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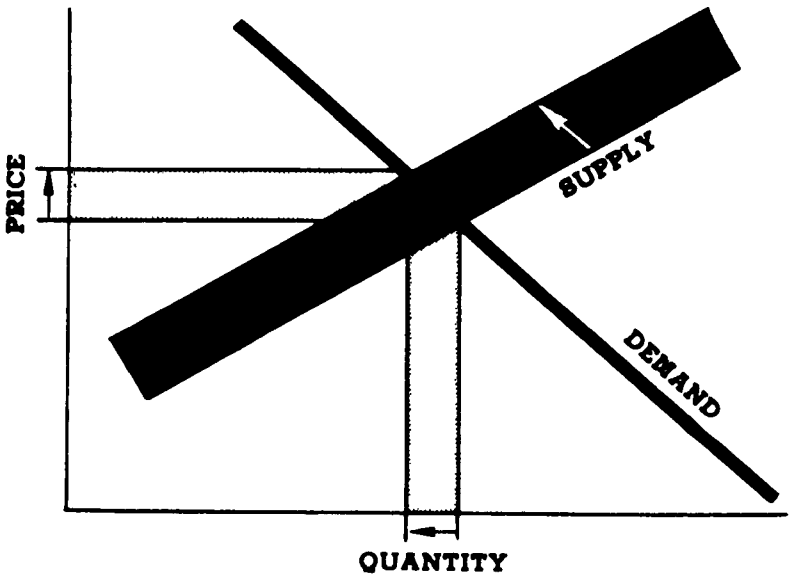
Economic Impact Analysis of Proposed Revised Effluent Guidelines and Standards for the Paint Manufacturing Industry



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ECONOMIC ANALYSIS OF PROPOSED REVISED EFFLUENT GUIDELINES AND STANDARDS FOR THE PAINT MANUFACTURING INDUSTRY

Prepared for

OFFICE OF WATER PLANNING AND STANDARDS
ENVIRONMENTAL PROTECTION AGENCY
Washington, D. C. 20460

under

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U.S. Environmental Protection Agency

This report has been reviewed by the Office of Planning and Evaluation. EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

PREFACE

The attached document is a contractor's study prepared for the Office of Analysis 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 BPT, BAT, PSES, NSPS, PSNS guidelines established under the Federal Water Pollution Control Act (the Act), as amended.

The study supplements the technical study ("EPA Development Document") supporting the proposal of regulations under the Act. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposed limitations based upon an analysis of the feasibility of these limitations in accordance with the requirements 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 on production, effects upon foreign trade, and other community and competitive effects.

The study has been prepared with the supervision and review of the Office of Analysis and Evaluation of the EPA. This report was submitted in fulfillment of Contract No. 68-01-4466 by Arthur D. Little, Inc. This report reflects work completed as of October 1979.

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. 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 paint manufacturing industry.

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I. EXECUTIVE SUMMARY

A. PURPOSE AND SCOPE

The work covered in this report was authorized by the Environmental Protection Agency under contract number 68-01446. The objective of the work was to examine the economic impact of various options for the control of wastewater from paint manufacturing plants. The control of wastewater from paint manufacturing plants will be covered under BAT, PSES, PSNS and NSPS regulations. BAT is the best available technology covered in the Development Document and will affect all plants which discharge wastewater. PSES is pretreatment standards for existing sources, and the regulation will cover all plants which are currently indirect dischargers. PSNS and NSPS are regulations for new sources and cover pretreatment standards for indirect dischargers and performance standards for direct dischargers.

Technical data concerning costs for various control options, numbers and sizes of plants and their respective wastewater discharge characteristics were furnished by the technical contractor to the Effluent Guidelines Division. Other information and data were obtained from National Paint and Coatings Association, Robert Morris Associates, Kline Guide to the Paint Industry, various trade journals, U.S. Government data, and Arthur D. Little, Inc., estimates.

The regulations will be established to control discharge of pollutants by plants manufacturing paint as defined in SIC 2851.

B. METHODOLOGY

The paint manufacturing industry was characterized in a general way by reviewing Bureau of Census data, the Paint Industry Redbook, Kline's Guide to the Paint Industry, the EPA 308 survey, and Arthur D. Little, Inc., estimates. Using this data, the industry was segmented by plant production size. Financial models for plants in each segment were prepared to correspond with available financial data. A preliminary determination of impact was prepared using the control costs furnished by EPA. Before-tax return on investment was selected as the screening criterion, since there was little difference in this value on the basis of plant size. On the basis of the screening analysis, two segments — very small, and small — were determined to be potentially impacted. For these segments detailed impact evaluations were made for two control options — zero discharge by contract hauling and physical/chemical pretreatment. Price effects, plant closures, production effects, and employment effects were calculated. In addition, total industry costs for investment and annual operating costs were calculated.

C. PRESENT ECONOMIC CONDITIONS

The paint industry comprises some 1500 plants. Sixty-five percent of these plants are small, single-location, privately owned firms with less than 20 employees, less than $1 million in sales and with manufacturing facilities more than 30 years old. Together these plants account for only 11% of the total paint production. Some 35% of the plants account for 90% of the U.S. paint production. Sales range from less than $250,000 for the smallest plants to over $50 million for the very largest. Return on investment before tax ranges from 14 - 20%.

D. SUMMARY OF ECONOMIC IMPACT

An examination of the economic impact of control costs on model plant profitability indicates that the smallest plants are the most seriously affected. While the Effluent Guidelines Division presented costs for several control options, two were selected for detailed analysis. Option one involves physical-chemical pretreatment and Option two provides for zero discharge by the most economical method. In the case of Option one, the total industry costs are expected to be in the order of $5.5 million, which will be partly offset by an expected price increase of about 2.0¢ gallon. Closures of 155 very small plants can be expected on the basis of economic impact. Total industry costs for plants to comply with Option two are about $11 million. In this case, 232 very small plants can be expected to close because of economic impact, as shown in Tables 1 and 2. Table 1 summarizes the impact of Option one — Physical/Chemical Pretreatment. Table 2 shows the impact for Option Two — Zero Discharge by the most economical means (contract hauling for very small, small and medium plants, wastewater recycle with contract hauling for the rest).

TABLE 1

SUMMARY OF ECONOMIC IMPACT OF P/C PRETREATMENT ON THE PAINT INDUSTRY ($000)

Segment	VS	S	M	L	VL	Total
No. Plants	469	513	296	111	111	1500
Plants in Compliance	314	344	199	74	74	1005
Balance	155	169	97	37	37	495
Total Investment to Comply	2945	3211	3016.7	1639.1	2516	13327.8
Total Annual Cost	1503.5	1639.3	1746	947.2	1783.4	7619.4
Predicted Closures	155	0	0	0	0	155
Unemployment Estimate	775	0	0	0	0	775

TABLE 2

SUMMARY OF ECONOMIC IMPACT OF ZERO DISCHARGE* ON THE PAINT INDUSTRY ($000)

Segment	VS	S	M	L	VL	Total
No. Plants	469	513	296	111	111	1500
Plants in Compliance	237	259	150	56	56	758
Balance	232	254	146	55	55	742
Total Investment to Comply	881.6	965.2	1591.4	2805	4565	10808.2
Total Annual Cost	1020.8	1778	3518.6	1848	2816	10981.4
Predicted Closures	232	0	0	0	0	232
Unemployment Estimate	1160	0	0	0	0	1160

*Contract hauling for VS, S and M wastewater recycle with contract hauling for L and VL.

TABLE 3

SUMMARY OF IMPACT OF WASTEWATER TREATMENT COSTS
BAT, NSPS, PSES, PSNS

	VS		S		M		L		VL	
Segment	A	B	A	B	A	B	A	B	A	B
Treatment										
Physical Chemical	-4.2*	88*	10.2*	47*	16.8	10.8	12.8	6.1	17.7	2.4
Physical Chemical with Biological Treatment	-25.2*	697*	-10.0*	373*	8.7*	56.3*	9.9*	24.0	16.7	7.0
Wastewater Recycle with Contract Hauling	-8.9*	89.4*	8.3*	47.7*	16.4	11.8	12.4	7.0	17.6	2.9
Wastewater Recycle with Physical Chemical	-13.5*	160*	4.8*	85.4*	15.7	17.1	12.2	9.0	17.6	3.7
Wastewater Recycle with Physical Chemical Pre-Treatment and Biological Treatment	-27.3*	768*	-12.1*	411*	7.9*	62.6*	7.0*	26.9*	16.6	8.3
Contract Hauling	4.5*	17.6	12.9	9.4	16.5	3.8	12.1	2.1	16.7	1.2
Manually Operated Physical Chemical	-0.4*	17.6	12.9	9.4	18.6	1.6	NA	NA	NA	NA

A = Before Tax Return on Investment After Treatment

B = Control Investment as % of Fixed Assets

* = Potential Impact

E. LIMITS OF THE ANALYSIS

There are several critical assumptions which have a bearing on the accuracy of the analysis.

1. Model Plants

It is assumed that all plants in a segment are identical to the financial model for that segment. Any serious discrepancy in the 1976 profitability ratios could produce a large change in the degree of impact.

2. Control Costs

The sensitivity analysis indicated that no serious changes in impact occurred if operating costs were underestimated. However, if investment costs and annual capital costs are underestimated then a much larger portion of the small segment and part of the medium segment would become potential closure candidates.

3. Amount of Effluent Discharged

A major variable concerns the ratio of wastewater discharged to the number of paint gallons produced. The 308 survey indicated a wide range of values. If this is much larger than estimated, the impact will be more serious because of both the increased investment cost and increased operating and maintenance costs to handle a larger volume.

4. Capital Availability

For the economic analysis, capital was assumed borrowable on a 5 year direct reduction annual payback note at 12% interest. While the interest rate sensitivity is an important factor in the overall cost, the payback period has greater sensitivity. For instance, in the case of very small and small plants where financing might be difficult at best, a negative cash flow would result on paybacks of three years or less. In addition, the amount of capital required is a large percentage of plant fixed assets for very small and small plants. In this case, any loan would probably have to be self-financed or secured by a second mortgage on the owner's home, etc., at much higher interest rates.

5. Contract Hauling Costs

In some sections of the country, contract hauling costs are reported higher than those furnished. The sensitivity analysis shows that this also is a critical area.

Four factors contributing to control costs were found to be very sensitive in terms of their effect on closure probability. One is the cost for contract hauling of wastewater. If these costs are greater than those presented, a negative cash flow may result for all of the very small plants and for some of the small plants. Second, the cost of capital and, particularly, its payback period are important. Any requirement for capital investment for non-productive equipment is extremely difficult for small plants to manage, particularly on a short-term payback basis. Third is the ratio of water-thinned production to total paint production. Any increase in the ratio provided by EPA will result in a comparable increase in costs and reduced profits. Fourth, and perhaps most important, is the amount of wastewater discharged per unit of production. For the smaller plants, even a slight increase in this ratio will reduce profits to zero. Since about 20% of the industry responses to the 308 survey indicated ratios as much as five times higher than the ratio selected by the technical contractor, the actual number of closures may be higher than that estimated.

II. PURPOSE AND AUTHORITY

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters," Section 101(a). By July 1, 1977, existing industrial dischargers were required to achieve "effluent limitations requiring the application of the best practicable control technology currently available" ("BPT"), Section 301(b)(1)(A); and by July 1, 1983, these dischargers were required to achieve "effluent limitations requiring the application of the best available technology economically achievable. . . . which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants" ("BAT"), Section 301(b)(2)(A). New industrial direct dischargers were required to comply with Section 306 new source performance standards ("NSPS"), based on best available demonstrated technology; and new and existing dischargers to publicly owned treatment works ("POTW"s) were subject to pretreatment standards under Sections 307(b) and (c) of the Act. While the requirements for direct dischargers were to be incorporated into National Pollutant Discharge Elimination System (NPDES) permits issued under Section 402 of the Act, pretreatment standards were made enforceable directly against dischargers to POTW's (indirect dischargers).

A. BAT EFFLUENT LIMITATIONS

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process employed, process changes, non-water quality environmental impacts (including energy requirements) and the costs of application of such technology [Section 304(b) (2)(B)]. In general, the BAT technology level represents the best economically achievable performance of plants of various ages, sizes, processes or other shared characteristics. BAT may include process changes or internal controls, even when not common industry practice.

The Agency has considered the volume and nature of discharges, the volume and nature of discharges expected after application of BAT, the general environmental effects of the pollutants, and the costs and economic impacts of the required pollution control levels.

Despite this expanded consideration of costs, the primary determinant of BAT is effluent reduction capability. As a result of the Clean Water Act of 1977, the achievement of BAT has become the principal national means of controlling toxic water pollution. Although direct discharges of paint wastewater are small fractions of wastewater from paint manufacturing operations, the Agency is setting BAT limitations which are also applicable to existing indirect dischargers who might convert to direct discharge. The paint formulating industry discharges over 50 different toxic pollutants and EPA has selected among seven available BAT technology options which will reduce this toxic pollution by a significant amount.

B. NEW SOURCE PERFORMANCE STANDARDS

The basis for new source performance standards (NSPS) under Section 306 of the Act is the best available demonstrated technology. New plants have the opportunity to design the best and most efficient paint manufacturing processes and wastewater treatment technologies, and, therefore, Congress directed EPA to consider the best demonstrated process changes, in-plant controls,

and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible. Because BAT represents the limit of current technology, the seven options considered for NSPS are identical to the seven options described above under BAT Effluent Limitations. No further improvement in technology is anticipated in new sources. However, a new plant may reduce the hazardous waste generated in meeting NSPS as a result of extensive in-plant control being incorporated into plant design.

C. PRETREATMENT STANDARDS FOR EXISTING SOURCES

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. PSES are designed to prevent the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of POTWs. The Clean Water Act of 1977 adds a new dimension by requiring pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives, including the beneficial use of sludges on agricultural lands. The legislative history of the 1977 Act indicates that pretreatment standards are to be technology-based, analogous to the best available technology for removal of toxic pollutants. The general pretreatment regulations (40 CFR Part 403), which served as the framework for these proposed pretreatment regulations for the paint formulating industry, can be found at 43 FR 27736 (June 26, 1978).

D. PRETREATMENT STANDARDS FOR NEW SOURCES

Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. New indirect dischargers, like new direct dischargers, have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-plant controls, and end-of-pipe treatment technologies, and to use plant site selection to ensure adequate treatment system installation. The pretreatment options for new dischargers to POTWs are the same as those for PSES, presented in the preceding section.

The purpose of this report is to provide the economic impact support for any BAT, BPT, or NSPS pretreatment standards for existing sources (PSFS), and pretreatment standards for new segments of the Paint Industry, under Sections 301, 304, 306, 307 and 501 of the Clean Water Act.

III. METHODOLOGY

A. INDUSTRY SEGMENTS AND MODEL PLANTS

After the Paint Industry was characterized in a general way, the plants were segmented by size in terms of sales/production. Sizes were selected to correspond with available financial data. For each segment, a model statement of revenues minus total costs was prepared. The major item from which control costs were to be subtracted is profit before tax. Other features such as plant fixed assets, working capital, etc., were also calculated. Return on investment before tax was selected as a key financial indicator because there is little difference in this value for each of the model plants. It therefore offers the opportunity of comparing the impact of various control costs regardless of plant size by applying a single criteria for evaluating the impacts.

B. PRELIMINARY DETERMINATION OF IMPACT

Applying costs for control to the profit before tax for each model resulted in an estimated profit before tax after treatment. This value divided by the total plant investment (net fixed assets plus working capital) resulted in a Before Tax Return on Investment After Treatment.

For purposes of screening, it was assumed that any plant having a Before Tax Return on Investment After Treatment of 10% or less would be in the highly impacted category. For plants whose Before Tax Return on Investment After Treatment is significantly above this value no further detailed analyses were made. However, the cost for compliance for those plants was calculated and included in the total industry costs. In addition, any control option whose investment cost was greater than 25% of plant fixed assets was also considered to be highly impacted.

C. ECONOMIC IMPACTS

Before Tax Return on Investment was selected as the closure criterion since it is independent of plant size, it is easily understood by the small plant investors and it is a reasonable test for a plant owner to judge whether he should keep his money in the paint business or place it elsewhere. Ten percent was selected as a lower limit because this rate of return is readily obtainable from a variety of sources which suggests that a return at a lower rate would create an incentive to close the plant and re-invest in some other fashion.

It is recognized that many small plants will stay in operation despite an unfavorable return vis-à-vis alternative investment opportunities. Nevertheless, in conducting an impact analysis one must utilize the data available and closure predictions must be made on the basis of financial judgments not emotional judgments.

D. SENSITIVITY

Those plants in the highly impacted category, as determined by the initial screening, were further examined by determining the sensitivity to variables such as contract hauling costs, capital payback periods, ratio of wastewater to product, etc.

1. Price Effects

Since one method of recovering costs would be to raise prices, the average cost per gallon of product was calculated for each segment to maintain its Before Tax Return on Investment before treatment. From this data, an average price increase was calculated by dividing industry costs by gallons produced.

Assuming an average price increase, Before Tax Return on Investment After Treatment was again determined and capital availability estimated to see if those plants previously impacted could recover sufficiently to be removed from the potential closure category.

2. Capital Costs and Availability

Assuming that the necessary capital must be raised from outside financial assistance, capital costs were calculated for two long- and two short-term payback periods. These costs were used in determining Before Tax Return on Investment After Treatment for each of the segments determined as highly impacted in the screening analysis.

3. Discounted Cash Flow Analysis

Another method for determining potential plant closures is to examine the net present value of future revenues by discounted cash flow after treatment equipment is installed vs. plant salvage value. In the paint industry discounted cash flow analyses are not used as investment criteria except perhaps by the largest plants and are certainly not used as a criteria for closure. Salvage value of paint plants would be very difficult to estimate with any degree of accuracy.

IV. PRE-REGULATION INDUSTRY CONDITIONS

A. INDUSTRY CHARACTERISTICS

The paint industry comprises about 1200 companies operating 1500 manufacturing plants distributed throughout the United States (Figure 1). For the most part, the industry is dominated by a large number of very small companies which sell their products on a local or regional basis. This structure has come about partly because of high distribution costs and partly because it takes very little capital and little sophistication to enter this business. The large majority of paint plants blend the raw materials together according to formulae that have been handed down through the family or are readily available from one of their raw material suppliers. Only the very large plants manufacture some of their own raw materials and do the research and development required for new products.

An overview of the types of plants in this industry responding to the EPA survey, Department of Commerce data and Arthur D. Little, Inc., estimates shows that 67% are single-location operations, 74% are privately owned, 63% have fewer than 20 employees, 84% produce less than 1 million gallons of product annually, 50% are over 20 years old, 61% have annual sales of less than $1 million, and 30% ship their product less than 100 miles.

1. Description of the Products

The paint industry manufactures a wide variety of products generally sold in two classifications: trade sales and chemical coatings. It manufactures a few allied products, such as putty, shellac, etc., that are outside these categories, but they represent a very minor portion of the total industry. Companies and/or plants in the trade sales segment of the industry manufacture products sold directly to professional painters or to the public through company-owned and operated stores, hardware stores, retail stores and discount stores. The products are sold under nationally known brand names, private labels, and local or regional brand names. Chemical coatings, on the other hand, are generally sold directly to an industrial finisher, or manufactured and used in-house, and in a few cases, sold to the public.

Some companies manufacture only trade sales paints, others manufacture only chemical coatings, and still others manufacture only allied products. Most of the companies, however, manufacture products in more than one category. According to the 308 survey, 35% of the industry manufactures no trade sales paints, 20% manufactures no chemical coatings, and 75% manufactures no allied products. At the other end of the scale, 14% manufactures only trade sales paints, 26% manufactures only chemical coatings, and about 4% manufactures only allied products. More than 50% of the production of 42% of the plants is for trade sales; more than 50% of the production of 46% of the plants is for chemical coatings; and more than 50% of the production of about 7% of the plants is for allied products.

2. Industry Pricing

The paint industry, with few exceptions, is extremely competitive; prices are very frequently established to meet those of the competition. Some companies will calculate the lowest possible break-even selling price and try to establish their actual selling price somewhere between that price and one that provides a reasonable profit. Sometimes, small paint companies will sell at break-even or below, simply to keep their equipment running and their personnel busy.

Source: 308 Survey.

FIGURE 1 GEOGRAPHICAL DISTRIBUTION OF PAINT MANUFACTURING SITES

In inflationary times, labor costs tend to rise rapidly. To maintain some profit, the increased labor costs must be offset by higher selling prices, increased productivity, or lower raw material costs. Between 1960 and 1967, however, labor costs in the paint industry rose approximately 3.7% annually. At the same time, prices were increased approximately 1.2%, with an actual decline in raw material costs of about 1.6%. An increase in productivity of 1.9% coupled with the differential between rising labor costs and lower raw material costs provided relatively good profitability for the industry. Since 1967, however, gains in productivity have not offset the spread. The annual labor rate has been rising about twice as fast as in the 1960-67 period and raw material costs have also increased. This created a situation where profit margins declined considerably. The drastic increases in the cost of raw materials in 1973 and 1974, were coupled with a rather large increase in selling price that arrested this decline and put the paint industry back to the average profitability that it enjoyed in the 1960-67 period. Unfortunately, however, the industry is again facing the same conditions that it faced in 1967-74 and it is inevitable that industry profits will decline.

One of the key issues in looking at the economic impact of the control regulations on this industry is to determine whether prices will increase because of the regulations. This, of course, is extremely difficult to determine until the regulations are actually established. On the basis of previous studies, it may be expected that many plants will have treatment facilities already installed, so any wastewater effluent will meet the regulations. No price increase would be required on the products sold by these companies, which account for approximately 70% of industry sales.

3. Seasonality

Companies manufacturing predominantly trade sales paints have a marked seasonal pattern. Sales generally rise through the first half of the year, cool off through the summer months, and then decline steadily until they reach a minimum in December and January. Chemical coatings do not reflect the same seasonal pattern as the trade sales products although they do reach a peak during the middle of the year and then tend to drop off again in the December-January period. Sales of trade sales paints tend to increase during times of unemployment because workers then can spend their idle time repainting their homes.

The years 1974 and 1975 were not good for the paint industry, primarily because of general economic conditions and the extreme shortage of some essential raw materials. Trade sales paints showed about an 18% increase in dollar volume, but only a 4% increase in production over 1973. Sales of chemical coatings increased by more than 20%, but production actually declined over the same period. Growth in the industry has historically been somewhat slower than that of the gross national product and shows seasonality, particularly in architectural paints, which tend to peak in the summer and to correspond with housing starts. Chemical coatings generally tend to correspond with sales of the automotive and appliance industries and show less seasonality. The total value of shipments by the industry in 1974 was some $3.7 billion for about 900 million gallons.

B. INDUSTRY SEGMENTATION

In order to look at the impact of control regulations on individual plants it would be necessary to have financial data on each individual plant. For the "large" and "very large" segments, financial data on companies are available, as most of these are publicly owned and are required to provide such data to stockholders and other interested parties. There is a problem, however, because the financial data for these multi-plant companies are presented for the

ompany as a whole and not on a plant by plant basis. At the other end of the scale, for single-lant companies, such detailed financial information is not generally available and one has to nake assumptions about the financial profile of such companies. Models showing the financial rofiles of typical plants within each segment of the industry have been constructed using data rovided by the National Paint and Coatings Association in its publication "Operating Cost Survey 1976"; Kline Guide to the Paint Industry, 1975; Annual Statement Studies, 1976 Robert Morris Associates; and Arthur D. Little, Inc. estimates.

I. Types of Plants

The EPA's 308 survey of the industry, the previous economic study, company annual reports, private economic studies of the paint industry, government data, data made available rom the National Paint and Coatings Association, and Arthur D. Little, Inc., estimates indicate he distribution of these plants by various characteristics. The overwhelming majority is under rivate ownership (Table 4) and about two-thirds of the plants represent a single-plant company (Table 5). Ten plants are in the "captive" category, but for the most part these are owned by automotive or appliance manufacturers. Most of the plants have fewer than ten employees, (Table 6) which is not surprising in an industry that is composed of so very many small companies. Almost one-half of the plants are more than 30 years old (Table 7). Table 8 shows the average production by plant size. Tables 9, 10 and 11 show the distribution of plants versus the percentage of product type produced — trade sales, chemical coatings and allied products. Tables 12 and 13 show the distribution by plant of the percentage of water-thinned and solvent-thinned paints, respectively. There are 136 plants that use thinner other than water or organic solvent for at least a portion of their production, and 112 plants that manufacture resin.

TABLE 4

PAINT PLANTS BY CORPORATE ORGANIZATION

	No.	%
Public	301	20.0
Private	1111	74.1
Partnership	22	1.5
Proprietorship	61	4.1
Cooperative	5	0.3
		100.0

TABLE 5

PLANT DISTRIBUTION BY SITE STATUS

	No.	%
Single-plant Company	1004	66.9
Branch	311	20.7
Division	175	11.7
Captive	10	0.7
		100.0

Source: 308 Survey and Arthur D. Little, Inc., estimates.

TABLE 6

AVERAGE NUMBER OF EMPLOYEES PER PAINT PLANT
(1349 plant base)

	No.	%
Less than 10	562	41.7
11-20	286	21.2
21-30	134	9.9
31-40	64	4.7
41-50	66	4.9
51-60	49	3.6
61-70	30	2.2
71-80	15	1.1
81-90	19	1.4
91-100	19	1.4
101-150	52	3.8
Over 150	53	3.9

Source: 308 Survey

TABLE 7

DISTRIBUTION OF PAINT PLANTS BY AGE OF OPERATION
(1352 plant base)

	No.	%
Less than 3 years	67	4.9
3-5	102	7.5
6-10	168	12.4
11-20	321	23.7
21-30	268	19.8
Over 30	426	31.5

Source: 308 Survey

TABLE 8

AVERAGE PAINT PLANT PRODUCTION LAST FIVE YEARS (GALLONS)

(1327 plant base)

	No.	%
Less than 50,000	373	28.1
50,001-200,000	359	27.0
200,000-1,000,000	387	29.2
1,00,000-5,000,000	181	13.6
More than 5,000,000	27	2.0

Source: 308 Survey

TABLE 9

DISTRIBUTION OF TRADE SALES AS A PERCENT OF TOTAL PAINT PRODUCED

(1312 Plant Base)

Percent Trade Sales	No. Plants	%
0	464	35.4
1-10	125	9.5
11-20	39	3.0
21-30	44	3.4
31-40	39	3.0
41-50	58	4.4
51-60	34	2.6
61-70	47	3.6
71-80	43	3.3
81-90	77	5.9
91-100	160	12.2
100	182	13.9

Source: 308 Survey

TABLE 10

DISTRIBUTION OF CHEMICAL COATINGS AS A PERCENT OF TOTAL PAINT PRODUCED

(1305 Plant Base)

Percent Chemical Coatings	No. Plants	%
0	295	22.6
1-10	190	14.6
11-20	62	4.8
21-30	56	4.3
31-40	38	2.9
41-50	66	5.1
51-60	26	2.0
61-70	33	2.5
71-80	44	3.4
81-90	44	3.4
91-100	111	8.5
100	340	26.0

Source: 308 Survey

TABLE 11

DISTRIBUTION OF ALLIED PRODUCTS AS A PERCENT OF TOTAL PAINT PRODUCED

(1252 Plant Base)

Percent of Allied Products	No. Plants	%
0	919	73.4
1-10	170	13.6
11-20	22	1.8
21-30	17	1.4
31-40	22	1.8
41-50	15	1.2
51-60	6	0.5
61-70	4	0.3
71-80	7	0.6
81-90	8	0.6
91-100	25	2.0
100	37	3.0

Source: 308 Survey

TABLE 12

DISTRIBUTION OF WATER-THINNED PAINTS AS A PERCENT OF TOTAL

(1304 Plant Base)

Percent Water-Thinned	No. Plants	%
0	345	26.4
1-10	274	21.0
11-20	86	6.6
21-30	53	4.1
31-40	52	4.0
41-50	63	4.8
51-60	83	6.4
61-70	99	7.6
71-80	79	6.1
81-90	61	4.7
91-100	54	4.1
100	55	4.2

Source: 308 Survey

TABLE 13

DISTRIBUTION OF SOLVENT-THINNED PAINTS AS A PERCENT OF TOTAL

(1308 Plant Base)

Percent Solvent Thinned	No. Plants	%
0	135	10.3
1-10	98	7.5
11-20	66	5.0
21-30	100	7.6
31-40	78	6.0
41-50	114	8.7
51-60	60	4.6
61-70	50	3.8
71-80	51	3.9
81-90	97	7.4
91-100	229	17.5
100	230	17.6

Source: 308 Survey

2. Model Plant Development

On the basis of the industry segmentation, model plants were constructed to represent typical financial operating data for representative plants in each segment. In the construction of these models certain assumptions were necessary. Some assumptions were established by the EPA's technical contractor i.e. wastewater flow ratios of 0.2 gal/gal waterbased paint, and 50% of production is waterbased paint. This study assumes that the financial condition of all plants in the segment is the same as the model plant. Owners salary and other considerations to small plant owners are shown as normal profit before tax just as if the small individually owned plant were a part of a large corporation and would use equivalent financial reporting techniques.

Financial profiles of the model plants are shown in Table 14. Other data used in the construction of the models came from NPCA Operating Highlights, Robert Morris Associates studies and Arthur D. Little, estimates. The industry can be segmented into five categories on the basis of sales as follows:

- *Very large plants — sales over $10 million.* Plants in this category are in multi-plant companies which manufacture some of their own resins and some of their own pigments, have nationwide distribution through a large number of retail stores or are producing directly for large nationwide distributors. While this segment contains 111 plants it represents only about eight companies.
- *Large plants — sales between $5-10 million.* Plants in this category are very much like those in the very large category in that they are part of multi-plant companies, but the individual plants generally are smaller. The major distinction in this group is that very few, if any, manufacture any of their own raw materials. There are about 50 companies in this category.
- *Medium-sized plants — sales between $1-5 million.* In this category are plants that are owned by 150-200 companies, most of which have branch plant operations. These plants, however, are more like the smaller plants in the categories that follow than they are like those in the largest sales categories. The data indicate that these plants may be the most efficient in the industry in terms of size of plant for the market served. Some of the most profitable plants in the industry are in this category.
- *Small plants — sales $250,000 — $1 million. (See following category)*
- *Very small plants — sales less than $250,000.* Plants in this and the previous category are all single-company, single-plant locations, are privately owned, and account for a relatively small percentage of the total dollar volume of paint and coatings produced. These companies range in size from those with only two employees to some with 30 or more. Distribution of products from these plants is usually limited; products are sold through local hardware stores, home improvement centers, etc., generally at a lower retail price than the nationally known brands. Some companies in these categories, however, produce specialized products and are undoubtedly very profitable.

The distribution of the number of plants and their production by segments (Figure 2) shows that the very small plant segment has the largest number of plants and the smallest production.

TABLE 14

FINANCIAL PROFILES OF MODEL PAINT PLANTS

($000)

Segment	Very Small	Small	Medium	Large	Very Large
No. Plants	469	513	296	111	111
Annual Sales	200	600	2400	5000	15,000
Approx. No. Employees	5	12	42	80	280
Annual Production (000 gallons)	50	150	600	1250	3,750
Plant Profit Before Tax	6.8	27	140	293	1,260
Plant Net Worth	48.8	152	562	1726	4,348
Plant Working Capital	27.7	111	404	1310	3,928
Plant Total Assets	71.9	189	1106	2549	10,332
Plant Fixed Assets	21.6	40.4	289	732	2,851
Plant Total Investment	49.3	151.4	693	2042	6,779
Before Tax Return on Investment (%)	13.8	17.8	20.2	14.3	18.6

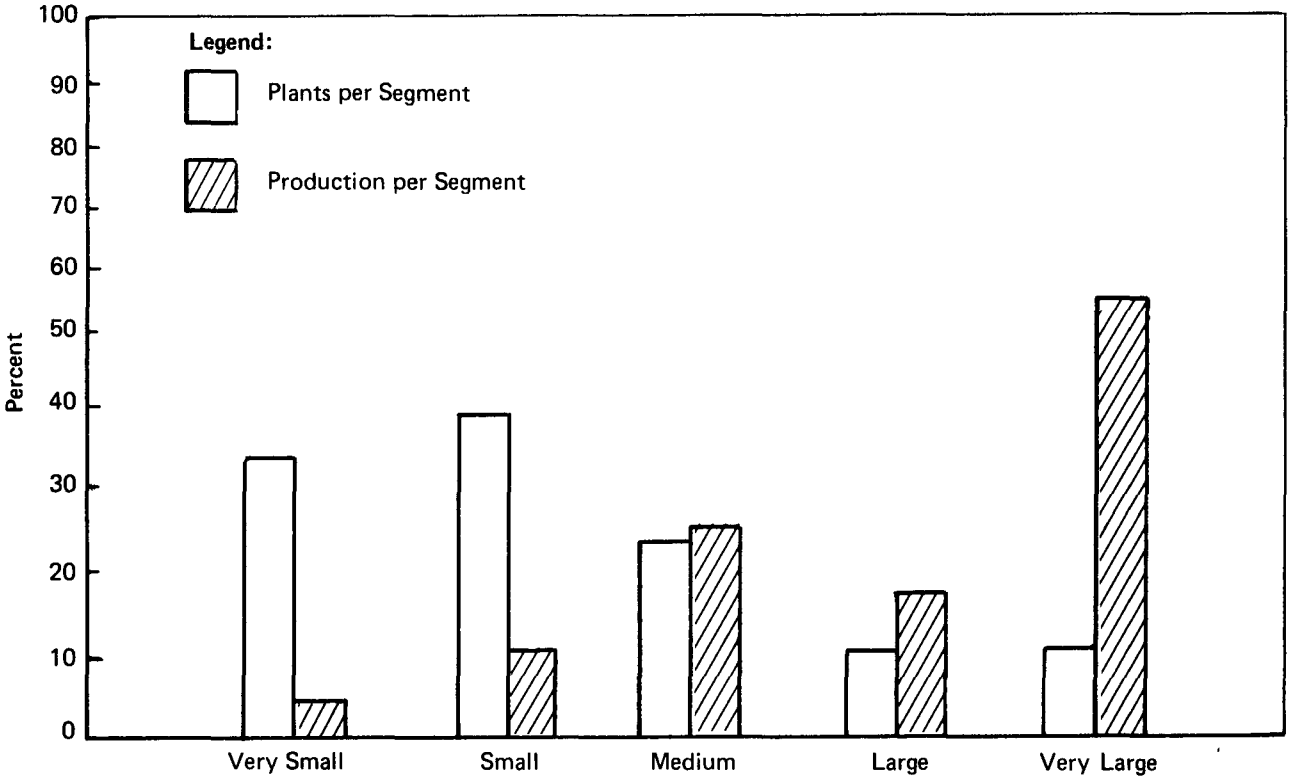

FIGURE 2 PERCENTAGE OF TOTAL PLANTS BY SEGMENT VS. PERCENTAGE OF TOTAL PRODUCTION BY SEGMENT

V. CONTROL COSTS

A. OPTIONS

The EPA studied seven alternative methods for controlling pollution from wastewater discharge by the paint industry:

1. Physical Chemical Pretreatment.
2. Physical Chemical Pretreatment with Biological Treatment.
3. Wastewater Recycle with Contract Hauling.
4. Wastewater Recycle with Physical Chemical Pretreatment.
5. Wastewater Recycle with Physical Chemical Pretreatment, and Biological Treatment.
6. Contract Hauling.
7. Manually Operated Physical Chemical Pretreatment.

Investment and operating costs have been provided for various size plants. These costs are presented in detail in the Development Document and are also summarized in Tables 15-21. The costs shown in this report have been deflated by a factor of 0.835 to reduce them to 1976 dollars, the base year for the data presented. This factor has been provided by EPA using a reference from ENR, 12, 21, 78 page 69 showing construction costs for 20 cities 1976-1978. Total investment, annual capital costs, annual operating costs and total annual costs are shown. The investment capital is assumed to be borrowed at a five year direct reduction annual payback at 12% interest. Depreciation figures shown in the Development Document under operating costs have been deleted so that operating costs show only operational and maintenance figures and the annual investment cost shows the debt payback for control equipment only.

B. APPLICATION OF COSTS

These costs were used for all segments in the initial screening for impact. Detailed analyses were made for two options for those segments impacted. In addition, sensitivity analyses were conducted for contract hauling cost, investment payback and wastewater/product ratios.

TABLE 15

PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	19.0	19.0	31.1	44.3	68.0
Annual Investment Cost	5.3	5.3	8.6	12.3	18.9
Annual Operating Cost	4.4	4.4	9.4	13.3	29.3
Total Annual Cost	9.7	9.7	18.0	25.6	48.2

TABLE 16

PHYSICAL CHEMICAL PRETREATMENT WITH BIOLOGICAL TREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	150.6	150.6	162.7	175.8	199.5
Annual Investment Cost	41.8	41.8	45.1	48.8	55.4
Annual Operating Cost	15.3	15.3	20.4	24.3	40.3
Total Annual Cost	57.1	57.1	65.5	73.1	95.7

TABLE 17

WASTEWATER RECYCLE WITH CONTRACT HAULING COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	19.3	19.3	34.2	51.0	83.0
Annual Investment Cost	5.3	5.3	9.4	14.1	23.0
Annual Operating Cost	7.6	7.6	11.1	19.5	28.2
Total Annual Cost	12.9	12.9	20.5	33.6	51.2

TABLE 18

WASTEWATER RECYCLE WITH PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	34.5	34.5	49.3	65.6	104.7
Annual Investment Cost	9.6	9.6	13.7	18.2	29.1
Annual Operating Cost	8.5	8.5	9.7	17.0	21.2
Total Annual Cost	18.1	18.1	23.4	35.2	50.3

TABLE 19

WASTEWATER RECYCLE WITH PHYSICAL CHEMICAL PRETREATMENT AND BIOLOGICAL TREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	166.0	166.0	180.9	197.1	236.2
Annual Investment Cost	46.0	46.0	50.2	54.7	65.5
Annual Operating Cost	19.5	19.5	20.6	27.7	31.6
Total Annual Cost	65.5	65.5	70.8	82.4	97.1

TABLE 20

CONTRACT HAULING COSTS

($000)

Segment	VS	S	M	L	VL
Total Investment	3.8	3.8	10.9	15.1	33.2
Annual Investment Cost	1.1	1.1	3.0	4.2	9.2
Annual Operating Cost	3.3*	5.9	21.1	40.0	115.4
Total Annual Cost	4.4	7.0	24.1	44.2	124.6

*Reduced to reflect smaller volume of sludge disposal costs.

TABLE 21

MANUALLY OPERATED PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M
Total Investment	3.8	3.8	4.7
Annual Investment Cost	1.1	1.1	1.3
Annual Operating Cost	5.9	5.9	8.6
Total Annual Cost	7.0	7.0	9.9

VI. ECONOMIC IMPACT

A. IMPACT SCREENING

As a first screening, the control costs developed by EPA were applied to the financial data developed for the model plants in each segment shown in Table 14. For this screening it was assumed that all plants in each segment are identical to the model. The criterion used to determine impact was a 10% or less before tax return on plant investment after treatment and/or that the investment for control is greater than 25% of plant fixed assets.

The effects of these costs on the model plants are shown in Tables 22-29.

TABLE 22

IMPACT OF PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	88.0	47.0	10.8	6.1	2.4
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	9.7	9.7	18.0	25.6	48.2
Profit Before Taxes After Treatment	(2.9)	17.3	122	267.4	1211.8
Total Investment After Treatment	68.3	170.4	724.1	2086.3	6847
Before Tax Return on Investment After Treatment (%)	(4.2)	10.2	16.8	12.8	17.7

TABLE 23

IMPACT OF PHYSICAL CHEMICAL PRETREATMENT WITH BIOLOGICAL TREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	697	373	56.3	24.0	7.0
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	57.1	57.1	65.5	73.1	95.7
Profit Before Taxes After Treatment	(50.3)	(30.1)	74.5	219.9	1164.3
Total Investment After Treatment	199.9	302	855.7	2217.8	6978.5
Before Tax Return on Investment After Treatment (%)	(25.2)	(10.0)	8.7	9.9	16.7

TABLE 24

IMPACT OF WASTEWATER RECYCLE WITH CONTRACT HAULING COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	89.4	47.7	11.8	7.0	2.9
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	12.9	12.9	20.5	33.6	51.2
Profit Before Taxes After Treatment	(6.1)	14.1	119.5	259.4	1208.8
Total Investment After Treatment	68.6	170.7	727.2	2093	6862
Before Tax Return on Investment After Treatment (%)	(8.9)	8.3	16.4	12.4	17.6

TABLE 25

IMPACT OF WASTEWATER RECYCLE WITH PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	159.7	85.4	17.1	9.0	3.7
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	18.1	18.1	23.4	35.2	50.3
Profit Before Taxes After Treatment	(11.3)	8.9	116.6	257.8	1209.7
Total Investment After Treatment	83.8	185.9	742.3	2107.6	6883.7
Before Tax Return on Investment After Treatment (%)	(13.5)	4.8	15.7	12.2	17.6

TABLE 26

IMPACT OF WASTEWATER RECYCLE WITH PHYSICAL CHEMICAL PRETREATMENT AND BIOLOGICAL TREATMENT COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	768	411	62.6	26.9	8.3
Profit Before Tax	6.8	27	140	239	1260
Total Annual Cost	65.5	65.5	70.8	82.4	97.1
Profit Before Taxes After Treatment	(58.7)	(38.5)	69.2	156.6	1162.9
Total Investment After Treatment	215.3	317.4	873.9	2239.1	7015.2
Before Tax Return on Investment After Treatment (%)	(27.3)	(12.1)	7.9	7.0	16.6

TABLE 27

IMPACT OF CONTRACT HAULING COSTS

($000)

Segment	VS	S	M	L	VL
Fixed Assets (Before Treatment)	21.6	40.4	289	732	2851
Investment % Fixed Assets	17.6	9.4	3.8	2.1	1.2
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	4.4	7.0	24.1	44.2	124.6
Profit Before Taxes After Treatment	2.4	20	115.9	248.8	1135.4
Total Investment After Treatment	53.1	155.2	703.9	2057.1	6812.2
Before Tax Return on Investment After Treatment (%)	4.5	12.9	16.5	12.1	16.7

TABLE 28

IMPACT OF MANUALLY OPERATED PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	VS	S	M
Fixed Assets (Before Treatment)	21.6	40.4	289
Investment % Fixed Assets	17.6	9.4	1.6
Profit Before Tax	6.8	27	140
Total Annual Cost	7.0	7.0	9.9
Profit Before Taxes After Treatment	(0.2)	20	130.1
Total Investment After Treatment	53.1	155.2	697.7
Before Tax Return on Investment After Treatment (%)	(0.4)	12.9	18.6

1. Impact of Costs on Indirect Dischargers

Table 29 summarizes the impact of control costs for all treatment technologies on various size paint plants. The control options selected by EPA for PSES are as follows: Option 1 — Physical Chemical Pretreatment and Option 2 — Zero discharge. For Option 1, small plants may elect manually operated physical chemical pretreatment and Contract Hauling for Option 2. Very small plants show potential for high impact by all technologies.

2. Impact of Costs on Direct Dischargers

The control options selected by EPA are those which are required for PSES, namely — Physical Chemical Pretreatment and Zero Discharge. According to the screening analysis the four small and two large plants in this category can meet zero discharge without the potential of high impact. They can clearly meet less stringent limitations based on some other technology.

3. New Sources

The requirements for NSPS are the same as BAT. PSNS requirements are the same as PSES. New sources therefore will have the same limitations as existing sources and will be under no competitive disadvantage because of regulations. The added investment and cost may slow entry into the industry, however.

B. IMPACT ANALYSIS OF SELECTED OPTIONS

The options selected by EPA for study are: Option 1 — Physical Chemical Pretreatment, Option 2 — Zero Discharge by the most economical method.

1. Industry Wide Price Effects

One of the techniques for recovering the costs associated with effluent control is to pass these costs through to plant customers. To estimate a general industry price increase, one must assume that all plants affected will pass on costs for control and that the entire industry will follow suit, even though a large majority of plants already have controls in place and are already incurring control costs. For each segment, the amount of additional revenue necessary to maintain return on investment at the pre-control level was calculated. This value divided by the segment production shows the increase in cost per gallon estimated for affected plants in each segment. Since prices are normally established by the larger producers, no additional price increase is expected over that shown for the largest segment.

Table 30 shows that in order to maintain ROI in the very large plant a price increase of 2¢/gallon could be expected if either zero discharge or physical chemical pretreatment is promulgated. This price increase would, of course, benefit all plants.

2. Industry Wide Costs of Compliance

Table 31 shows the anticipated industry costs resulting from plants having to comply with Option 1 — Physical Chemical Pretreatment. It is assumed that plants discharging treated wastewater can meet this regulation so that only those plants discharging untreated water are included. With an expected 2.0¢ per gallon price increase, this is enough to recover the cost of control for all but the small and very small segments. Table 32 shows the industry costs for plants having to comply with Option 2 — Zero Discharge which include all discharging plants (742). An anticipated price increase of 2¢/gallon will recover the incremental costs for control for only the very large plants.

TABLE 29

SUMMARY OF IMPACT OF WASTEWATER TREATMENT COSTS
BAT, NSPS, PSES, PSNS

Segment	VS		S		M		L		VL	
Treatment	A	B	A	B	A	B	A	B	A	B
Physical Chemical	-4.2*	88*	10.2*	47*	16.8	10.8	12.8	6.1	17.7	2.4
Physical Chemical with Biological Treatment	-25.2*	697*	-10.0*	373*	8.7*	56.3*	9.9*	24.0	16.7	7.0
Wastewater Recycle with Contract Hauling	-8.9*	89.4*	8.3*	47.7*	16.4	11.8	12.4	7.0	17.6	2.9
Wastewater Recycle with Physical Chemical	-13.5*	160*	4.8*	85.4*	15.7	17.1	12.2	9.0	17.6	3.7
Wastewater Recycle with Physical Chemical Pre-Treatment and Biological Treatment	-27.3*	768*	-12.1*	411*	7.9*	62.6*	7.0*	26.9*	16.6	8.3
Contract Hauling	4.5*	17.6	12.9	9.4	16.5	3.8	12.1	2.1	16.7	1.2
Manually Operated Physical Chemical	-0.4*	17.6	12.9	9.4	18.6	1.6	NA	NA	NA	NA

A = Before Tax Return on Investment After Treatment

B = Control Investment as % of Fixed Assets

* = Potential Impact

TABLE 30

AVERAGE PRICE INCREASE TO MAINTAIN ROI
PHYSICAL CHEMICAL PRETREATMENT

Segment	No. Plants to Comply	Needed Revenue ($000)	Total Gallons (MM)	Price Increase/Gallon (¢)
VS*	155	$ 763.8	7.75	9.8
S**	169	1,288.7	25.35	5.1
M**	97	1,051.0	58.2	1.8
L	37	1,144.8	46.25	2.5
VL	37	2,284.4	138.75	1.6
Total	495	$6,532.7	276.3	2.4 (Ave.)

ZERO DISCHARGE

Segment	No. Plants to Comply	Needed Revenue ($000)	Total Gallons (MM)	Price Increase/Gallon (¢)
VS*	232	$ 1,143.2	11.6	9.8
S*	254	1,936.9	38.1	5.1
M*	146	3,838.0	87.6	4.4
L***	55	2,194.4	68.75	3.2
VL***	55	3,714.3	206.25	1.8
Total	742	$12,826.8	412.3	3.1 (Ave.)

*Contract Haul.
**Manually operated physical chemical.
***Wastewater recycle with contract haul.

TABLE 31

INDUSTRY CONTROL COSTS FOR OPTION 1
PHYSICAL CHEMICAL PRETREATMENT
($000)

Segment	VS	S	M	L	VL	Total
No. Plants	155	169	97	37	37	495
Annual Control Cost/Plant	4.4	7.0	9.9	25.6	48.2	–
Total Annual Cost	682	1,183	960.3	947.2	1,783.4	5,555.9
Cost/Gallon Product (¢)	9.4	4.7	1.6	2.0	1.3	2.0

TABLE 32

INDUSTRY COSTS FOR OPTION 2 – ZERO DISCHARGE
($000)

Segment	VS	S	M	L	VL	Total
No. Plants	232	254	146	55	55	742
Annual Cost/Plant	4.4	7.0	24.1	33.6	51.2	–
Total Annual Cost	1,020.8	1,778	3,518.6	1,848	2,816	10,981.4
Cost/Gallon (¢)	8.8	4.7	4.0	2.7	1.4	2.7

While Table 32 includes the direct dischargers in the total industry costs for compliance with zero discharge. Table 33 shows a separate breakdown of these costs. Since zero discharge is economically achievable, other less stringent levels will also be achievable and therefore have not been evaluated.

TABLE 33

IMPACT OF ZERO DISCHARGE CONTROL COSTS ON
DIRECT DISCHARGERS
($000)

Segment	S	VL
No. Plants	4*	2**
Total Investment for Control	15.2	166
Annual Investment Cost	4.4	46
Annual Operating Cost	23.6	56.4
Total Annual Cost	28.0	102.4
Predicted Closures	0	0
Predicted Unemployment	0	0

*Contract Hauling
**Wastewater Recycle with Contract Hauling

3. Closure Analysis

a. Effect on Small and Very Small Segment Impact

Assuming a 2¢ price increase for the selected options, the effect of this increase on control cost impact is shown in Table 34. This price increase does little for the very small plant, but it may provide enough return to the small plant to avoid closure if profits decline or costs increase in the future.

A 2¢/gallon price increase does not appear to be a large amount when considering the retail price per gallon of paint. A better comparison, however, is shown in Table 35, where profit before tax on a per-gallon basis is shown for Option 1 and Option 2 before and after regulation.

TABLE 34

EFFECT OF 2¢ PRICE INCREASE
($000)

Segment	VS	S	
Treatment	Contract Hauling	Manually Operated Physical Chemical Pretreatment	Contract Hauling
Profit Before Tax	7.8	30.0	30.0
Investment Cost	1.1	1.1	1.1
Operating Cost	3.3	5.9	5.9
Total Annual Cost	4.4	7.0	7.0
Profit Before Tax After Treatment	3.4	23	23
Total Investment After Treatment	53.1	155.2	155.2
Before Tax Return on Investment After Treatment (%)	6.4	14.8	14.8

TABLE 35

PROFIT BEFORE TAX AFTER TREATMENT PER GALLON PRODUCT
(¢/gal)

Segment	VS		S		M		L		VL	
Option	1	2	1	2	1	2	1	2	1	2
Profit Before Tax	13.6	13.6	18.0	18.0	23.3	23.3	23.4	23.4	33.6	33.6
Total Annual Cost	8.8	8.8	4.7	4.7	1.7	4.0	2.1	2.7	1.3	1.4
Profit Before Tax After Treatment	4.8	4.8	13.3	13.3	21.6	19.3	21.3	20.7	32.3	32.2
Loss in Profit (%)	64.7	64.7	50.7	50.7	7.3	17.2	9.0	11.5	3.9	4.2

4. Capital Availability

Summary Table 29 shows the investment for control as a percent of fixed assets.

It was assumed that if this value was greater than 25% then capital availability would be a problem. Several lending institutions were checked to verify this policy and most agreed that small companies would have difficulty raising capital without some outside collateral. Second mortgages on the owner's home was the method mentioned most often. This, of course, would imply a much higher interest rate than for a commercial loan. Rates and payback periods are discussed in the section on sensitivity.

Only the very large plants could have capital available for all alternatives. Medium and large plants could not raise capital easily if biological treatment was selected as the control technology. For small and very small plants capital availability for most options will be difficult. Contract hauling is the best from an investment standpoint.

5. Closure Effects

The industry survey developed for EPA by its technical contractor shows in Table V-6 the wastewater discharge volumes of the industry. This table shows 608 zero dischargers out of 1374 total plants, 122 plants did not report the volume discharged. An examination of the answers to other questions by these 122 plants shows that 86 practice zero discharge for an industry total of 694 or 50.5% of the plants responding to the survey. Using this as a guide the 126 very small plants not responding to the survey were assumed to follow the same practice. The discharge practice of the industry therefore, is assumed to be as follows:

758 Zero Discharge
736 Indirect Discharge
6 Direct Discharge

1,500 Total Plants

It is interesting that Table VII-3 in the engineering report, while it contains multiple data from some plants, it shows that about 64% of the industry practices zero discharge. An analyses of the responses to the question regarding discharging treated vs. untreated water indicates 58% of the plants practice zero discharge. Since there is some discrepancy in the total number of zero dischargers EPA selected the lower number (758 or 50.5%) in order to evaluate the impact on the greatest number of plants.

The total number of discharging plants is 742 and of these about one third treat the wastewater before discharging, according to the 308 survey. A breakdown of these data by plant size is shown in the following table:

TABLE 36

WASTEWATER DISCHARGE PRACTICE

Segment	VS	S	M	L	VL	Total
Zero discharge	237	259	150	56	56	758
Treated discharge	77	85	49	18	18	247
Untreated discharge	155	169	97	37	37	495
Total	469	513	296	111	111	1500

Source: 308 survey and Arthur D. Little, Inc., estimates.

a. Baseline Closures

No baseline closures were predicted for two reasons. First and most important is that Census of Manufactures data and industry publications indicate a stable condition in the net total number of plants over a period of years. This indicates that for each plant which closes a new one starts up (probably on the premises of the closed plant). Secondly, the total number of plants used in the study (1500), selected on the basis of the 308 survey, appears lower than the number of plants reported by Department of Commerce data so that deduction of predicted baseline closures would understate the industry impact due to control costs.

6. Production Effects

Assuming the worst case, e.g., that 232 very small plants closed under Option 2 the total production from these plants is about 11.6 million gallons annually. Spreading this product equally among the remaining plants would amount to 9000 gallons annually for each. This represents an increase of 6% for a small plant and 0.2% for a very large plant. The industry is currently operating at less than 85% of full production capacity so that no production effects will be noted.

7. Employment Effects

For Option 1, some 155 plants are predicted to close creating 775 unemployed mostly in urban areas. Under Option 2, 232 plants are predicted to close with about 1160 unemployed.

VII. LIMITS OF THE ANALYSIS

A. MODEL PLANTS

On the basis of the 308 survey and an analysis of unreturned questionnaires 1500 paint plants has been adopted as the total figure. This figure is not in agreement with published "Census of Manufactures" data or the "Paint Red Book." If there are more plants than the 1500 assumed, it is highly likely that they will fall into the very small category and the number of closures would increase in direct proportion to the number of plants omitted.

It was also assumed that all plants in each segment have financial data equivalent to the model plant. Recognizing that not all plants of the same size will have the same profitability an analysis of the range of profitability suggests that no additional closures can be predicted for plants which differ from the model.

B. CONTROL COSTS

A sensitivity analysis of the effect of increasing contract hauling costs by factors of 2 and 3 show little change in the impact predicted. However, for small and very small plants total investment and annual investment cost can be critical. Any serious underestimate of these costs could increase predicted closures.

C. AMOUNT OF EFFLUENT

This is a major variable noted in the 308 survey. Even a slight change in ratios will seriously affect small plants and if the change is large enough medium sized plants would be highly impacted. High pressure rinsing will reduce the amount of effluent but even if it reduced it by a factor of five the small plants would still be affected. In addition the small and very small plants probably could not borrow the capital necessary to install this equipment.

This is the most serious assumption in the analysis since the entire economic analysis is based on the assumed ratio. At the higher ratios most of the small paint plants would be predicted as closures.

D. CAPITAL AVAILABILITY

Capital availability for small plants was assumed available under a five year direct payback with 12% annual interest. Short term loans are more likely for non-productive equipment especially where regulations may change and render the equipment obsolete. Short term paybacks could create serious cash flow problems for small plants. For some alternatives the capital investment required is so high that these options are not available for small and very small plants.

E. PRICE INCREASE

A 2¢/gal price increase will return the cost of control for only very large plants under zero discharge conditions. Since prices are largely established by these plants, all other plants will operate at a lower profitability than pre-regulation conditions.

F. CONTRACT HAULING COSTS

The Development Document used 30¢/gal as the contract hauling charge. Sensitivity has been examined using 30, 60 and 90¢/gal. as shown in the following tables.

TABLE 37

SENSITIVITY OF CONTRACT HAULING COSTS ON PHYSICAL CHEMICAL PRETREATMENT COSTS

($000)

Segment	L			VL		
Hauling Cost (¢/gal)	30	60	90	30	60	90
Profit Before Taxes	293	293	293	1260	1260	1260
Total Annual Cost	25.6	31.2	36.8	48.2	65.1	82.0
Profit before Tax after Treatment	267.4	261.8	256.2	1211.8	1194.9	1178
Before tax return on Investment after Treatment (%)	12.8	12.5	12.3	17.7	17.5	17.2

TABLE 38

SENSITIVITY OF CONTRACT HAULING COSTS ON WASTEWATER RECYCLE COSTS

($000)

Segment	L			VL		
Hauling Cost (¢/gal)	30	60	90	30	60	90
Profit Before Taxes	293	293	293	1260	1260	1260
Total Annual Cost	33.6	41.1	48.6	51.2	66.2	81.2
Profit Before Tax After Treatment	259.4	251.9	244.4	1208.8	1193.8	1178.8
Before Tax Return on Investment after Treatment (%)	12.4	12.0	11.7	17.6	17.4	17.2

TABLE 39

SENSITIVITY OF CONTRACT HAULING COSTS ON
MANUALLY OPERATED PHYSICAL CHEMICAL TREATMENT COSTS

($000)

Segment	M			S		
Hauling Costs (¢/gal)	30	60	90	30	60	90
Profit Before Taxes	140	140	140	27	27	27
Total Annual Cost	9.9	12.3	13.4	7.0	8.7	9.2
Profit Before Tax After Treatment	130.1	127.7	126.6	20.0	18.3	17.8
Before Tax Return on Investment after Treatment (%)	18.6	18.3	18.1	12.9	11.8	11.5

TABLE 40

SENSITIVITY OF CONTRACT HAULING COSTS
ON CONTRACT HAULING

($000)

Segment	VS			S			M		
Hauling Cost (¢/gal)	30	60	90	30	60	90	30	60	90
Profit before Taxes	6.8	6.8	6.8	27	27	27	140	140	140
Total Annual Cost	4.4	5.9	7.4	7.0	10.8	14.5	24.1	42.8	61.6
Profit Before Tax After Treatment	2.4	0.9	(0.6)	20.0	16.2	12.5	115.9	97.2	78.4
Before Tax Return on Investment After Treatment (%)	4.5	1.7	(1.1)	12.9	10.4	8.1	16.5	13.8	11.1

On the basis of these data, it can be shown that any increase in the costs for contract hauling will have the most effect on the small and very small plants. Substantial increases could adversely affect the medium sized plants as well.

G. CAPITAL INVESTMENT PAYBACK

Since the payback period on high risk capital may be much shorter than that indicated in the development document the sensitivity to this variable was determined for medium, small and very small plants for manually operated physical chemical pretreatment and contract hauling. Time spans of 3, 5, 10 and 30 years (life of equipment) were used. 12% interest was assumed in all cases.

TABLE 41

EFFECT OF PAYBACK PERIOD FOR MANUALLY OPERATED PHYSICAL CHEMICAL TREATMENT INVESTMENT

($000)

Segment	S				M			
Payback Period (yrs.)	3	5	10	30	3	5	10	30
Profit Before Taxes	27	27	27	27	140	140	140	140
Annual Cost of Capital	1.6	1.1	0.7	0.5	2.0	1.3	0.8	0.6
Operating Cost	5.9	5.9	5.9	5.9	8.6	8.6	8.6	8.6
Total Annual Cost	7.5	7.0	6.6	6.4	10.6	9.9	9.4	9.2
Profit Before Tax After Treatment	19.5	20.0	20.4	20.6	129.4	130.1	130.6	130.8
Before Tax Return on Investment After Treatment (%)	12.6	12.9	13.1	13.3	18.5	18.6	18.7	18.7

TABLE 42

EFFECT OF PAYBACK PERIOD FOR CONTRACT HAULING INVESTMENT

($000)

Segment	VS				S				M			
Payback Period (yrs.)	3	5	10	30	3	5	10	30	3	5	10	30
Profit Before Taxes	6.8	6.8	6.8	6.8	27	27	27	27	140	140	140	140
Annual Cost of Capital	1.6	1.1	0.7	0.15	1.6	1.1	0.7	0.5	4.5	3.0	1.9	1.3
Operating Cost	3.3	3.3	3.3	3.3	5.9	5.9	5.9	5.9	21.1	21.1	21.1	21.1
Total Annual Cost	4.9	4.4	4.0	3.4	7.5	7.0	6.6	6.4	25.6	24.1	23.0	22.4
Profit Before Tax After Treatment	1.9	2.4	2.8	3.4	19.5	20.0	20.4	20.6	114.4	115.9	117	117.6
Before Tax Return on Investment After Treatment (%)	3.6	4.5	5.3	5.6	12.6	12.9	13.1	13.3	16.4	16.5	16.8	16.9

H. WASTEWATER/PRODUCTION RATIO

The 308 survey indicated that as much as 19% of the industry created ratios of wastewater to product of 1:1 or greater. It is anticipated that these higher ratios are found in the smaller plants. Assuming that capital investment remains as it is at the 0.2 ratio but that operating costs are directly proportional to volume, the following table shows the effect of increasing ratio on contract hauling costs for the very small, small and medium segments.

TABLE 43

EFFECT OF INCREASED WASTEWATER/PRODUCT RATIO

($000)

Segment	VS			S			M		
Ratio	0.2	0.6	1.0	0.2	0.6	1.0	0.2	0.6	1.0
Profit Before Taxes	6.8	6.8	6.8	27	27	27	140	140	140
Total Annual Cost	4.4	11.0	17.6	7.0	18.8	30.6	24.1	66.3	108.5
Profit Before Tax After Treatment	2.4	(4.2)	(10.8)	20.0	8.2	(3.6)	115.9	73.7	31.5
Before Tax Return on Investment After Treatment (%)	4.5	(7.9)	(20.3)	12.9	5.3	(2.3)	16.5	10.5	4.5

These data indicate a high impact for all very small plants at all ratios. High impact is also noted for small and medium plants at the higher ratios. Negative returns for very small plants and small plants at the 1:1 ratio would predict closure under these conditions.

The Development Document provides capital costs for a high pressure water rinsing system. Assuming that the volume could be reduced from the average 0.2:1 ratio to 0.04:1 through high pressure rinsing then the following conditions would result. Operating costs are assumed to be no higher than those associated with normal rinsing and therefore are omitted. Operating costs for contract hauling have been included however.

From an economic view the high pressure rinse system is attractive for very large, large and medium plants which would have to meet zero discharge regulations. Small and very small plants would not make the investment since conventional contract hauling is less costly and requires less investment and provides a higher return on investment. It is also apparent that many indirect dischargers could change to zero discharge by installing this equipment. For instance the return on investment for very large, large and medium plants is greater using this technology than with Physical Chemical Pretreatment. Such an effect would reduce the load on POTW's and increase the demand on landfill operations significantly.

TABLE 44

COST FOR REDUCTION OF WASTEWATER FROM 0.2/GAL TO 0.04 GAL/GAL VIA HIGH PRESSURE RINSING WITH CONTRACT HAULING

($000)

Segment	VS	S	M	L	VL
Gal/day 0.2/1	20	50	250	500	1500
Gal/day 0.04/1	4	10	50	100	300
Capital Investment High Pressure Rinse	16.6	16.6	16.6	16.6	16.6
Capital Investment Contract Haul	3.8	3.8	3.8	10.9	15.1
Total Investment	20.4	20.4	20.4	27.5	31.7
Annual Cost of Capital	5.7	5.7	5.7	7.6	8.8
Annual Operating Cost Contract Haul*	2.4	2.9	5.9	9.6	24.8
Total Annual Cost	8.1	8.6	11.6	17.2	33.6

*Sludge disposal varied by volume, other costs (i.e., labor) are as shown in the Engineering Report.

TABLE 45

IMPACT OF WASTEWATER REDUCTION WITH CONTRACT HAULING COSTS

Segment	VS	S	M	L	VL
Fixed Assets (Before Treat)	21.6	40.4	289	732	2851
Investment % Fixed Assets	94.4	50.5	7.1	3.8	1.1
Profit Before Tax	6.8	27	140	293	1260
Total Annual Cost	8.1	8.6	11.6	17.2	33.6
PBT After Treatment	(1.3)	18.4	128.4	275.8	1226.4
Total Investment After Treatment	69.7	171.8	713.4	2069.5	6810.7
Before Tax Return on Investment after Treatment (%)	(1.9)	10.7	18.0	13.3	18.0

I. DISCOUNTED CASH FLOW VS. PLANT SALVAGE VALUE

While this technique is not used by the paint industry to determine closure options, one can predict closure on the assumption that plant salvage value is greater than the discounted value of a future amount of earnings after treatment. Plant salvage value is, at best, difficult to estimate in an industry dominated by small, old plants. For the most part, fixed assets of land and building are what is salvageable and it is extremely difficult to factor land appreciation values over the projected period. For very small plants, depreciation is estimated at 1.6% of sales or about $3,200 which represents the present value of equipment. This added to the value of the land and building suggests that 75% of fixed assets is the lowest reasonable estimate of plant salvage value that can be used in the analysis. The following table shows the net present value of return (profit before tax) after zero discharge over 5, 10, 30 and 50 years at 12% discount rate against the salvage value of small and very small plants.

TABLE 46

DISCOUNTED CASH FLOW VS. SALVAGE VALUE
($000)

	VS		S	
Segment	**Before Treatment**	**After Treatment**	**Before Treatment**	**After Treatment**
Profit before Tax	6.8	2.4	27	20.0
Net Present Value				
5 years	24.5	8.7	97.3	72.1
10 years	38.4	13.6	152.6	113
30 years	54.8	19.3	217.5	161
50 years	56.4	19.9	224.2	166
Salvage Value	16.2	16.2	30.3	30.3

This data shows that small plants after treatment still have net present values greater than salvage values for both short and long term operations. If profitability declines and/or costs increase during this period then much longer periods of this condition would occur. For instance if the combination of decreased profitability and cost increases reduced profit by 20% then the very small plants would have a negative DCF vs Salvage value forever.

VIII. REFERENCES

1. Economic Analysis of Proposed Effluent Guidelines Paint and Allied Products and Printing Ink Industries EPA-230/1-74-052, August 1974.

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3. Paint Red Book Eighth Edition; Palmerton Publishing Company.

4. Operating Cost Survey, 1976. National Paint and Coatings Association.

5. Draft Engineering Report for Development of Effluent Limitations Guidelines for the Paint Manufacturing Industry. Burns and Roe.

6. U.S. Department of Commerce, Census of Manufactures.