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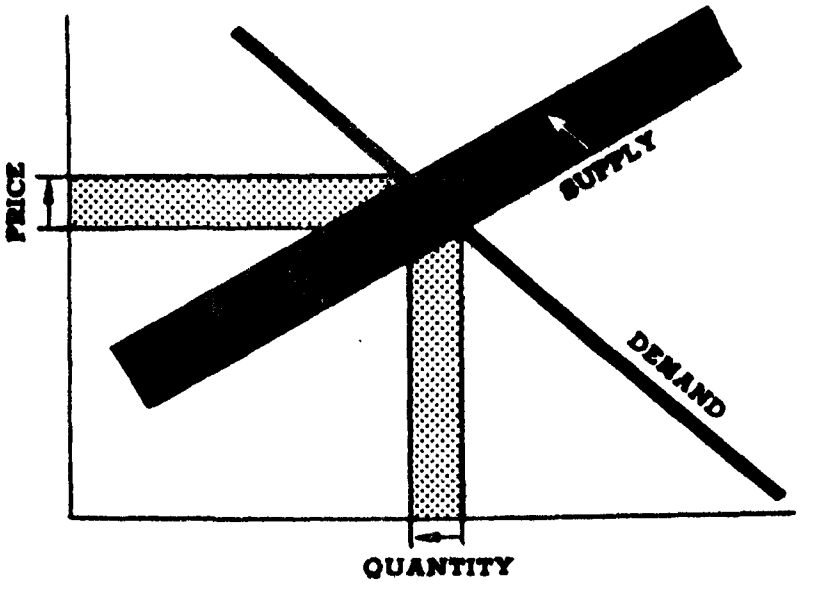
MARCH, 1975

ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES

THE METAL FINISHING INDUSTRY

APPENDIX - E



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

EPA - 230/1-74-032

ECONOMIC ANALYSIS
OF
THE PROPOSED EFFLUENT GUIDELINES

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OFFICE OF PLANNING AND EVALUATION
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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 sections 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 feasbility 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 a modification of an EPA contract. Work was completed as of March 1975.

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 received 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 proceeding 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.

LIST OF TABLES (con't)

LIST OF EXHIBITS

ENVIRONMENTAL PROTECTION AGENCY

APPENDIX E

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX E

ECONOMIC IMPACT OF PROPOSED REVISED EFFLUENT GUIDELINES AND COSTS ON METAL FINISHING INDUSTRY ESTABLISHMENTS IN THE 1-4 EMPLOYEE AND 5-9 EMPLOYEE MODEL PLANT SIZE CATEGORIES

INTRODUCTION

On February 25, 1975 the Environmental Protection Agency furnished Kearney capital investment and annual costs based on proposed revised BPT effluent guidelines containing a general variance for small establishments. This variance is less stringent than the original BPT standards. The establishments included are the 1-4* employee and 5-9* employee establishments. This appendix discusses changes in economic impact which will result from these revised effluent guidelines and costs.** The revised effluent guidelines and costs apply to establishments which are municipal and direct dischargers, and Kearney's analysis will be conducted for both types of establishments. A separate section is devoted to the direct dischargers as described in Tab D.

REVISED COST ESTIMATES

The original proposed effluent guidelines and associated

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* Establishment size category by total number of employees.

** Changes in economic impact that will occur relative to the economic impact analysis presented in Kearney's September, 1974 report to EPA entitled "Economic Analysis of Proposed Effluent Guidelines - the Metal Finishing Industries." This report will hereafter be referred to as "the Metal Finishing Report."

costs were developed for the metal finishing industry by EPA through its technical contractor, Battelle Columbus Laboratories. EPA, through this technical contractor, provided Kearney with capital investment costs and variable operating costs for meeting BPT effluent limitations. The original BPT costs prepared by Battelle Columbus Laboratories were based on a water pollution abatement technique which included the capability of achieving the destruction of oxidizable cyanides, reduction of hexavalent chromium, neutralization of acid and alkali wastes and removal of all but small amounts of heavy metal pollutants. These costs were scaled to model plants based on establishment size by number of employees and four plant process types (which were characterized as plant process types A, B, C and D).* The original capital equipment cost estimates by establishment size and plant process type are presented in Table E-1 on the following page.

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* A detailed technical description of the four plant process types is presented in the Metal Finishing Report, Section V, Page V-31, under the heading "Model Plants Production Processes."

Table E-1

Summary of Original BPT Capital Costs
Alternate A - 1977(1)

Model Plant Size (Employees)(2)	Process Group Segment A	B	C	D
1 - 4	$33,469	$43,930	$50,946	$61,961
5 - 9	49,201	60,349	71,877	81,756

Notes: (1) This table is constructed from Table V-5 of the Metal Finishing Report.
(2) Figures are presented for only those establishment size segments where EPA revised effluent guidelines and costs.

Source: Table V-5 of the Metal Finishing Report.

The original annual operating costs by establishment size and plant process type are presented in Table E-2 below.

Table E-2

Summary of Original BPT Annual Costs
Alternate A - 1977(1)
(1973 Price Levels)

Annual Costs	Model Plant Size (Employees) and Process Segment 1-4 A	B	C	D	5-9 A	B	C	D
Fixed:								
Cost of Capital(2)	$ 1,765	$ 2,317	$ 2,686	$ 3,267	$ 2,095	$ 3,183	$ 3,791	$ 4,311
Depreciation(3)	3,530	4,634	5,374	6,536	5,190	6,366	7,582	8,624
Labor(3)	4,000	4,000	4,000	4,000	12,000	12,000	12,000	12,000
Variable Costs(4)	1,523	2,689	3,550	3,960	5,116	10,728	9,790	14,231
Total Costs	$10,818	$13,640	$15,610	$17,763	$24,401	$32,277	$33,163	$39,166
1973 Dollars(5)	$10,255	$12,930	$14,800	$16,840	$23,132	$30,600	$31,400	$37,130

Notes: (1) This table is constructed from Exhibits V-8 through V-11 of the Metal Finishing Report.
(2) Source is Exhibit V-7 of the Metal Finishing Report.
(3) Source is Exhibit V-7 of the Metal Finishing Report.
(4) Exhibit V-7 and variable costs adjusted for average employment in Plant Groups as explained in Exhibits V-8 through V-11 of the Metal Finishing Report.
(5) Totals adjusted by a factor of .948 to reflect 1973 dollars.

Sources: Exhibits V-7 through V-11 of the Metal Finishing Report.

On February 26, 1975 EPA furnished Kearney new capital investment and variable operating costs for meeting BPT effluent limitations in the 1-4 employee and 5-9 employee model plant size categories. These costs are based on the assumption that the water usage rate will be 160 liters per square meter and that the water pollution abatement technique will destroy cyanides and equalize and neutralize the flow. EPA stated that this technique would apply to all establishments in the 1-4 employee and 5-9 employee model plant size categories regardless of plant process type, and calculated a range of costs.*

The revised capital equipment cost estimates by establishment size are presented in Table E-3.

Table E-3

Summary of Revised BPT Capital Costs
Alternate A - 1977
(1973 Price Levels)

Model Plant Size (Employees)	Range of BPT Capital Costs	
	Lower Bound	Upper Bound
1 - 4	$13,700	$20,500
5 - 9	35,600	53,300

Note: This table corresponds to Table V-5 of the Metal Finishing Report.

Source: EPA, February 26, 1975.

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* The range of costs reflected a lower and upper pollution control cost limit to account for differences resulting from the various plant process types. No precise cost estimates were provided by plant process type. These will hereafter be referred to as the "lower bound" and "upper bound" of pollution control costs.

Note that the range of revised BPT capital costs is substantially lower than the range of original BPT capital costs, representing a 59.1% reduction at the lower bound and a 66.9% reduction at the upper bound in the 1-4 employee establishment size category; and a 27.6% reduction at the lower bound and a 34.8% reduction at the upper bound in the 5-9 employee establishment size category.

The revised annual operating costs by establishment size provided by EPA included operating and maintenance costs, without interest and depreciation. These costs are presented in Table E-4.

Table E-4

Summary of Revised BPT Operating and Maintenance Costs
Alternate A - 1977
(1973 Price Levels)

Model Plant Size (Employees)	Range of BPT Annual Operating and Maintenance Costs	
	Lower Bound	Upper Bound
1 - 4	$3,900	$6,500
5 - 9	4,300	7,100

Source: EPA, February 26, 1975.

A comparison of the revised BPT annual costs presented in Table E-4 and the original labor and variable costs presented in Table E-2 indicates that the range of revised BPT annual costs is substantially lower than the range of original BPT annual costs. This represents a 29.4% reduction at the lower bound an 18.3% reduction at the upper bound in the 1-4 employee

establishment size category; and a 74.8% reduction at the lower bound and a 72.9% reduction at the upper bound in the 5-9 employee establishment size category.

Revised cost of capital and depreciation can be calculated from the figures presented in Tables E-3 and E-4. Cost of capital, depreciation and operating costs constitute the revised BPT annual costs which are presented in Table E-5.

Table E-5

Summary of Revised BPT Annual Costs
Alternate A - 1977(1)

Annual Costs	Range of BPT Annual Costs by Model Plant Size (Employees) 1-4 Lower Bound	1-4 Upper Bound	5-9 Lower Bound	5-9 Upper Bound
Cost of Capital(2)	$ 685	$1,025	$1,780	$ 2,665
Depreciation(3)	1,370	2,050	3,560	5,330
Operating Costs(4)	3,900	6,500	4,300	7,100
Total Annual Costs	$5,955	$9,575	$9,640	$15,095

Notes: (1) This table corresponds to Exhibits V-8 through V-11 of the Metal Finishing Report.
(2) The cost of capital is calculated on the basis of 10% of average investment. Average investment is equal to one-half of the initial capital cost.
(3) Straight-line depreciation--10 year life.
(4) As furnished by the EPA on 2/26/75.

Sources: Tables E-3 and E-4 and Kearney calculations.

The revised cost figures cited in Tables E-3, E-4, and E-5 will be used as the basis for calculating the revised estimate of economic impact.

IMPACT ANALYSIS

The following assumptions have been made in Kearney's estimate of economic impact based on the revised effluent guidelines and costs furnished by EPA.

1. The revised BPT effluent guidelines and costs apply to 1977 only. They do not apply to 1983 standards. The 1983 standards have not been considered in this appendix.

2. All industry conditions, as described in Sections I, II and III of the Metal Finishing Report, are expected to remain unchanged.

3. The baseline industry forecast, as presented in Section VI-A of the Metal Finishing Report, is assumed to remain constant. Under these conditions the 1977 baseline forecast of the number of establishments in the 1-4 employee size category is 328 and the 5-9 employee size category is 140.

4. The impact framework, as presented in Section IV of the Metal Finishing Report, will be used as the basis for calculation of economic impact.

(a) Price Effects

Price determination factors, as presented in Section VI-B of the Metal Finishing Report, are assumed to remain unchanged. The market price resulting from the revised costs of meeting effluent guidelines will be determined by the costs incurred by the industry.

It should be noted at this point that the price increases in Tables VI-10 through VI-13 of the Metal Finishing Report were utilized to develop an estimate of the market price increase for each process segment. The price increases calculated for each process segment were determined by weighting the price change per establishment size by market share for those establishments which have the lowest estimated treatment costs and represent 80% or more of industry capacity. These were the establishments with 20 or more employees. Therefore, the market price increases for the 10 employees and under establishments were not a factor in the determination of the market price increases used for analysis in the original Metal Finishing Report.

Price increase factors will be calculated for the 1-4 employee and 5-9 employee model plant size categories to show the price levels which must be attained to recover the costs associated with the revised effluent guidelines. These price increase factors should be used only to gain an understanding of the order of magnitude of required price increases in these size categories. The estimated market price increases will remain the same as those presented in the original Metal Finishing Report, as lower costs for smaller plants will result in only minor second order changes in industry market prices due to the relatively small sales volume of small establishments and the nature of the market. Kearney believes that the market price

increases will continue to be dominated by the cost characteristics of the above 20 employee establishments, which represent 80% or more of industry capacity. Therefore, the final determination of market prices and all other impacts stemming from the price elasticity of demand will be the same as in Sections VI-B and VI-C of the Metal Finishing Report.

The lower and upper bound of price increase factors by model plant size required to cover the revised BPT pollution control costs in 1977 are presented in Table E-6.

Table E-6

Price Increase Factors (as a Percent of Sales)
by Model Plant Size (Employees)
Alternate A - 1977(1)

Model Plant Size (Employees)	Percent Price Increase	
	Lower Bound	Upper Bound
1 - 4	9.6%	15.9%
5 - 9	5.7	9.2

Note: This table corresponds to Tables VI-10 and VI-11 of the Metal Finishing Report.

Sources: Table E-5 and Exhibit II-1 of the Metal Finishing Report.

These price increases correspond to a range of price increases of 19.1% to 31.3% in the 1-4 employee model plant size category and 15.8% to 25.4% in the 5-9 employee model plant size category, as cited in the Metal Finishing Report, Section VI-B, Page VI-19, under the heading, "Price Increase Factors Associated with the 1977 Proposed Effluent Guidelines - Alternate

A." Note that the revised price increases are substantially less than the original price increases as calculated in the Metal Finishing Report.

(b) Economic Impact

The purpose of this section is to present a quantitative analysis of the economic impact associated with the revised effluent guidelines and costs furnished to Kearney by EPA on February 26, 1975.

1. Volume Impact. Since market prices will continue to be dominated by the cost characteristics of the above 20 employee establishments, which represent 80% or more of industry capacity, the adjustment in industry volume due to the revised effluent guidelines and costs is not expected to change from that presented in Section VI-C of the Metal Finishing Report.

2. Operational Impacts. Operational impacts on plant engineering, processes and employment resulting from the revised effluent guidelines and costs are not expected to change from those presented in Section VI-C of the Metal Finishing Report. (Refer to the Metal Finishing Report, Section VI-C, Pages VI-39 through VI-47.)

3. Customers and Suppliers. Impacts on customers and suppliers resulting from the revised effluent guidelines and costs are not expected to change from those presented in Section VI-C of the Metal Finishing Report.

4. Capital Investment and Financing. The funds required

for pollution control investment will remain much higher than current average annual expenditures. Table E-7 compares the pollution control investment requirements resulting from the revised cost estimates with 1967 levels of capital expenditures adjusted to 1973 dollars.

Table E-7

Pollution Control Capital Investment Requirements for the Metal Finishing Industry(1)
($ Millions)

Model Plant Size (Employment)	1967 Capital Expenditures (2)(3)	Range of 1977 Capital Expenditures Required for Revised Capital Investment Estimates		1977 Capital Expenditures Required For Original Capital Investment Estimates(3)
		Lower Bound	Upper Bound	
1 - 4	$ 0.14	$ 4.5	$ 6.7	$13.62
5 - 9	0.64	4.9	7.5	8.73

Notes: (1) This table corresponds to Table VI-23 of the Metal Finishing Report.
(2) 1967 values have been adjusted to 1973 dollars using a 1.25 inflation factor.
(3) Data taken directly from Table VI-23 of the Metal Finishing Report.

Sources: Table E-3 and Table VI-23 and Exhibit VI-63 of the Metal Finishing Report.

Note that the capital expenditure requirements are reduced from those originally calculated in the Metal Finishing Report.

All capital investment and financial implications cited for the original 1977 capital investment requirements in the Metal Finishing Report apply to the 1977 capital investment requirements resulting from the revised effluent guidelines and

costs, which are presented in Table E-7.

5. Micro-Impacts. The micro-impacts of economies of scale in pollution abatement, economies of process specialization and economies of scale in financing resulting from the revised effluent guidelines and costs are not expected to change from those presented in Section VI-C of the Metal Finishing Report. (Refer to the Metal Finishing Report, Section VI-C, Pages VI-55 through VI-63.)

6. Closure Analysis. EPA's revised effluent guidelines and costs did not include separate cost figures for each plant process type, (i.e., plant process types A, B, C, and D). Kearney considered the lower and upper bound of the new costs furnished by EPA for each plant process type and establishment size category presented in the original Metal Finishing Report. By analyzing each plant process type against the lower and upper bound of revised cost estimates, all potential closure possibilities can be identified.

Income statements which include projected pollution control costs for 1977 under the revised effluent guidelines and costs are presented in Exhibit E-1.*

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* This exhibit is organized by plant process type. Sales, production and operating expense and interest on old debt are as presented for each plant process type in the Metal Finishing Report. Operating costs due to pollution control and depreciation reflect the new costs furnished by EPA on February 26, 1975.

To analyze the economic impact after pollution control costs are in effect, the earnings of each establishment size category are compared to the average long-term capital invested. A calculation of the ratio of earnings before taxes and interest in relation to the value of the long-term debt and equity (including pollution control investment) is estimated in Exhibit E-2. Those establishments with a ratio of less than .1 to 1 are estimated to close. These ratios are summarized in Table E-8.

Table E-8

Summary of Calculated Earnings to Average Capital Ratios
Alternate A - 1977

	Model Plant Size (Employees)			
	1 - 4		5 - 9	
Process Type	Lower Bound	Upper Bound	Lower Bound	Upper Bound
A	.271	.159	.386	.272
B	.294	.180	.428	.309
C	.288	.175	.419	.302
D	.329	.212	.482	.356

Note: This table corresponds to Exhibit VI-46 of the Metal Finishing Report.

Source: Exhibit E-2.

As can be seen from the table, the analysis indicates no closures.

A financial source will apply a highly individual criterion to establishment credit requirements for small firms. Since small firms sometimes attempt to minimize taxes by taking out investment income as salary of owners, simple ratios alone do not show credit worthiness. Financing sources will tend to examine both the business and the owner's credit worthiness in

evaluating the request for a loan. Often the owner will be required to secure the debt partially with personal assets. Usually both the business and the owner will be required to be obligated for repayment.

As a minimum test of financial strength, cash flow will have to be sufficient to retire the debt incurred. This can be expressed as shown below:

$$(E_{BI \& T} - I) \quad (I - T_R) \quad + D = DR$$

where:

$E_{BI \& T}$: Earnings before interest and taxes

I: Interest on debts

T_R: Rate of taxes on profit

D: Depreciation

DR: Debt retirement (principal)

The left-hand side of the equation represents cash flow. The requirement can also be expressed as a coverage ratio: cash flow/debt retirement. This ratio shows how well debt retirement is covered by the cash flow projected.

This financing test has been applied to the metal finishing industry for the revised effluent guidelines and costs. Cash flow requirements arising out of current balance sheet items are assumed constant. Debt retirement is based on amortization of the loan for pollution control equipment over five years. This is in accordance with the requirements of banks, as summarized in Section II of the Metal Finishing Report. An accelerated tax write-off of five years with a straight-line depreciation method is used. Retirement of current debt occurs at 10% per year.

Interest cost is set at 8% on existing debt and 10% on the new treatment system investment. One hundred percent of pollution abatement system costs is assumed debt financed.

It is estimated that establishments not having earnings before interest and taxes of at least 10% on long-term investment with a coverage ratio of less than .1 to 1 will not be able to finance the required pollution control investment. It is likely that establishments meeting this criterion with a coverage ratio in the range of .1 to .2 to 1 will be required to provide collateral, a percentage of equity financing, or undertake other steps to secure the loan. However, failure to acquire financing will not necessarily be caused by the impact of pollution control regulations. Some owners may decide not to commit their personal assets to meet financing requirements, due to age or other personal reasons. Hence, they may sell or close their businesses.

The calculation of this coverage criterion for each plant process type is presented in Exhibit E-3. Coverage ratios are summarized in Table E-9.

Table E-9

Summary of Coverage Ratios Derived
from Cash Flow/Debt Retirement Analysis
Alternate A - 1977

Plant Process Type	Model Plant Size (Employees)			
	1 - 4		5 - 9	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
A	2.84	1.66	2.84	1.82
B	3.01	1.79	3.08	1.99
C	2.97	1.75	3.03	1.96
D	3.26	1.97	3.37	2.20

Source: Exhibit E-3.

As can be seen from the table, the analysis indicates no closures.

Although no closures are indicated on the basis of the earnings to average capital ratios and coverage ratios derived from cash flow/debt retirement analysis, some closures will probably occur, for the following reasons:

(a) The foregoing closure evaluation was based on the characteristics of the "typical" establishment. However, within each size category there is variation in firm performance and market conditions. The "typical" firm is not representative of the complete range of performance. There are firms which are less profitable than average due to more intense competition in geographical or specialized markets, or due to high cost production factors.

(b) Firms may close due to space and process line rearrangement requirements. Some firms will be faced with moving the plant location to have adequate space for pollution control equipment. The costs associated with such moves may result in some closures. Other firms might

be faced with plant expansion or significant process line rearrangements. Some of these firms might close rather than pay the associated costs.

(c) Some Kearney industry contacts indicated that their cash flow was so low that the only way they could obtain the funds for the required pollution control equipment would be to pledge personal assets for collateral on a loan or use personal funds to cover the purchase. Many of these stated that they would close rather than make this personal commitment.

(d) Effluent guidelines are only one regulatory consideration confronting the metal finishing industry. Other pollution control regulations (OSHA, Air Emission Guidelines, etc.) are anticipated by this industry. The combined costs of these regulations could result in some closures.

It should be noted that 48 establishments in the 1-4 employee size category and 27 establishments in the 5-9 employee size category were closed in the 1977 baseline forecast due to below average profits and movement into larger size categories.

To analyze the potential closures which might result from the factors presented above, the assumption was made that 5% of the establishments in the 1977 baseline forecast have below zero profits or less before interest and taxes. Model income statements based on revised effluent guidelines and costs (Exhibit E-1) are used to determine how much more capital investment can be allocated for pollution control before the ratio of earnings before interest and taxes falls below .1 to 1 and closures result. The calculation of the percentage of firms which are likely to

close is made with a normal distribution using the average profits before interest and taxes for each plant process type/establishment size category as the midpoint of the curve. (Detailed methodology appears in Exhibit E-4.)

The percentage of firms under the range of conditions considered which will be closed in each size category by plant process type is presented in Exhibit E-4. Table E-10 presents the anticipated range of closures.

Table E-10

Percent Range of Closures Anticipated
Due to Low Profitability Establishments
Alternate A - 1977

Model Plant Size (Employees)	Percent Range of Closures	
	Lower Bound	Upper Bound
1 - 4	12.5%	27.1%
5 - 9	9.7	14.9

Source: Exhibit E-4.

On the basis of the baseline forecast (Exhibit VI-1 of the Metal Finishing Report) and by applying the appropriate plant process type (A, B, C or D) to each type of metal finishing operation (process segment), the lower and upper bound of closures can be calculated. These detailed calculations are presented in Exhibit E-5. Table E-11 summarizes the lower and upper bound of closures by model plant size category.

Table E-11

Estimated Closures Resulting
from the Revised Effluent Guidelines
Alternate A - 1977(1)

Model Plant Size (Employees)	Range of Establishment Closures(2)	
	Lower Bound	Upper Bound
1 - 4	49	80
5 - 9	16	20

Notes: (1) This table corresonds to Table VI-34 of the Metal Finishing Report.
(2) Figures have been rounded from the totals for direct and municipal dischargers from Exhibit E-5.

Source: Exhibit E-5.

Note that the range of possible closures in the 1-4 employee establishment size category is 49 to 80 and the range of possible closures in the 5-9 employee establishment size category is 16 to 20.

The range of the employment impact of closures can be estimated by multiplying the average employment per establishment in each size group, as shown in Table E-11, by the estimated lower and upper bound of closures. The range of the employment impact of closures appears in Table E-12.

Table E-12

Impact of Closures on Employment(1)

Model Plant Size (Employees)	Range of Employees Affected	
	Lower Bound	Upper Bound
1 - 4	98	160
5 - 9	112	140

Notes: (1) This table corresponds to the Total Number of Employees Affected, 1977 - Alternate A, in Exhibit VI-63 of the Metal Finishing Report.

Sources: Table E-11 and Exhibit V-8 of the Metal Finishing Report.

7. Total Annual Costs. Since market prices will continue to be dominated by the cost characteristics of the above 20 employee establishments, which represent 80% or more of industry capacity, the adjustment in industry volume due to the revised effluent guidelines and costs is not expected to change from that presented in Section VI-C of the Metal Finishing Report. This is because the demand will not change as market price remains constant.

8. Other Impacts. Other impacts considered, specifically foreign trade and impacts on local or regional economies, are not expected to change substantially from those presented in Section VI-C of the Metal Finishing Report.

SUMMARY

A detailed summary of the important impacts associated with the revised effluent guidelines and costs for the 1-4 employee and 5-9 employee model plant size categories is shown in Table E-13 on the following page.

Table E-13

Revised Economic Analysis of Effluent Guidelines (1977) - Metal Finishing Industry Direct and Municipal Dischargers (1)

	Establishment Size by Number of Employees	
	1-4	5-9
Average Sales Volume	$53,730	$146,290
SIC Code	3471 and 3479	3471 and 3479
Number of Plants in Size Segments 1967	376	167
Percent of Total Industry Plants	39.6%	17.6%
Number of Plants in 1977 Baseline	328	140
Number of Plants with BPT Treatment in Place	N/A	N/A

Model Plant Size (Employees) Range	1-4		5-9	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Cost of Pollution Abatement				
Total Capital Cost "1977 - Alternate A"(2)	$4,493,600	$6,724,000	$4,948,000	$7,462,000
Average Annual Investment "1977 - Alternate A"(3)	$120,000		$540,000	
Average Annual Investment for Pollution Control "1977 - Alternate A"(4)	$ 449,360	$ 672,400	$ 498,400	$ 746,200
Average Annual Investment with Pollution Control "1977 - Alternate A"(5)	$ 569,360	$ 792,400	$1,038,400	$1,286,200
Total Capital Expenditures as Percent of Capital(6)	183%	249%	131%	172%
Annualized Costs for Segment				
Incremental Increases Including Capital Charges "1977 - Alternate A"(7)	$1,953,240	$3,140,600	$1,349,600	$2,113,300
Incremental Increases Excluding Capital Charges "1977 - Alternate A"(8)	$1,279,200	$2,132,000	$ 607,400	$ 994,000
Incremental Increases Including Capital Charges as a Percent of Sales "1977 - Alternate A"(9)	9.6%	15.9%	5.7%	9.2%
Expected Price Increases Due to Pollution Control "1977 - Alternate A"(10)	12.5%	16.1%	12.5%	16.1%
Plant Closures				
Total Closures Anticipated "1977 - Alternate A"(11)	49	80	16	20
Percent Reduction of Size Segment Capacity Due to Closure "1977 - Alternate A"(12)	14.9%	24.4%	11.4%	14.2%
Employment				
Total Number of Employees Affected "1977 - Alternate A"(13)	98	160	112	140
Percent of Total Employees in Size Segment "1977 - Alternate A"(14)	14.9%	24.3%	10.0%	12.5%
Community Effects Impact on Industry Growth "1977 - Alternate A"(15)	Minor	Minor	Minor	Minor
Balance of Trade Effects(16)	Minor	Minor	Minor	Minor

See the following pages for footnotes explanation.

FOOTNOTES

(1) This table corresponds to Exhibit VI-63 of the Metal Finishing Report.

(2) The range of 1977 total capital cost is calculated by multiplying the number of establishments in each size group in the 1977 baseline forecast times the low and high BPT capital costs. These costs were furnished by EPA on 2/26/75 and correspond to the costs in Tables V-6 through V-11 of the Metal Finishing Report.

(3) The average annual investment is the annual investment projected during 1977 without pollution control equipment costs.

(4) The average annual investment for pollution control is based on an economic life of 10 years and equal to 10% of initial system cost.

(5) Based on an economic life of 10 years, average annual treatment system investment will be equal to 10% of initial system cost. Average annual investment with pollution control is equal to the average annual treatment system investment plus the average annual investment.

(6) The percentages represent the range of cost associated with each size category for direct and municipal dischargers. The calculation is based on the percent capital cost (as shown in Exhibit E-1) is of long-term debt plus equity (as shown in Exhibit E-2). The capital cost exhibit corresponds to Exhibits V-6 through V-11 of the Metal Finishing Report and the long-term debt plus equity exhibit corresponds to Exhibits VI-30 through VI-45 of the Metal Finishing Report.

(7) The range of 1977 total annual costs is calculated by multiplying the number of establishments in each size group in the 1977 baseline forecast times the low and high BPT annual costs. These costs were furnished by EPA on 2/26/75 and correspond to the costs in Tables V-6 through V-11 of the Metal Finishing Report.

(8) Incremental increases excluding capital charges for 1977 are calculated by multiplying the 1977 capital costs by .15 and subtracting from the annual costs including capital. The .15 factor reflects a capital charge of 15% consisting of 5% for the cost of capital (10% cost of capital on the average investment--one-half of the total) over a 10-year period and depreciation of 10% per year over a 10-year period.

(9) As derived from the costs furnished by EPA on 2/26/75, Table E-13 and Exhibit II-1 of the Metal Finishing Report.

(10) As derived from the figures furnished EPA on 2/26/75. These correspond to the price increases cited in Table VI-14 of the Metal Finishing Report.

(11) As derived from Table E-11.

(12) The percent reduction of size segment capacity due to closure is calculated against the estimated 1977 baseline number of establishments.

(13) The range of the employment impact of closures is estimated by multiplying the average employment per establishment in each size group as shown in Exhibits V-8 through V-11 by the estimated lower and upper bound closures as shown in Table E-11. Note baseline closures are excluded from this calculation. Closures are based on assuming Alternate A conditions.

(14) Employees affected as a percent of employment shown in Exhibit I-9 of the Metal Finishing Report.

(15) Measured against community and industry growth as a whole, the impacts are very minor.

(16) A minor impact on the balance of trade as a whole is indicated.

Sources: (As indicated in footnotes.)

CHANGES OCCURRING IN TAB D ESTIMATES

Tab D considered the impact of capital investment and total annual costs for pollution control equipment on industry prices, industry production, establishment closures, employment, communities, industry growth and balance of trade on direct discharging plants only.

All impacts discussed previously in this appendix apply to direct dischargers, with the exception of:

1. Capital investment and annual costs.
2. Establishment closures.
3. Employment.

(a) Capital Investment and Annual Costs

The incremental investment and annual costs required for the revised effluent guidelines for direct discharging establishments by size category are presented in Exhibit E-6. Table E-14 summarizes the total incremental investment and annual costs for pollution control for direct discharging establishments.

Table E-14

Total Incremental Investment and Annual Costs for BPCT Under the Revised Effluent Guidelines - 1977
($ Millions)

	Range of Costs	
	Lower Bound	Upper Bound
Incremental Investment Required for Pollution Control	$28.241	$31.046
Annual Cost for Pollution Control	$10.054	$11.102

Source: Exhibit E-6.

(b) Establishment Closures

Direct discharging establishment closures resulting from the revised effluent guidelines and costs are shown in Table E-15.

Table E-15

Estimate of Direct Discharging Establishment Closures Resulting from the Revised Effluent Guidelines, Alternate A - 1977

Model Plant Size (Employees)	Range of Closure Estimates	
	Lower Bound	Upper Bound
1 - 4	11	19
5 - 9	4	5

Note: Figures have been rounded from the totals for direct dischargers from Exhibit E-5.

Source: Exhibit E-5.

(c) Employment

The range of employment impact of closures is presented in Table E-16.

Table E-16

Impact of Closures on Employment for the Direct Discharging Segment

Model Plant Size (Employees)	Range of Employees Affected	
	Lower Bound	Upper Bound
1 - 4	22	38
5 - 9	28	35

Source: Table E-15 and Exhibit V-8 of the Metal Finishing Report.

ENVIRONMENTAL PROTECTION AGENCY

EXHIBI

PROFIT BEFORE INTEREST AND TAXES OF TYPICAL METAL FINISHING ESTABLISHMENTS
BY ESTABLISHMENT SIZE AND PLANT PROCESS TYPE - ALTERNATE A - 1977

Plant Process Type	A				B				C				D			
Range	Lower Bound		Upper Bound		Lower Bound		Upper Bound		Lower Bound		Upper Bound		Lower Bound		Upper Bound	
Model Plant Size (Employees)	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9
Sales(2)	$60,400	$164,000	$60,400	$164,000	$61,200	$166,600	$61,200	$166,600	$60,980	$166,050	$60,980	$166,050	$62,380	$169,900	$62,380	$1
Less: Production and Operating Expense(3)	46,610	133,580	46,610	133,580	46,610	133,580	46,610	133,580	46,610	133,580	46,610	133,580	46,610	133,580	46,610	1
Operating Costs Due to Pollution Control(4)	3,900	4,300	6,500	7,100	3,900	4,300	6,500	7,100	3,900	4,300	6,500	7,100	3,900	4,300	6,500	
Depreciation(5)	1,370	3,560	2,050	5,330	1,370	3,560	2,050	5,330	1,370	3,560	2,050	5,330	1,370	3,560	2,050	
Subtotal	$ 8,520	$ 22,560	$ 5,240	$ 17,990	$ 9,320	$ 25,160	$ 6,040	$ 20,590	$ 9,100	$ 24,610	$ 5,820	$ 20,040	$10,500	$ 28,460	$ 7,220	$
Plus: Interest on Old Debt(6)	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$ 1,197	$ 748	$
Profit Before Interest and Taxes	$ 9,268	$ 23,757	$ 5,988	$ 19,187	$10,068	$ 26,357	$ 6,788	$ 21,787	$ 9,848	$ 25,807	$ 6,568	$ 21,237	$11,248	$ 29,657	$ 7,968	$

Notes:
(1) This exhibit corresponds to Exhibit(s) VI-12 of the Metal Finishing Report.
(2) These sales figures are obtained from Exhibits VI-12 through VI-15 of the Metal Finishing Report.
(3) Production and operating expenses are obtained from Exhibit II-3 of the Metal Finishing Report.
(4) Operating costs (revised) were obtained from EPA February 25, 1975.
(5) Depreciation is straight line depreciation - 10 year life.
(6) Interest on old debt is added in at this point as it was included in the production and operating expense figure above. These figures were obtained from Exhibit VI-12.

Sources: Table E-4 and Exhibits II-3, V-8 through V-11 and, VI-12 through VI-16 of the Metal Finishing Report.

ENVIRONMENTAL PROTECTION AGENCY

EXHIBIT E-2

RATIO OF CALCULATED EARNINGS TO AVERAGE CAPITAL FOR THE METAL FINISHING INDUSTRY
BY ESTABLISHMENT SIZE AND PLANT PROCESS TYPE - ALTERNATE A - 1977

Plant Process Type	A				B				C				D			
Range	Lower Bound		Upper Bound		Lower Bound		Upper Bound		Lower Bound		Upper Bound		Lower Bound		Upper Bound	
Model Plant Size (Employees)	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9
Average Long-Term Capital Investment																
Equity(1)	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720	$17,950	$28,720
Long-Term Debt(2)	9,350	14,960	9,350	14,960	9,350	14,960	9,350	14,960	9,350	14,960	9,350	14,960	9,350	14,960	9,350	14,960
Pollution Control Debt/Equity(3)	6,850	17,800	10,250	26,650	6,850	17,800	10,250	26,650	6,850	17,800	10,250	26,650	6,850	17,800	10,250	26,650
Total Average Capital	$34,150	$61,480	$37,550	$70,330	$34,150	$61,480	$37,550	$70,330	$34,150	$61,480	$37,550	$70,330	$34,150	$61,480	$37,550	$70,330
Earnings on Capital Before Interest and Taxes(4)	$ 9,268	$23,757	$ 5,988	$19,187	$10,068	$26,357	$ 6,788	$21,787	$ 9,848	$25,807	$ 6,568	$21,237	$11,248	$29,657	$ 7,968	$25,087
Ratio of Calculated Earnings to Average Capital	.271	.386	.159	.272	.294	.428	.180	.309	.288	.419	.175	.302	.329	.482	.212	.356

Notes: (1) Values for equity are taken from Exhibit II-4.
(2) Values for long-term debt are taken from Exhibit II-4.
(3) Pollution control investment is the average investment cost as furnished by EPA on February 26, 1975.
(4) Income before taxes and interest is taken from Exhibit E-1.

Sources: Exhibit E-1, EPA and Exhibits VI-30 through VI-33 of the Metal Finishing Report.

ENVIRONMENTAL PROTECTION AGENCY

EXHIBIT -3

CASH FLOW/DEBT RETIREMENT ANALYSIS BY ESTABLISHMENT
SIZE AND PLANT PROCESS TYPE - ALTERNATE A - 1977

Plant Process Type	Range of Coverage	Employee Size Class	Earnings Before Interest and Taxes(1)	Interest		Profits Before Taxes(4)	Estimated Taxes(5)	Net Profits(6)	Depreciation		Cash Flow(9)	Debt Retirement			Coverage(12)
				Present Debt(2)	Pollution Control Debt(3)				Present(7)	Treatment System(8)		Present Debt(10)	Treatment System Debt(11)	Total Debt	
A	Lower Bound	1-4	$ 7,898	$ 748	$ 874	$ 6,276	$1,381	$ 4,895	$2,800	$ 2,740	$10,435	$ 935	$ 2,740	$ 3,675	2.84
		5-9	20,197	1,197	2,271	16,729	3,680	13,049	4,300	7,120	24,469	1,496	7,120	8,616	2.84
	Upper Bound	1-4	3,938	748	1,308	1,882	414	1,468	2,800	4,100	8,368	935	4,100	5,035	1.66
		5-9	13,857	1,197	3,401	9,259	2,037	7,222	4,300	10,660	22,182	1,496	10,660	12,156	1.82
B	Lower Bound	1-4	8,698	748	874	7,076	1,557	5,519	2,800	2,740	11,059	935	2,740	3,675	3.01
		5-9	22,797	1,197	2,271	19,329	4,252	15,077	4,300	7,120	26,497	1,496	7,120	8,616	3.08
	Upper Bound	1-4	4,738	748	1,308	2,682	590	2,092	2,800	4,100	8,992	935	4,100	5,035	1.79
		5-9	16,457	1,197	3,401	11,859	2,609	9,250	4,300	10,660	24,210	1,496	10,660	12,156	1.99
C	Lower Bound	1-4	8,478	748	874	6,856	1,508	5,348	2,800	2,740	10,888	935	2,740	3,675	2.97
		5-9	22,247	1,197	2,271	18,779	4,131	14,648	4,300	7,120	26,068	1,496	7,120	8,616	3.03
	Upper Bound	1-4	4,518	748	1,308	2,462	542	1,920	2,800	4,100	8,820	935	4,100	5,035	1.75
		5-9	15,907	1,197	3,401	11,309	2,488	8,821	4,300	10,660	23,781	1,496	10,660	12,156	1.96
D	Lower Bound	1-4	9,878	748	874	8,256	1,816	6,440	2,800	2,740	11,980	935	2,740	3,675	3.26
		5-9	26,097	1,197	2,271	22,629	4,978	17,651	4,300	7,120	29,071	1,496	7,120	8,616	3.37
	Upper Bound	1-4	5,918	748	1,308	3,862	850	3,012	2,800	4,100	9,912	935	4,100	5,035	1.97
		5-9	19,757	1,197	3,401	15,159	3,335	11,824	4,300	10,660	26,784	1,496	10,660	12,156	2.20

Notes:
(1) Profit Before Taxes and Interest is calculated in Exhibit E-1 with depreciation adjusted from an economic life of ten years to a tax life of five years.
(2) Interest on present debt is at 8% per annum on the debt as shown in Exhibit F-1.
(3) Based on amortization over five years, 26.38 of the debt will be paid each year if payments are made yearly, and the interest rate is 10%. For the average year interest will be 6.38% and principal retirement 20%. These data are used in the table. In actuality first year payments will have more interest and less principal retirement and last year payments the reverse. If interest is paid annually and principal retired in equal amounts, total interest paid will be lower averaging 5% on total investment; but cash flow requirements would be higher in initial years.
(4) Profits before tax are profits before taxes and interest less interest.
(5) Estimated taxes are based on a 22% on the first $25,000 and 48% thereafter.
(6) Net profits are profits before taxes less taxes.
(7) Present depreciation is estimated to equal 10% of net fixed assets shown by the Robert Morris survey.
(8) Treatment system depreciation is based on a fast tax write-off for pollution control equipment in accordance with Section 169 of the Internal Revenue Code. A longer write-off period and the investment tax credit would not fit well with the amortization requirements of five years and in some cases income may not be high enough to utilize the full credit.
(9) Cash Flow equals Net Profits plus depreciation.
(10) Present Debt is as shown in Exhibit E-2. Retirement is estimated to be 10% per year.
(11) Treatment System Debt is based on financing 100% of the pollution control treatment system requirements. This is an upper bound estimate of cash flow requirements. Typical financing is likely to require some equity participation in financing. For small firms this is likely to require use of personal assets.
(12) Coverage is the ratio of Cash Flow to Debt Retirement.

Sources: Exhibit E-1 and E-2, and Exhibits VI-53 through VI-56.

EXHIBIT E-4

ENVIRONMENTAL PROTECTION AGENCY

PERCENT ESTIMATED 1977 CLOSURES DUE TO
REVISED EFFLUENT GUIDELINES BY PLANT
PROCESS TYPE AND ESTABLISHMENT SIZE CATEGORY(1)

Plant Process Type	Model Plant Size (Employees)			
	1-4		5-9	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
A	15.2%	27.1%	11.1%	14.9%
B	14.0	23.0	10.4	13.4
C	14.2	23.9	10.6	13.6
D	12.5	19.2	9.7	11.9

Note: (1) Percent estimated 1977 closures are calculated as follows: (Earnings on capital before taxes and interest from Exhibits E-9 through E-16) - (.1 of total average capital from Exhibits E-9 through E-16)] ÷ [(Earnings on capital before taxes and interest from Exhibits E-9 through E-16) ÷ (1.645 which is the standard normal variable exceeded with given probabilities of 5.0)] = A number which can be translated into a percentage from probabilities that given standard normal variables will be exceeded.

Sources: Exhibits E-9 through E-16 and "Statistics, a New Approach" by The Free Press.

ENVIRONMENTAL PROTECTION AGENCY

EXHIBIT E-

CASH FLOW/DEBT RETIREMENT ANALYSIS BY ESTABLISHMENT SIZE AND PLANT PROCESS TYPE - ALTERNATE A - 1977

Plant Process Type	Range of Coverage	Employee Size Class	Earnings Before Interest and Taxes(1)	Interest		Profits Before Taxes(4)	Estimated Taxes(5)	Net Profits(6)	Depreciation		Cash Flow(9)	Debt Retirement			Coverage(12)
				Present Debt(2)	Pollution Control Debt(3)				Present(7)	Treatment System(8)		Present Debt(10)	Treatment System Debt(11)	Total Debt	
A	Lower Bound	1-4	$ 7,898	$ 748	$ 874	$ 6,276	$1,381	$ 4,895	$2,800	$ 2,740	$10,435	$ 935	$ 2,740	$ 3,675	2.84
		5-9	20,197	1,197	2,271	16,729	3,680	13,049	4,300	7,120	24,469	1,496	7,120	8,616	2.84
	Upper Bound	1-4	3,938	748	1,308	1,882	414	1,468	2,800	4,100	8,368	935	4,100	5,035	1.66
		5-9	13,857	1,197	3,401	9,259	2,037	7,222	4,300	10,660	22,182	1,496	10,660	12,156	1.82
B	Lower Bound	1-4	8,698	748	874	7,076	1,557	5,519	2,800	2,740	11,059	935	2,740	3,675	3.01
		5-9	22,797	1,197	2,271	19,329	4,252	15,077	4,300	7,120	26,497	1,496	7,120	8,616	3.08
	Upper Bound	1-4	4,738	748	1,308	2,682	590	2,092	2,800	4,100	8,992	935	4,100	5,035	1.79
		5-9	16,457	1,197	3,401	11,859	2,609	9,250	4,300	10,660	24,210	1,496	10,660	12,156	1.99
C	Lower Bound	1-4	8,478	748	874	6,856	1,508	5,348	2,800	2,740	10,888	935	2,740	3,675	2.97
		5-9	22,247	1,197	2,271	18,779	4,131	14,648	4,300	7,120	26,068	1,496	7,120	8,616	3.03
	Upper Bound	1-4	4,518	748	1,308	2,462	542	1,920	2,800	4,100	8,820	935	4,100	5,035	1.75
		5-9	15,907	1,197	3,401	11,309	2,488	8,821	4,300	10,660	23,781	1,496	10,660	12,156	1.96
D	Lower Bound	1-4	9,878	748	874	8,256	1,816	6,440	2,800	2,740	11,980	935	2,740	3,675	3.26
		5-9	26,097	1,197	2,271	22,629	4,978	17,651	4,300	7,120	29,071	1,496	7,120	8,616	3.37
	Upper Bound	1-4	5,918	748	1,308	3,862	850	3,012	2,800	4,100	9,912	935	4,100	5,035	1.97
		5-9	19,757	1,197	3,401	15,159	3,335	11,824	4,300	10,660	26,784	1,496	10,660	12,156	2.20

Notes:
(1) Profit Before Taxes and Interest is calculated in Exhibit E-1 with depreciation adjusted from an economic life of ten years to a tax life of five years.
(2) Interest on present debt is at 8% per annum on the debt as shown in Exhibit F-1.
(3) Based on amortization over five years, 26.38 of the debt will be paid each year if payments are made yearly, and the interest rate is 10%. For the average year interest will be 6.38% and principal retirement 20%. These data are used in the table. In actuality first year payments will have more interest and less principal retirement and last year payments the reverse. If interest is paid annually and principal retired in equal amounts, total interest paid will be lower averaging 5% on total investment; but cash flow requirements would be higher in initial years.
(4) Profits before tax are profits before taxes and interest less interest.
(5) Estimated taxes are based on a 22% on the first $25,000 and 48% thereafter.
(6) Net profits are profits before taxes less taxes.
(7) Present depreciation is estimated to equal 10% of net fixed assets shown by the Robert Morris survey.
(8) Treatment system depreciation is based on a fast tax write-off for pollution control equipment in accordance with Section 169 of the Internal Revenue Code. A longer write-off period and the investment tax credit would not fit well with the amortization requirements of five years and in some cases income may not be high enough to utilize the full credit.
(9) Cash Flow equals Net Profits plus depreciation.
(10) Present Debt is as shown in Exhibit E-2. Retirement is estimated to be 10% per year.
(11) Treatment System Debt is based on financing 100% of the pollution control treatment system requirements. This is an upper bound estimate of cash flow requirements. Typical financing is likely to require some equity participation in financing. For small firms this is likely to require use of personal assets.
(12) Coverage is the ratio of Cash Flow to Debt Retirement.

Sources: Exhibit E-1 and E-2, and Exhibits VI-53 through VI-56.

EXHIBIT E-6

ENVIRONMENTAL PROTECTION AGENCY

POLLUTION CONTROL INVESTMENT AND ANNUAL COSTS FOR BPCT
UNDER REVISED EFFLUENT GUIDELINES AND COSTS - 1977(1)

Process Segment(2)	Establishment Size Segment(3)	Number of Plants(4)	Total Investment(5) $(Million)	Incremental Investment Required for Pollution Control - BPCT(8) Lower Bound(6) $(Million)	Upper Bound(7) $(Million)	Percent of Investment(9)	Total Annual Sales(10) $(Million)	Annual Cost for Pollution Control(11) Lower Bound(6) $(Million)	Upper Bound(7) $(Million)	Percent of Sales(9)
Cadmium Plating	1-4	9	$ 0.246	$ 0.123	$ 0.185	50-75	$ 0.486	$ 0.054	$ 0.086	11-18
	5-9	4	0.175	0.142	0.213	81-122	0.585	0.039	0.060	7-10
	10-19	4	0.328	0.318	0.430	97-131	1.139	0.197	0.224	17-20
	20-49	5	1.022	1.596	1.721	156-168	3.000	0.519	0.588	17-20
	50-99	2	0.786	0.910	0.986	116-125	2.526	0.337	0.394	13-16
	100-249	0	-	-	-	-	-	-	-	-
	250+	0	-	-	-	-	-	-	-	-
Precious Metal Plating	1-4	13	0.355	0.178	0.267	50-75	0.698	0.077	0.125	11-18
	5-9	6	0.262	0.214	0.320	82-122	0.878	0.058	0.091	7-10
	10-19	6	0.491	0.476	N/A(12)	97	1.708	0.289	N/A	17
	20-49	7	1.430	2.235	N/A	156	4.200	0.727	N/A	17
	50-99	2	0.786	0.910	N/A	116	2.526	0.337	N/A	13
	100-249	0	-	-	-	-	-	-	-	-
	250+	0	-	-	-	-	-	-	-	-
Anodizing	1-4	32	0.874	0.438	0.656	50-75	1.719	0.190	0.306	11-18
	5-9	15	0.655	0.534	0.800	82-122	2.195	0.145	0.226	7-10
	10-19	15	1.229	0.978	1.299	80-106	4.271	0.587	0.703	14-17
	20-49	16	3.269	4.881	5.311	149-163	9.600	1.510	1.616	16-17
	50-99	4	1.572	1.744	1.896	111-121	5.052	0.599	0.648	12-13
	100-249	1	1.170	0.910	.986	78-84	2.940	0.312	0.336	11-11
	250+	1	-	2.270	2.474	-	6.566	0.778	0.841	12-13
Pickling	1-4	8	0.218	0.110	0.164	50-75	0.430	0.048	0.077	11-18
	5-9	3	0.131	0.107	0.160	82-122	0.439	0.029	0.045	7-10
	10-19	3	0.246	0.196	N/A	80	0.854	0.117	N/A	14
	20-49	3	0.613	0.915	N/A	149	1.800	0.283	N/A	16
	50-99	1	0.393	0.436	N/A	111	1.263	0.150	N/A	12
	100-249	1	1.170	0.910	N/A	78	2.940	0.312	N/A	11
	250+	0	-	-	-	-	-	-	-	-
Phosphatizing	1-4	3	0.082	0.041	0.062	50-76	0.161	0.018	0.029	11-18
	5-9	1	0.044	0.036	0.053	82-120	0.146	0.010	0.015	7-10
	10-19	1	0.082	0.065	0.087	79-106	0.285	0.039	0.047	14-17
	20-49	1	0.204	0.305	0.332	150-163	0.600	0.094	0.101	16-17
	50-99	0	-	-	-	-	-	-	-	-
	100-249	0	-	-	-	-	-	-	-	-
	250+	0	-	-	-	-	-	-	-	-
Etching	1-4	21	0.573	0.288	0.431	50-75	1.128	0.125	0.201	11-18
	5-9	9	0.393	0.320	0.480	81-122	1.317	0.087	0.136	7-10
	10-19	8	0.655	0.522	N/A	80	2.278	0.313	N/A	14
	20-49	8	1.634	2.441	N/A	149	4.800	0.755	N/A	16
	50-99	2	0.786	0.872	N/A	111	2.526	0.300	N/A	12
	100-249	2	2.338	1.820	N/A	78	5.880	0.624	N/A	11
	250+	0	-	-	-	-	-	-	-	-
Total		217	$24.212	$28.241	$31.046	117-128	$76.936	$10.054	$11.102	13-14

Notes:

(1) Data in these tables reflect only direct discharging establishments. Dollar values are at 1973 price levels. The data reflect the costs for the 1967 size distribution of establishments. This number of establishments and distribution by size and process segment is expected to change due to closures which are the result of the costs of meeting the effluent limitation guidelines in 1977.

(2) The designation "process segment" indicates that the estimated number of firms in this segment primarily provide this type of service will usually also provide other services many of which may fall in other primary process segments.

(3) Establishment size is measured by total establishment employment. Sample data indicates that employment and sales are directly correlated. More definitive employment data is available for the industry so this measure was selected as the size segmentation parameter as opposed to sales or other size variables.

(4) Number of plants by size segment reflects the size distribution of the industry as a whole which has been assumed applicable to each process segment.

(5) Total long-term investment is defined as long-term debt plus equity. Investment data is in 1973 dollars. If final investment were used as a base, Kearney estimates that measure would be 40% to 60% of the long-term investment indicated.

(6) The lower bound estimate of investment and annual cost required for pollution control assumes only treatment of waste streams compatible with the stream produced by the primary service being provided as indicated under process segment.

(7) The upper bound estimate of investment and annual cost required for pollution control represents the cost which would be associated with the treatment of diversified waste streams indicating that significant secondary services are being provided in addition to those which have waste streams compatible with the primary service being provided as shown under process segment

(8) Investment data is based on the technical and cost information developed by Battelle Columbus Laboratories. This includes the use of a $146 thousand (1974 prices) evaporator in all shops with 20 or more employees are not estimated to require an evaporator However, it also should be noted that shops in the range of 20-49 employees cannot justify the inclusion of an evaporator in their system based on the savings generated in water usage and in the size of the treatment system required For this reason the economic impact assessment of closure on these shops has been done by eliminating the evaporator investment and increasing the annual costs by the amount saved. This is only an approximation of the adjustments from removing the evaporator from the system Reworking the entire treatment system to exclude the evaporator requires adjustment of the size of the treatment system itself to reflect the need to process a larger stream of waste water. If the evaporator is eliminated from the 20-49 employee size segment on this approximation basis, total investments required are reduced by approximately $3 million and annual costs are increased by about $130 thousand in total for the industry This does not consider the adjustment in the treatment system but only the direct elimination of investment and savings due to the evaporator. The detailed information necessary to develop complete 1977 investment and annual costs without evaporators is not available at the present time

(9) This range represents the range implicit in the lower and upper bound estimates of investment in pollution control equipment as a percent of the total investment indicated. A similar calculation is performed for percent of sales

(10) Total annual sales for each size segment have been calculated on the bases of estimated average sales per establishment.

(11) Annual costs for pollution control include depreciation (straight line over 10 years to reflect economic life), cost of capital at 10% per year on the average investment net of depreciation (i.e., one-half of total investment), maintenance, and operating cost.

(12) N/A indicates that there are not estimated to be any establishments which would utilize treatment system capable of treating diverse waste streams in addition to the treatment required by the primary process indicated. In this instance, the total for the upper bound column reflects using the lower bound estimate where N/A is indicated.