Commission.
(b) Source for general description of the NPDES permit process: 40 CFR 124.
(c) Source for description of TNRCC's TPDES permit process:
http://www.tnrcc.state.tx.us/permitting/waterperm/wwperm/index.html
(d) The steps listed above do not necessarily represent all steps in the permit review process. For example, permit applications for "new sources" may require development of an environmental impact statement (40 CFR 122.29(c)).
(e) Additional information about the NPDES program is available at: http://www.epa.gov/owm/npdes.htm , and at http://www.epa.gov/owm/permits/pwcourse/manual.htm .

As of 1999, the TPDES permit application fee charged by TNRCC to an industrial facility for a new or amended wastewater discharge/disposal permit (for major facilities) is $2,050.

B. Wastewater Treatment System Construction Time Period:

With respect to the hypothetical "WWTU Option" for the OxyVinyl K174-containing wastewater, there is data contained in a recent USEPA report[23], relevant to the time required for construction of industrial wastewater systems for liquid wastes from the mineral processing industry. The report concluded that a **year or more** is required to construct on-site, an industrial wastewater treatment system consisting of three large tanks with piping/ pumps/ instrumentation/ electrics (for the three sequential treatment steps of (a) neutralization, (b) precipitation, and (c) sludge dewatering):

> "*[W]hen all the lead time is added [to the other timing considerations also enumerated], a year or more could be needed before the treatment system is operational.*"

To substantiate this conclusion, the report identified and quantified (in weeks/months), the following seven wastewater treatment system construction timing/scheduling elements:

Industrial Wastewater Treatment System Construction Period Timing Elements		
Item	Description of Construction Time Element	Weeks Required*
1	EPA assumes that large capacity tanks cannot be prefabricated and must be field erected requiring 7 to 10 weeks lead time.	7 to 10 weeks
2	Although these tanks could be field erected concurrently it is more likely that some work would be performed in tandem extending the time required to obtain and erect the tanks to as much as 15 to 30 weeks.	8 to 20 weeks (additional to item 1)
3	In addition, time must be allocated to install piping, pumps, electrical and instrumentation requiring approximately an additional 4 to 6 weeks.	4 to 6 weeks
4	After installation of equipment, additional time must be planned for testing and operational adjustments before the system is fully operational. This testing	4 weeks

[23] USEPA, "Appendix D: Estimate of Time Required to Build an Acid Waste Treatment System", Background Document for Analysis of the Land Disposal Restrictions – Phase IV: Underground Injection Data and Issues, Office of Ground Water and Drinking Water, April 1998.

	and adjustment could require as much as 4 weeks.	
5	Environmental permits (e.g. for air emissions and surface waste disposal) must be obtained, which may take weeks to months following construction and testing.**	3 to 52 weeks (3 "weeks" if < 1 month, to 52 weeks if 12-mos needed for NPDES under USEPA Region 6 NPDES review "backlog" as of Dec 1999)
6	In certain jurisdictions, building permits and other environmental permits must be obtained before construction may begin. This lead time may range from weeks to months.	3 to 12 weeks (3 "weeks" if < 1 month, to 12 weeks if 3-months needed for construction permit)
7	Other unforeseen delays such as those due to weather could increase the length of time to complete construction by additional months.	4 to 8 weeks (1 to 2 months illustratively)
	Total weeks required =	33 to 112 (**8 to 26 months**)
	Number of months exceeding RCRA statutory 6-month "effective date" for final rules =	**2 to 20 months**

Explanatory Notes:
(a) * Months converted to weeks, using conversion factor of 4.3 weeks per month.
(b) ** According to the description of TNRCC's TPDES (NPDES) permitting process, a request for authorization of construction must be included with the application for a new/amended industrial wastewater disposal/discharge permit. The authorization to construct is not considered by the TNRCC until TNRCC has declared the application administratively complete (i.e. all requested information has been provided in the permit application). After determined administratively complete, the application then undergoes (a) in-depth technical evaluation, (b) draft permit applicant notification period (2 weeks), (c) public notice period, (d) public comment period, and (e) USEPA Region 6 review period (45-days). (for more TNRCC info see: http://www.tnrcc/state.tx.us/water/quality/wwpermits).

Although this USEPA reference report addresses a particular type of on-site industrial wastewater -- corrosive (acid) mineral processing wastes -- it is sufficient for use as a case-study for purpose of generalizing to other types of industrial wastewaters, because at a basic design level, most all engineering systems for on-site treatment of industrial wastewaters, similarly consist of a series of interconnected tanks. To a large degree, it is the chemical treatment process within the tanks which varies from industry to industry, not the basic design components of the tank system.

ATTACHMENT F

PROFIT RATE DATA

INDUSTRY SALES & PROFIT PERFORMANCE (1992-1999)
Industrial Chemicals & Synthetics Manufacturing (SIC codes= 281+282+286)
Source: "Quarterly Financial Reports", US Bureau of the Census.
http://www.census.gov/csd/qfr/view/

				A. SALES REVENUES		B. AFTER-TAX PROF		C. PROFIT PERCENT	
Nr. of data years	Nr. of data quarters	Year	Quarter	Quarterly Sales Revenues ($millions)	Annual Sales Revenues ($millions)	Quarterly After-Tax Profit ($millions)	Annual After-Tax Profit ($millions)	Quarterly After-Tax Profit as % of Sales	Annual After-Tax Profit as % of Sales
1	1	1999	4Q	$38,796	$151,771	$1,361	$7,548	3.5%	5.0%
	2	1999	3Q	$37,255		$1,879		5.0%	
	3	1999	2Q	$39,067		$2,413		6.2%	
	4	1999	1Q	$36,653		$1,895		5.2%	
2	5	1998	4Q	$35,199	$146,511	$1,006	$7,931	2.9%	5.4%
	6	1998	3Q	$36,325		$1,388		3.8%	
	7	1998	2Q	$38,086		$2,800		7.4%	
	8	1998	1Q	$36,901		$2,737		7.4%	
3	9	1997	4Q	$38,981	$166,300	($88)	$9,594	-0.2%	5.8%
	10	1997	3Q	$41,730		$2,174		5.2%	
	11	1997	2Q	$43,536		$3,987		9.2%	
	12	1997	1Q	$42,053		$3,521		8.4%	
4	13	1996	4Q	$40,158	$162,486	$1,858	$8,480	4.6%	5.2%
	14	1996	3Q	$41,256		$3,402		8.2%	
	15	1996	2Q	$42,426		($226)		-0.5%	
	16	1996	1Q	$38,646		$3,446		8.9%	
5	17	1995	4Q	$38,252	$156,659	$810	$11,046	2.1%	7.1%
	18	1995	3Q	$38,413		$2,659		6.9%	
	19	1995	2Q	$40,699		$4,003		9.8%	
	20	1995	1Q	$39,295		$3,574		9.1%	
6	21	1994	4Q	$36,927	$140,447	$1,694	$8,418	4.6%	6.0%
	22	1994	3Q	$35,122		$2,504		7.1%	
	23	1994	2Q	$35,320		$2,121		6.0%	
	24	1994	1Q	$33,078		$2,099		6.3%	
7	25	1993	4Q	$30,533	$122,667	$382	$4,081	1.3%	3.3%
	26	1993	3Q	$30,608		$99		0.3%	
	27	1993	2Q	$31,592		$2,037		6.4%	
	28	1993	1Q	$29,934		$1,563		5.2%	
8	29	1992	4Q	$30,657	$122,545	($372)	($2,582)	-1.2%	-2.1%
	30	1992	3Q	$30,996		$1,599		5.2%	
	31	1992	2Q	$31,105		$1,965		6.3%	
	32	1992	1Q	$29,787		($5,774)		-19.4%	
Summary Statistics:									
Minimum				$29,787	$122,545	($5,774)	($2,582)	-19.38%	-2.11%
Mean				$36,543	$146,173	$1,704	$6,815	4.41%	4.45%
Median				$37,091	$149,141	$1,930	$8,175	5.22%	5.32%
Maximum				$43,536	$166,300	$4,003	$11,046	9.84%	7.05%
Range interval (max-min)				$13,749	$43,755	$9,777	$13,628	29.22%	9.16%
Standard deviation (sample)				$4,134	$16,717	$1,808	$4,285	5.25%	2.85%
Kurtosis				-1.09	-1.19	7.21	0.99	11.27	1.72
Skewness				-0.26	-0.41	-2.20	-1.44	-3.01	-1.71

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