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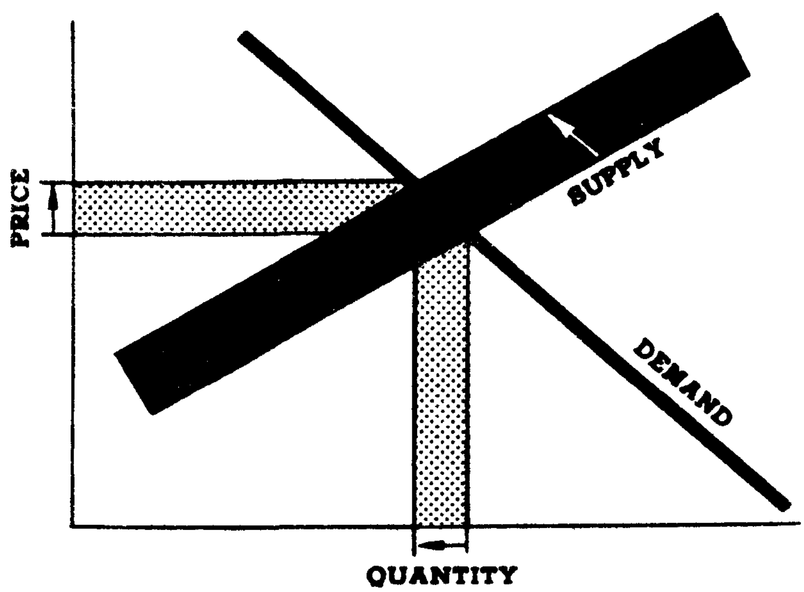
ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES

ON THE ELECTROLYTICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE INDUSTRIES; AND ON THE CALCIUM CARBIDE INDUSTRY



U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Planning and Evaluation
Washington, D.C. 20460

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ECONOMIC ANALYSIS

OF

EFFLUENT GUIDELINES

ON THE ELECTROLYTICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE INDUSTRIES; AND ON THE CALCIUM CARBIDE INDUSTRY

DECEMBER, 1974

OFFICE OF PLANNING AND EVALUATION
ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D. C. 20460

CONTRACT NO. 68-01-1545

PREFACE

The attached document is a contractor's study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under section 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposal of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68 01 1545, Task Order No. 4 by Kearney: Management Consultants. Work was completed as of December 20, 1974.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under sections 304(b) and 306 of the Act for the subject point source category. The study is not an official EPA publication. It will be considered along with the information contained in the Development Document and any comments revealed by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceedings or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF PLANNING AND EVALUATION

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ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES ON THE ELECTROLTYICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE INDUSTRIES; AND ON THE CALCIUM CARBIDE INDUSTRY

EXECUTIVE SUMMARY

ELECTROLYTICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE

Four firms operating five plants are currently manufacturing electrolytically produced chromium, manganese and synthetic manganese dioxide. Consumption of chromium metal was 5.2 thousand short tons in 1973. Of this, approximately 52% was imported. Consumption of manganese metal was 35.2 thousand short tons in 1973. Of this, approximately 6% was imported.

Where pure chromium or manganese is a requirement, there are no technically feasible substitutes. Where high grade manganese dioxide is a requirement, there is no economically feasible substitute product. These products are each produced by electrolytic methods.

The firms which produce electrolytic chromium, manganese and synthetic manganese dioxide are large and financially sound. Each of these firms is engaged not only in the production of electrolytic products, but also other ferroalloys, metals and industrial chemicals.

The demand for these electrolytically produced products is primarily derived from the demand for major end use products.

Prices are determined by supply and demand conditions.

The combined incremental total annual operating costs (those for 1977 plus those for 1983), for water pollution abatement on a per ton basis are less than 3% of the price for each product sidered.

The combined total incremental investment costs (those for 1977 plus those for 1983) as a percent of net earnings are in all cases less than 1%. Thus, these costs will not unduly burden the financial positions of the firms producing these products.

If these costs are "passed on" to end users, a significant decrease in the quantity demanded is not anticipated. This is because the demand for each of these electrolytic products is a "derived demand" and the costs of electrolytic products are a very small portion of the total manufacturing costs of the products that use them. Also, there are no technically feasible or economic direct substitutes, and the minor cost increase will not change the relative market share for imported products.

CALCIUM CARBIDE

The calcium carbide industry is comprised of four firms operating five installations. The latest estimate of 1973 calcium carbide production is 350,000 tons. The two principal end uses for calcium carbide are for the production of cyanamide and acetylene. There is no economic substitute for calcium carbide in the production of cyanamide. Petroleum based raw materials* may be substituted in the production of acetylene. These materials currently have over 25% of this market. However, this market share will decline as the price of petroleum based substitutes for calcium carbide increases relative to the price of calcium carbide, as is expected due to the current energy situation.

Calcium carbide is produced in modified electric arc reduction furnances. The firms which produce calcium carbide are large, diversified and financially sound.

The demand for calcium carbide is primarily derived from requirements for cyanamide and acetylene. Prices are primarily related to supply and demand conditions in these markets and the price and availability of petroleum based substitutes.

The combined incremental total annual operating costs (for 1977 plus those for 1983) for water pollution abatement on a per ton basis are less than .5% of the market price.

The combined incremental investment costs (for 1977 plus those for 1983) as a percent of net earnings are less than 1%. Thus, these costs will not unduly burden the financial positions of the firms producing calcium carbide.

If these costs are "passed on" to end users, a significant

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* Primarily natural gas and liquid hydrocarbon feeds.

decrease in the quantity demanded is not anticipated. This is because the demand is a "derived demand" and the price increase necessary to cover pollution control costs is minor. There are few technically feasible and economic substitutes, and the price of petroleum based substitutes is anticipated to increase more than the price of calcium carbide (with pollution control costs). Also, the minor cost increase will not change the relative market share for imports.

IMPACT
CONCLUSIONS

Costs associated with conforming to the proposed effluent guidelines are expected to be passed on to end users. The minor anticipated price increases are not expected to produce a significant decrease in shipments. No significant net effect on the earnings or profitability of the firms producing these products is expected. No closures or significant curtailment of operations nor reduction in industry employment are forecast.

ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES ON THE ELECTROLYTICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE INDUSTRIES; AND ON THE CALCIUM CARBIDE INDUSTRY

INTRODUCTION

This report assesses the economic impact of proposed effluent guidelines on establishments which electrolytically produce chromium (Cr), manganese (Mn), and synthetic manganese dioxide (MnO_2); and on establishments which produce calcium carbide (CaC_2) in modified electric arc reduction furnances. This report is divided into two sections. Section I deals with the electrolytically produced products and Section II with calcium carbide.

Capital recovery factors were used to prorate the total investment cost and debt service over the depreciable life of the capital equipment required to effect compliance with the proposed effluent guidelines. The capital recovery factor used for electrolytically produced chromium, manganese and synthetic manganese dioxide reflects an interest rate of 8% and a depreciable life of 15 years. The capital recovery factor used for calcium carbide relects an interest rate of 10% and a depreciable life of 15 years. These capital recovery factors are different than the capital recovery factor originally supplied by the Environmental Protection Agency reflecting an interest rate of 6% and a depreciable life of 10 years. This was done because an interest rate of 6% did not reflect market conditions and a depreciable life of

10 years was not consistent with prevailing Internal Revenue Service allowances.*

The two capital recovery factors used in this report differ from each other due to the prevailing capital market conditions at the time the two sections were written. The two different capital recovery factors are used in this interim final report. However, Kearney anticipates that the capital recovery factor used for the final report will reflect an interest rate of 10% and a depreciable life of 15 years for all industries considered. In any case, the difference in interest rates does not have any important effect on the conclusions of the impact analysis.

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* The EPA Technical Manager approved this approach.

SECTION I

ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES ON THE ELECTROLYTICALLY PRODUCED CHROMIUM, MANGANESE AND SYNTHETIC MANGANESE DIOXIDE INDUSTRIES - SIC 3313

INDUSTRY DESCRIPTION

Firms which electrolytically produce chromium, manganese and synthetic manganese dioxide are shown in Table I-1 below.

Table I-1

Firms Which Electrolytically Produce Cr, Mn, and MnO_2

Firm	Location	Product(s) Produced Cr	Mn	MnO_2
ESB, Inc.	Covington, Tennessee			x
Foote Mineral Company	New Johnsonville, Tennessee		x	
Kerr-McGee Chemical Company	Hamilton, Mississippi		x	
	Henderson, Nevada			x
Union Carbide Corporation	Marietta, Ohio	x	x	x

Source: Exhibit I-1.

These firms are part of the larger industry category of specialty ferroalloy producers shown in Exhibit I-1.

Consumption and imports of chromium metal and manganese metal from 1967 to 1973 are shown in Table I-2 on the following page.

Table I-2

Domestic Consumption and Imports of Selected Electrolytically Produced Ferroalloys
(Thousands of Short Tons)

	Average 1961 1966	1967	1968	1969	1970	1971	1972	1973 Pre.
Chromium Metal								
Total Consumption	N.A.	3.6	3.1	3.3	3.5	3.1	3.2	5.2
Imports	1.1	1.2	1.4	1.5	1.9	1.6	1.9	2.7
Percent of Total Consumption	N.A.	33.8	44.3	44.2	54.7	52.2	59.4	51.9
Manganese Metal								
Total Consumption	21.1	24.0	25.7	28.0	24.5	27.5	30.2	35.2
Imports	1.6	2.3	3.2	1.4	1.3	2.9	4.1	2.2
Percent of Total Consumption	7.5	9.7	12.4	4.9	5.2	10.5	13.6	6.3

Source: Statement for Relief from Excessive Imports, 1973; The Ferroalloys Association.

The data in Table I-2 indicate that until 1973 the consumption of chromium metal and manganese metal was fairly constant. The increase in consumption in 1973 is mainly attributable to large increases in the production of iron and steel castings and steel mill products.

Production, foreign trade and net consumption data for the larger class of specialty ferroalloys for 1972 are shown in Exhibit I-2.

PRINCIPAL APPLICATIONS AND POTENTIAL SUBSTITUTE PRODUCTS

(a) Chromium

Principal applications for chromium metal are as an alloying agent in the production of specialty ferrous products and in plating ferrous products. Metals such as nickel, cobalt, molybdenum, and titanium can be substituted for chromium in some alloys. However, the use of these substitutes frequently results in higher costs or decreased performance of the alloy. Generally where the requirement is for pure chromium, no technically feasible substitutes exist.

(b) Manganese

The major use of manganese metal is in the production of low carbon sheet steel, welding electrode coatings, primary aluminum and copper alloys, and manganese chemicals. Where pure manganese is required, no technically feasible substitutes exist.

(c) Synthetic Manganese Dioxide

Electrolytically produced synthetic manganese dioxide is principally used in the manufacture of dry cell batteries, particularly for the manganese-alkaline battery and the premium or heavy-duty Leclanché cells. This product can also be used in the manufacture of glass, and certain types of chemicals. High grade MnO_2 ore, (naturally occurring, called pyrolusite) can be used in battery production, but the resulting product is of lower quality.

Other types of batteries are manufactured that do not require manganese dioxide in any form. In all other applications, substitutes for synthetic manganese dioxide usually increase cost or alter the overall quality of the end product.

PRODUCTION TECHNIQUES

(a) Chromium

Electrolytic chromium is the purest form of the metal commercially available, 99+% pure. It is produced by electrolysis from one of several electrolytes containing chromium. Approximately 75% of the electrolytic production utilizes a chromium-alum solution.

(b) Manganese

Manganese metal is produced by electrolytic methods. High grade manganese ore and slag generated during the electric furnace production of ferromanganese are used as raw material inputs.

(c) Synthetic Manganese Dioxide

Synthetic manganese dioxide of high purity is produced by electrolytic means. Manganese ore is first dried and calcined. It is then leached with depleted cell solution to generate new cell solution and then plated out. This process is separate and distinct from the electrolytic manganese production process.

FINANCIAL CHARACTERISTICS OF THE FIRMS IN THE INDUSTRY

Financial profiles of the producers of specialty ferroalloys for 1973 are shown in Exhibit I-3. The 1973 financial profiles of the producers of electrolytic chromium, electrolytic manganese and electrolytic synthetic manganese dioxide are presented in Table I-3.

Table I-3

Financial Profiles of Electrolytic Chromium Manganese and Synthetic Manganese Dioxide Producers - 1973(1)

Company	Plant Location	Net Sales ($ Millions)	Net Earnings ($ Millions)	Equity ($ Millions)	Earnings as a Percent of Sales	Earnings as a Percent of Equity	Total Employees
ESB, Inc	Covington, Tennessee	436.0	19.3	156.0	4 4	12.4	17 000
Foote Mineral Company	New Johnsonville, Tennessee	87 0	2.8	58 7	3 2	4 8	2,122
Kerr-McGee Chemical Company	Hamilton, Mississippi	728 0	62 8	558.6	8.6	11.2	8,966
	Henderson, Nevada						
Union Carbide Corporation	Marietta, Ohio	3,938 8	290.9	2,105.2	7 4	13 8	109,417

Note: (1) No information is available on specific investment and earnings of these companies as related to sales of electrolytically produced chromium, manganese and synthetic manganese dioxide. The reason for this is that these products constitute a small portion of the total investment and earnings of these producers. It is Kearney's understanding that production of these products is profitable.

Source: Exhibit I-3.

Each of these firms is engaged not only in the production of electrolytic products, but also other ferroalloys, metals and industrial chemicals.

PRICING ANALYSIS

The demand for electrolytically produced chromium is derived from the demand for plating ferrous products and the production of iron alloys and steel requiring high purity chrome. The demand for electrolytically produced manganese is derived from the demand for low carbon sheet steel, welding electrode coatings, and primary aluminum and copper alloys. The demand for synthetic manganese dioxide is almost exclusively determined by the requirement for dry cell batteries. Therefore, the prices of the electrolytic products considered in this report are primarily determined by supply and demand conditions in these markets. Other factors affecting price are purity in the case of chromium and manganese, and volume discounts for large bulk purchases.

Historically, the quantity sold has been insensitive to price increases because of the small portion of the cost of end use products represented by these electrolytically produced products.

Recent quotes for these special ferroalloys are: chromium, $2.10 per pound; manganese, $0.39 per pound; and synthetic manganese dioxide $0.30 per pound.* High grade MnO_2 ore (pyrolusite) was recently quoted at $0.08 per pound.* However, as pointed out previously, synthetic manganese dioxide and high grade MnO_2 ore are not directly competitive in most instances.

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* Quotations are from major current producers.

TECHNICAL AND COST DATA BASE

Kearney was provided costs of meeting the proposed effluent guidelines by EPA through its technical contractor, Datagraphics, Inc. Exhibit I-4 presents costs to meet Level I, or Best Practicable Control Technology Currently Available (BPCTCA); and Level II, or Best Available Control Technology Economically Achievable (BACTEA) as calculated by Datagraphics, Inc.

The annual costs were developed by calculating the annual capital costs for 15 years at 8% interest and adding the operating costs.

IMPACT ANALYSIS

The combined incremental total annual operating costs, (those for 1977 plus those for 1983), for water pollution abatement on a per ton basis by product are presented in Table I-4 shown below.

Table I-4

Combined Incremental Total Annual Operating Costs

Product	Increased Annual Operating Cost per Ton Due to Pollution Abatement	Price per Ton	Cost as a Percent of Price
Chromium	$52.12	$4,200.00	1.24%
Manganese	20.02	780.00	2.57
Synthetic Manganese Dioxide	15.96	600.00	2.66

Source: Exhibit I-4.

If the entire increased annual costs are "passed on" to the users of electrolytic chromium, manganese, and synthetic manganese dioxide they would represent less than a 3% price increase.

The combined total incremental investment costs (those for 1977 plus those for 1983), on a typical capacity tonnage basis, by product are shown in Table I-5.

Table I-5

Combined Incremental Investment Costs for Pollution Control (BPT plus BAT)

Product	Tonnage(1)	Total Investment Cost(2) ($ Millions)	Net Earnings(3) ($ Millions)	Total Investment as a Percent of Net Earnings(4)
Cr	3,000	.30	300	0.1%
Mn	9,000	.34	50	0.7
MnO	5,500	.15	50	0.3

Notes: (1) Tonnage figures approximate single producer capacity, a weighted average of the capacities of all producers, or a typical tonnage.
(2) The 1977 investment cost per input product ton plus the 1983 investment cost per input product ton as cited in Exhibit I-4 multiplied by tonnage.
(3) Net earnings figures approximate single producer earnings, a weighted average of the earnings of all producers or typical net earnings.
(4) Calculated by dividing total investment costs by net earnings.

Sources: Exhibits I-3 and I-4.

Thus, the combined total incremental investment cost for water pollution abatement systems will not unduly burden the financial positions of the firms producing electrolytic chromium, electrolytic manganese and electrolytic synthetic manganese dioxide.

If all costs associated with conforming to the proposed effluent guidelines are "passed on" to end users in the form of price increases, a significant decrease in demand is not anticipated due to the following factors.

1. The demand for each of the electrolytic products is primarily a "derived demand."

2. The costs of electrolytic products are a very small portion of the total manufacturing costs of the products that use them.

3. There are few feasible or economic substitutes for electrolytically produced products in most applications.

4. The minor anticipated price increase is not expected to substantially change the relative demand for imports of these electrolytically produced products.

IMPACT CONCLUSIONS

The costs associated with conforming to the proposed effluent guidelines are expected to be passed on to end users. The minor anticipated price increases are not expected to produce a significant decrease in shipments. No significant net effect on the earnings or profitability of the firms producing these products is expected. No closures or significant curtailment of operations and reduction in industry employment are forecast.

ENVIRONMENTAL PROTECTION AGENCY

PRODUCERS OF SPECIALTY FERROALLOYS

Company	Plant	Products									
		Cr	Mn	MnO_2	FeB	FeCb	FeMn	FeMo	FeTi	FeW	FeV
Climax Molybdenum	Langeloth, Pa.							A			
Diamond Shamrock Corp.	Kingwood, W. Va.						C				
ESB, Inc.	Covington, Tenn.			C							
Foote Mineral Co.	New Johnsonville, Tenn.		C								
Kawecki Chemical Co.	Easton, Pa.					A					
Kerr-McGee Chemical Company	Hamilton, Miss.		C								
	Henderson, Nev.			C							
Mobil Chemical Co.	Nichols, Fla					A					
Molybdenum Corp.	Washington, Pa.					A		A		A	
Monsanto Chemical Company	Columbia, Tenn.							A			
Reading Alloys Co.	Robesonia, Pa.					A					A
Shieldalloy Corp.	Newfield, N. J.				A	A			A		A
Union Carbide Corp.	Marietta, Ohio	C	C	C							

Notes: A - Aluminothermic Process
C - Electrolytic Process

Sources: 1972 Minerals Yearbook, Preprint, EG/EPA and Datagraphics, Inc.

EXHIBIT I-1

ENVIRONMENTAL PROTECTION AGENCY

1972 PRODUCTION DATA OF SPECIALTY FERROALLOYS

	U.S. Production	Imports	Exports	Net Consumption
Chromium Metal	N.A.	1.9	N.A.	3,200
Manganese Metal	23,200	N.A.	N.A.	29,949 (1)
Manganese Dioxide	N.A.	N.A.	N.A.	N.A.
Ferroboron	N.A.	N.A.	N.A.	368
Ferrocolumbium	737	N.A.	N.A.	1,721
Ferromanganese	N.A.	N.A.	N.A.	N.A.
Ferromolybdenum	N.A.	N.A.	454	4,489
Ferrotitanium	938	23 (2)	N.A.	6,169 (3)
Ferrotungsten	N.A.	407	11	619
Ferrovanadium	N.A.	334	269	4,493

Notes: (1) Gross Weight
(2) Calculated, based on 25.7% average contained element.
(3) Includes scrap Titanium Metal.

Source: 1972 Minerals Yearbook, Preprint.

ENVIRONMENTAL PROTECTION AGENCY

1973 FINANCIAL PROFILES OF FERROALLOY PRODUCERS - SIC 3313

Company	Plant Location	Net Sales ($ Millions)	Net Earnings ($ Millions)	Equity ($ Millions)	Earnings Percent of Sales	Earnings Percent of Equity	Total Employees
Climax Molybdenum Co.	Langeloth, Pa.	$ 1,336.8	$105.1	$ 840.4	7.9%	12.5%	17.940
Diamond Shamrock Corp.	Kingwood, W. Va.	651.1	50.5	412.3	7.8	12.2	9,295
ESB Inc. (1)	Covington, Tenn.	436.0	19.3	156.0	4.4	12.4	17,000
Foote Mineral Co.	New Johnsonville, Tenn.	87.0	2.8	58.7	3.2	4.8	2,122
Kawecki Chemical Co.	Easton, Pa.	86.7	4.7	49.7	5.4	9.5	1,800 (2)
Kerr-McGee Chemical Co.	Hamilton, Miss. Henderson, Nev.	728.0	62.8	558.6	8.6	11.2	8,966
Mobil Chemical Co.	Nichols, Fla.	12,755.6	849.3	5,714.8	6.7	14.9	73,900
Molybdenum Corp.	Washington, Pa.						
Monsanto Chemical Co.	Columbia, Tenn.	2,647.7	238.3	1,496.2	9.0	15.9	58,277
Reading Alloys Co.	Robesonia, Pa.	N/A (3)	N/A	N/A	N/A	N/A	N/A
Shieldalloy Co.	Newfield, N. J.	18.0	N/A	1.5	N/A	N/A	180
Union Carbide Corp.	Marietta, Ohio	3,938.8	290.9	2,105.2	7.4	13.8	109,417

Notes: (1) Fiscal year ended March 31, 1974.
(2) As of December 31, 1970.
(3) N/A is not available.

Source: Annual Reports.

EXHIBIT I-3

ENVIRONMENTAL PROTECTION AGENCY

INCREMENTAL COST DATA FOR WASTE WATER TREATMENT

Product	1977		1983		NSPS	
	Investment Cost/Annual IPT(1)	Annual Cost/Ton	Investment Cost/Annual IPT(1)	Annual Cost/Ton	Investment Cost/Annual IPT(1)	Annual Cost/Ton
Cr	\$90.71	\$47.43	\$8.96	\$4.69	\$157.62	\$59.16
Mn	29.79	15.57	8.51	4.45	92.33	30.68
MnO_2	23.40	12.24	7.11	3.72	30.51	15.95

Note: (1) Based on an annual input product tonnage (IPT) of:

	1977	1983	NSPS
Cr	3,068	3,068	3,068
Mn	9,048	9,048	9,410
MnO_2	5,876	5,876	5,876

Source: EG/EPA and Datagraphics, Inc.

EXHIBIT I-4

SECTION II

ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES ON THE CALCIUM CARBIDE INDUSTRY - SIC 2819912

INDUSTRY DESCRIPTION

The calcium carbide industry is comprised of four firms operating five installations as shown in Table II-1.

Table II-1

Calcium Carbide Producers

Firm Name	Plant Location
Airco Alloys & Carbide Division, Airco, Inc.	Louisville, Kentucky
Chemetron, Midwest Carbide Corp.	Koekirk, Iowa Pryor, Oklahoma
Pacific Carbide & Alloys Corp.	Portland, Oregon
Union Carbide Corporation, Ferroalloys Division	Ashtabula, Ohio

Source: EG/EPA, Datagraphics, Inc., and annual reports.

Of these four firms, three are large diversified firms. Very little information is available for Pacific Carbide & Alloys Corporation.

Airco, Inc. intends to resume production of calcium carbide at its Calvert City, Kentucky plant in the near future.

The latest estimate of total 1973 calcium carbide production is 350,000 tons. Total calcium carbide production, shipments and value of shipments for the years 1968 through 1972 are presented in Table II-2 on the following page.

Table II-2

Calcium Carbide Production, Shipments and Value of Shipments

Year	Production (Tons)	Shipments (Tons)	Value ($)
1968	942,098	596,376	$56,002,000
1969	856,039	514,172	40,354,000
1970	791,346	503,172	41,046,000
1971	625,338	455,876	40,906,000
1972	493,418	354,972	24,619,000

Source: Exhibit II-1.

Over this five year period production steadily declined. The total decline was approximately 47.6%. Similarly, shipments steadily declined 40.4% and the value of shipments dropped by 56.1%. These declines occurred due to the substitution of cheaper petroleum based raw materials in the production of acetylene. This downward trend will stop or reverse as the price of petroleum based substitutes* for calcium carbide increases relative to the price of calcium carbide.

PRINCIPAL APPLICATIONS AND POTENTIAL SUBSTITUTE PRODUCTS

The two principal end uses for calcium carbide are for the production of cyanamide and acetylene. Calcium carbide is heated in an atmosphere of nitrogen to produce cyanamide. Cyanamide is

* Primarily natural gas and liquid hydrocarbon feeds.

used as a raw material in the chemical process industries and agriculture. Acetylene is produced by reacting calcium carbide with water. Acetylene is used in metalworking applications such as cutting and welding and as a chemical feed stock.

Other markets for calcium carbide include uses as a reducing agent in some metallurgical processes, a desulfurizing agent for ductile iron treatment, and as a drying agent in various applications. These are minor markets in comparison to cyanamide and acetylene.

There is no direct economic substitute for calcium carbide in the production of cyanamide.

Acetylene for use as a chemical raw material can be generated from natural gas or liquid hydrocarbon feeds. This is more economical in the case of many large scale chemical plants. Acetylene produced from natural gas (petro-acetylene) currently accounts for in excess of 25% of the acetylene market. However, in other cases, calcium carbide has a cost advantage. Rising natural gas prices will tend to reduce any petro-acetylene cost advantage.

FOREIGN TRADE

Detailed calcium carbide import and export data is not available. However, information from producers indicates that imports and exports represent only a minor portion of total domestic consumption and production respectively.

PRODUCTION TECHNIQUES

Calcium carbide (CaC_2) is an inorganic chemical made from quicklime and carbon. Quicklime is prepared by burning limestone. Carbon is most frequently obtained from coke, although it can also be obtained from anthracite or petroleum coke.

Molten calcium carbide is produced in modified electric arc reduction furnaces. These furnaces are continuously charged and are tapped directly into chill pots of approximately five-ton capacity on a continuous or intermittent schedule. After solidifying, the calcium carbide is crushed, sized and packed for shipment. Shipping sizes range from ten pounds to five tons.

FINANCIAL CHARACTERISTICS OF FIRMS IN THE INDUSTRY

Airco, Inc., Chemetron and Union Carbide Corporation had a composite margin on sales of 6.6% in 1972. This compares with an average 1973 margin on sales of 6.9% for 82 companies in the chemical process industry.* The return on net worth of these calcium carbide companies was 12.6% in 1973. This compares with an average 1973 return on net worth of 15.0% for 82 companies in the chemical process industry.* Detailed financial data for Airco, Inc., Chemetron and Union Carbide Corporation is presented in Exhibit II-2. Financial data is not available for Pacific Carbide and Alloys Corporation. No information is available on

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* Monthly Economic Letter of the First National City Bank, April, 1974.

investment and earnings of these companies as related to sales of calcium carbide. The reason for this is that calcium carbide constitutes a small portion of the investment and earnings of these producers. It is Kearney's understanding that the production of calcium carbide is profitable.

PRICING ANALYSIS

Producers attempt to price on the basis of manufacturing costs. Raw materials typically account for 80% of total calcium carbide production costs. The remaining costs, referred to as conversion costs, include labor, maintenance, power, etc. This industry is extremely sensitive to the price of coal as it provides three vital ingredients which are coke, carbon electrodes and very often electric power.

The demand for calcium carbide is primarily derived from the demand for cyanamide and acetylene. Therefore, the price of calcium carbide is directly related to supply and demand conditions in these markets and the price and availability of petroleum based substitutes. The current price of calcium carbide is approximately $180 per ton.*

TECHNICAL AND COST DATA BASE

Sources of water pollution are wet air pollution devices and contact cooling. Many modern carbide furnaces are "closed" in

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* Quotations are from a major current producer.

that almost all of the by-product gas (carbon monoxide), is collected and utilized.

Kearney was provided costs of meeting the proposed effluent guidelines by EPA through its technical contractor, Datagraphics, Inc. Exhibit II-3 presents costs to meet Level I, or Best Practicable Control Technology Currently Available (BPCTCA), and Level II, or Best Available Control Technology Economically Achievable (BACTEA) as calculated by Datagraphics, Inc. These costs have been calculated applying the "6/10 Rule" to the investment costs supplied by EPA when appropriate. Total annual operating costs include annualized capital charges (interest and depreciation) and actual operating costs. The capital charges included in the total annual costs are based on 10% and 15 years.

IMPACT ANALYSIS

The combined incremental total annual operating costs (for 1977 plus those for 1983) for water pollution abatement per capacity ton range from 18 to 38 cents. If this entire cost increase is "passed on" to calcium carbide customers it represents a 0.2% increase based on a selling price of $180 per ton.

The combined incremental investment costs (for 1977 plus those for 1983) as a percentage of 1972 net earnings (for the three firms where financial information is available) range from 0.035% to 0.936%. These costs per capacity ton range from $0.62 to $1.62. Based on a selling price of $180 per ton this is less than 1%.

If all costs associated with conforming to the proposed effluent guidelines are "passed on" to end users in the form of price increases, a significant decrease in demand is not anticipated for the following reasons.

1. The demand for calcium carbide is primarily a "derived demand."

2. The anticipated price increase necessary to cover pollution control costs is minor.

3. There are few feasible and economic substitutes for calcium carbide. Where petroleum based substitutes are technically feasible and economic, the price of these substitutes is anticipated to increase relative to the price of calcium carbide (with pollution control costs).

4. Imports are presently not a factor in this market. The minor price increase anticipated will not change the relative demand for imports.

IMPACT CONCLUSIONS

The costs associated with conforming to the proposed effluent guidelines are expected to be passed on to end users. The minor anticipated price increase is not expected to produce a significant decrease in shipments. No significant net effect on the earnings or profitability of the firms producing calcium carbide is expected. No closures or significant curtailment of operations and reduction in industry employment are forecast.

ENVIRONMENTAL PROTECTION AGENCY

ANNUAL PRODUCTION AND SHIPMENTS OF CALCIUM CARBIDE (CaC_2)
(Quantity Figures - Short Tons, Values in Thousands of Dollars)

Year	Number of Establishments	Total Production Quantity	Total Shipments (Includes Interplant Transfers)			Commericial Shipments Only			Imports			Apparent Consumption	
			Quantity	Value (fob Plant)	Average Price/Ton	Quantity	Value (fob Plant)	Average Price/Ton	Quantity	Value (In Foreign Country)	Average Price/Ton	Quantity	Value
1963	(N/A)	1,109,109	641,391	60,697	94.63	284,554	25,103	88.22	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1964	11	1,131,659	689,737	62,608	90.77	241,083	21,293	88.32	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1965	11	1,098,003	643,767	57,404	89.17	278,701	22,225	79.74	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1966	11	1,063,202	586,966	51,299	87.40	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1967	11	912,293	564,392	53,184	94.23	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1968	8	942,098	596,376	56,002	93.90	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1969	8	856,039	514,172	40,354	78.48	(D)	(D)	(N/A)	17,876	1,215	67.97	532,048	41,569
1970	8	791,346	503,967	41,046	81.45	(D)	(D)	(N/A)	18,649	1,301	69.76	522,616	42,347
1971	7	625,338	455,876	40,906	89.73	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1972	7	493,418	354,972	24,619	69.35	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
1973	(N/A)	298,884(P)	(N/A)	(N/A)	(N/A)	(D)	(D)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)

Notes: (D) Withheld to avoid disclosing figures for individual companies.

(N/A) Not available.

(P) Preliminary.

Source: Current Industrial Reports: Inorganic Chemicals, Series: M28A.

EXHIBIT II-1

ENVIRONMENTAL PROTECTION AGENCY

1973 FINANCIAL PROFILES OF CALCIUM CARBIDE PRODUCERS (OR THEIR PARENT COMPANIES)

	Net Sales ($ Millions)	Earnings ($ Millions)	Equity ($ Millions)	Earnings as a Percent of Sales	Earnings as a Percent of Equity	Current Assets ($ Millions)	Current Ratio	Working Capital ($ Millions)
Airco, Inc.	584.8	19.1	266.1	3.3	7.2	249.7	3.30	174.0
Chemetron (Midwest Carbide Corp.)	364.1	10.4	167.4	2.9	6.2	146.3	2.64	90.9
Pacific Carbide & Alloys Co.	N/A(1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Union Carbide Corp.	3,938.8	290.9	2,105.2	7.4	13.8	2,022.4	2.46	1,201.8

Note: (1) N/A is not available.

Source: Annual reports.

EXHIBIT II-2

ENVIRONMENTAL PROTECTION AGENCY

INVESTMENT AND TOTAL ANNUAL OPERATING COSTS FOR WATER POLLUTION CONTROL FOR CALCIUM CARBIDE PRODUCERS

			BPT - 1977 [1]		BAT - 1983 [1]	
Company	Location	Capacity Thousand Tons (2)	Investment Cost	Total Annual Operating Cost	Investment Cost	Total Annual Operating Cost
Airco, Inc.	Louisville, Ky.	150	$10,000 [3]	$6,456 [4]	$68,000 [3]	$26,040 [4]
Chemetron (Midwest Carbide Corp.)	Keokuk, Iowa	30	4,500	1,941	36,758	8,250
	Pryor, Okla.	50	6,096	3,050	50,000	12,273
Pacific Carbide & Alloys Co.	Portland, Ore.	20	3,518	1,360	28,833	6,072
Union Carbide Corp.	Ashtabula, Ohio	200 [5]	-0- [6]	-0- [6]	100,000 [4]	35,947 [4]

Notes:
(1) BPT = Best practicable control technology currently available.
BAT = Best available control technology economically achievable.
(2) Sources of capacities: EG/EPA.
(3) Actual figures obtained by EG/EPA, and supplied to Kearney.
(4) Recalculated using Crf (10%, 15 yrs.), Original data reflected Crf (6%, 10 yrs.).
(5) CaC_2 capacity calculated.
(6) Assumed zero.

Sources: EG/EPA and Datagraphics, Inc.