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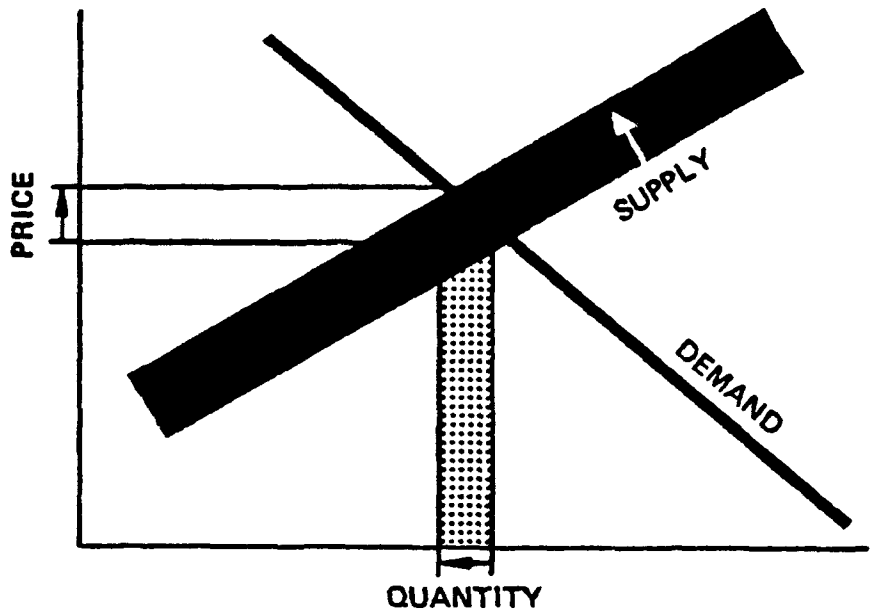
Economic Impact Analysis of Effluent Limitations and Standards for Plastics Molding and Forming Industry



Economic Impact Analysis of Effluent Limitations and Standards for the Plastics Molding and Forming Industry

Prepared for

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

This document is an economic impact assessment of the recently-issued effluent guidelines. The report is being distributed to EPA Regional Offices and state pollution control agencies and directed to the staff responsible for writing industrial discharge permits. The report includes detailed information on the costs and economic impacts of various treatment technologies. It is should be helpful to the permit writer in evaluating the economic impacts on an industrial facility that must comply with BAT limitations or water quality standards.

The report is also being distributed to EPA Regional Libraries, and copies are available from National Technical Information Service (NTIS), 5282 Port Royal Road, Springfield, Virginia 22161 (703)-487-4650.

If you have any questions about this report, or if you would like additional information on the economic impact of the regulation, please contact the Economic Analysis Branch in the Office of Water Regulations and Standards at EPA Headquarters:

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PREFACE

This document is a contractor's study prepared for the Office of Water Regulations and Standards of the Environmental Protection Agency (EPA). The purpose of the study is to analyze the economic impact which could result from the application of effluent limitations guidelines and standards issued under Sections 301, 304, 306, 307, 308, and 501 of the Clean Water Act to the plastics molding and forming industry.

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

The study has been prepared with the supervision and review of the Office of Water Regulations and Standards of EPA. This report was submitted in fulfillment of Contract No. 68-01-6426 by Meta Systems Inc and completed in December 1984.

Section 1

Executive Summary

1.1 Introduction and Purpose

This report presents an analysis of the economic impacts that are likely to result from the effluent limitations guidelines and standards for the Plastics Molding and Forming (PM&F) Industry. 1/ The regulation includes effluent limitations guidelines and standards based on Best Practicable Control Technology Currently Available (BPT), Best Available Technology Economically Achievable (BAT), Best Conventional Pollutant Control Technology (BCT), and New Source Performance Standards (NSPS), which are issued under authority of Sections 301, 304, 306, 307, 308 and 501 of the Clean Water Act (Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1251 et. seq.), as amended by the Clean Water Act of 1977 (Public Law 95-217). EPA is not promulgating PSES and PSNS for reasons explained in the preamble and the development document for the final rule. The primary economic impact variables assessed in this study include the cost of the regulation and the potential for this regulation to cause plant closures, price changes, unemployment, community impacts, shifts in the balance of foreign trade, impacts on new sources, and impacts on small businesses.

1.2 Scope

1.2.1 Industry Coverage

Many of the processes by which plastics are molded and formed use little or no water; only a small proportion of the PM&F plants use water. The effluent limitations guidelines and standards primarily affect those plants that use process water (wet processes) and those plants which are direct dischargers (not indirect dischargers). 2,3/ For regulatory purposes, the PM&F industry

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1/ This report uses the terms "plastics molding and forming" and "plastics forming" interchangeably. Also used interchangeably here are the terms "regulation" and "effluent limitations guidelines and standards."

2/ The Agency considered establishing categorical pretreatment standards for new and existing sources discharging pollutants to POTW's. For the reasons discussed in the preamble to the final rule, the Agency is not establishing pretreatment standards for the PM&F industry. (The preamble for the final PM&F rule is found in the Federal Register, 49 FR49026; Dec. 17, 1984.)

3/ The entire PM&F industry potentially is affected by this regulation, even though only one segment of that industry -- in this case the wet, direct discharging plants -- incurs costs for the installation, operation and maintenance of any pollution control equipment and practices to meet the effluent limitations. The other segments of the industry may be indirectly affected by the economic impacts of the regulation on production costs, product prices and other competitive factors in the PM&F industry.

is divided into three subcategories. These are: (1) processes that use contact cooling and heating water, (2) processes that use cleaning water, and (3) processes that use finishing water. This subcategorization, based upon the process (e.g., cleaning) for which water is used and the associated wastewater characteristics, is suited to the development of technical options. However, the economic achievability of effluent limitations guidelines and standards depends upon the ability of economic entities -- in this case PM&F plants -- to pay for the investment in and maintenance of pollution control practices and equipment. Therefore, for purposes of the economic impact analysis of existing sources, the portion of the PM&F industry bearing the pollution control costs is divided into four industry groups.

Each industry group represents a type of direct discharging PM&F plant in the data base that has in common one or more of the PM&F regulatory subcategories. The four industry groups are: (1) plants with processes only in the contact cooling and heating water subcategory; (2) plants with processes only in the cleaning water subcategory; (3) plants with processes in both the cleaning and contact cooling and heating water subcategories, and (4) plants with processes in both the cleaning and finishing water subcategories. Pollution control costs were developed only for the new source plants that had one PM&F process, not for new source plants with processes in combination. Thus, the economic impact analysis of new sources is divided into three industry groups: (1) plants with processes only in the contact cooling and heating water subcategory, (2) plants with processes only in the cleaning water subcategory, and (3) plants with processes only in the finishing water subcategory.[1/]

1.2.2 Treatment Technology Options Considered

EPA identified and considered three options for each subcategory for BPT, BAT and NSPS.[2/] They are summarized below.

[1/] For purposes of brevity throughout the economic analysis, the PM&F industry groups for existing plants will be referred to as: (1) plants with contact cooling and heating only; (2) plants with cleaning only; (3) plants with cleaning and contact cooling and heating; and (4) plants with cleaning and finishing. The three PM&F industry groups for new sources will be referred to as (1) plants with contact cooling and heating only, (2) plants with cleaning only, and (3) plants with finishing only.

[2/] EPA is promulgating BAT and NSPS for both the contact cooling and heating and the finishing subcategories for all pollutants except phthalates. The Agency believes that activated carbon will effectively control phthalates, but at this time, the Agency does not have treatability data for phthalates for that treatment process. EPA plans to study the treatment of phthalates by the activated carbon process. Depending on the results of that study, EPA may propose and promulgate limitations guidelines for phthalates. If limitations guidelines are to be proposed and promulgated, the Agency will reexamine the costs for phthalate control and, at that time, analyze the economic impacts of changes -- if any -- in the costs.

Contact Cooling and Heating Water Subcategory

Option 1: No regulation.

Option 2: Continuation of current good housekeeping practices. Plants are not required to install any additional treatment nor are they expected to remove any treatment that is currently in place. Limitations are based on the pollution concentrations currently discharged by plants employing good housekeeping techniques.1/

Option 3: Activated carbon treatment for phthalates only.

Cleaning Water Subcategory

Option 1: pH control and nutrient addition, followed by primary settling, flow equalization, and final treatment in a package activated sludge treatment system.

Finishing Water Subcategory

Option 1: No regulation.

Option 2: Settling.

Option 3: Settling followed by activated carbon treatment for phthalates only.

A more comprehensive description of these treatment technology options and associated compliance costs is contained in the Development Document.2/

The PM&F effluent limitations guidelines and standards affect the plastics molding and forming plants in which water comes in contact either with the surface of the plastic materials or products, or with forming equipment that are or have been in contact with plastic materials or products. Contact may occur during the molding or forming processes (e.g., when water is used to cool the plastic forms), or during the processes of cleaning or finishing (e.g., when water is used during cleaning or during finishing to wash the product or the mold).

1/ Although some plants may have minimal costs for this option, they are represented as zero in this study.

2/ EPA Industrial Technology Division (ITD): "Technical Development Document for Effluent Limitations Guidelines and Standards for the Plastics Molding and Forming Point Source Category," December, 1984. Hereafter "Development Document."

The plastics molding and forming industry is composed of three types of plants. Those that:

- o Primarily form and mold plastics products or parts;
- o Manufacture resins as well as form or mold plastics parts; and
- o Form or mold plastics products, but whose primary products are not plastics.

The first type of plant is sometimes termed a "custom producer" and has 3079 as a primary SIC while the second and third types are termed "captive producers" and have 3079 as a secondary SIC. 1/ For this study, estimates of the number of each of the above types of plants are based on EPA's survey of PM&F plants in the State Industrial Guides. According to that estimate there are 10,260 PM&F plants in the United States, of which 7,900 plants have a primary SIC of 3079, and 2,360 plants have 3079 as a secondary SIC. These 10,260 plants have an estimated annual net sales of $36 billion, 2/ and employ about 530,000 persons.

1.2.3 Industry Profile

For purposes of economic analysis, the plastics industry can be described as using three basic steps to produce a plastics product. The first step is synthesizing a resin or polymer from various petro-chemical feedstocks. The second step involves formulating the resin(s) with other materials to produce an intermediate compound. The final step involves molding and forming these compounds into specific products using heat and/or pressure. The end forms are either a final product (such as a plastic bag), or a component of some larger product (such as a plastic dashboard for a car). The production of resins, polymers, and intermediate plastics compounds is regulated by other categorical effluent limitations guidelines. 3/ Only the molding and forming production processes, the final step above, are covered by the PM&F regulation. 4/ Thus, this study concerns any plastics molding and forming

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1/ For definitions of the terms "custom" and "captive", see Section 2 of this report.

2/ All dollar figures in this report are in 1982 constant dollars unless otherwise specified.

3/ The proposed regulation on the organic chemicals, plastics and synthetic fibers category covers the synthesis of resins and polymers and the formulation of intermediate plastic compounds.

4/ Molding and forming processes (e.g., extrusion and pelletizing) used by plastic resin manufacturers to process crude intermediate plastic material for shipment off-site are excluded from the PM&F regulation and are regulated under the organic chemicals, plastics, and synthetic fibers category. However, plastic molding and forming processes used by plastic resin manufacturers to process plastic materials, which are further processed on-site into intermediate or final plastic products by molding and forming, are controlled by the effluent limitations guidelines and standards for plastics molding and forming.

process that discharges or may discharge pollutants to waters of the United States. Plastic molding and forming includes processes that blend, mold, form, or otherwise process plastic materials into intermediate or final plastic products. They include commonly recognized processes such as extrusion, molding, coating and laminating, thermoforming, calendering, casting, foaming, and cleaning and finishing. All PM&F processes may use contact water.

In the 20 year period following World War II, the plastics industry experienced rapid growth. The versatility and unique properties of plastics enabled them to penetrate into nearly every major consumer market. Major markets include transportation, packaging, building and construction, electrical and electronics, furniture and furnishings, consumer and institutional, and industrial and machinery. The two largest markets are packaging (36 percent of plastics consumption) and building and construction (21 percent). Many of the products within these markets are produced by extrusion and molding.

During the last few years the growth and development have slowed. These changes reflect the increasing maturity of the plastics industry (including saturation of some major product markets) as well as changes in national business cycles, and increasing materials prices. Competition from PM&F imports and from substitutes (e.g., paper) has also affected the industry's growth. The average growth rate (in terms of pounds of plastics produced) between 1976 and 1981 was about 6 percent per year. During the same period, production costs increased and profitability decreased. For 1982, profits after taxes were barely 3 percent of sales and return on net worth was only 7 percent.

While the industry's rate of growth has slowed compared to previous decades, the development of new grades and types of plastics materials and improved processing technology should allow plastics to continue to penetrate other markets. The Kline Guide predicts an industry growth rate (in terms of pounds of plastics produced) of 7.0 percent per year between 1981 and 1986. Higher growth rates are predicted for two markets within the industry: 11.2 percent for the electrical and electronic market (particularly plastic housing for protection of electronic instruments and machines) and 9.4 percent in the building and construction market (plastic used in such items as wire and cable, plumbing, wall covering and flooring). In addition, a large growth potential exists in some segments of the packaging market. The Bureau of Alcohol, Tobacco and Firearms, based on safety recommendations of the Food and Drug Administration (FDA), recently approved the use of Polyethelene Terephthalate (PET) bottles as liquor containers. Processes to produce some of the products for these growth sectors such as the extrusion of plastic coating on wire and cable, the extrusion of plastic pipe and blow molding of PET bottles, are wet processes and so potentially would be directly affected by the regulation.

1.3 Methodology, Data and Assumptions

This section summarizes the data, methodology, and assumptions used to analyze the economic impacts of the effluent limitations guidelines and standards on the plastics molding and forming industry. It describes the ways in which information on industry characteristics (from published sources) and from surveys conducted by EPA (under the authority of §308 of the Clean Water Act 1/) are used together with estimated costs of the treatment technology options (developed by EPA in a separate study 2/) to identify plants that may not be able to afford the installation of pollution control equipment. This section also summarizes the approaches used to identify potential plant closures, employment, price, and other impacts on plants in the industry. More detailed descriptions of the analytical techniques, and assumptions used appear, where appropriate, throughout the remainder of the report.

1.3.1 Information Source

This study is based on data from several sources. They include government reports, text books, trade association data, the trade press, discussions with individuals associated with the industry, and, of particular importance, a plant-level §308 survey conducted by EPA.

The §308 Survey was designed to provide accurate and current information on the characteristics of the industry's plants. 3/ In addition to technical characteristics (e.g., treatment in place), the §308 Survey provides information on the economic characteristics of PM&F plants, such as sales, employment, and the relationship, if any, of the plant to a larger corporation.

All the survey questionnaires were returned directly to EPA by the respondents, and procedures were employed to protect the confidentiality of any data subject to such a claim in accordance with 40 CFR Part 2. These procedures included removing the plant's identification from each questionnaire and assigning a code number to each before processing.

1/ Section 308 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. §1318 provides that: "Whenever required to carry out the objectives of this Act, including but not limited to ... developing or assisting in the development of any effluent limitation ... pretreatment standard, or standard of performance under this Act" the Administrator may require the owner or operator of any point source to establish and maintain records, make reports, install, use, and maintain monitoring equipment, sample effluent, and provide "such other information as he may reasonably require."

2/ EPA Industrial Technology Division (ITD): "Technical Development Document for Effluent Limitations Guidelines and Standards for the Plastics Molding and Forming Point Source Category," December 1984. Hereafter "Development Document."

3/ For other details on the §308 Survey design, see the Development Document.

Financial data were available for 381 plants in the industry that completed survey questionnaires. Data from 112 direct discharging plants (i.e., 20 percent of all direct discharging PM&F plants) were used in the closure analysis. Of the remaining 269 plants in the economic data base, data were not used for 100 plants because they do not discharge wastewater and data were not used from another 169 plants because they are indirect dischargers and so are not affected by this regulation. A financial profile was developed for each of the 112 plants included in the closure analysis, using the questionnaire data and publicly available data. Using §308 survey data EPA also developed costs of treatment technology options for each of these 112 plants.

Publicly available data used in this report include financial information from the Society of the Plastics Industry (SPI), 1/ FINSTAT, 2/ data from the U.S. Census of Manufactures, 1982, 3/ State Industrial Guides, the Kline Guide to the Plastics Industry 4/ and various trade publications.

1.3.2 Overview of Approach

In general, compliance with effluent limitations guidelines and standards imposes added costs on plants in the industry. These costs include capital expenditures on pollution control equipment (fixed costs) and operating and maintenance expenses (variable costs), both of which cause the average production costs of a plant to increase. Under such conditions, plant owners have the following options:

- Raise the price of their products and pass through the increased costs to purchasers;
- Absorb the increase in costs; or
- Shut down the operation and go out of business.

The approach of this study is to examine the impact to the industry given that one of these were to occur. Other impacts such as employment, community, and foreign-trade effects are evaluated based on impacts of the effluent regulation on the industry.

1/ The Society of the Plastics Industry, Inc., Financial Operating Ratios, 1978, 1980, 1982, and 1983.

2/ FINSTAT is financial statistical data, summarized by the firm size, derived from Dun & Bradstreet's Financial Profiles data base and compiled by Social and Scientific Systems, Inc., a contractor to the U.S. Small Business Administration's (SBA) Office of Advocacy. SBA provided summaries of the data for EPA's use.

3/ U.S. Department of Commerce, Bureau of the Census, 1982 Census of Manufactures.

4/ C. H. Kline & Co., Inc., The Kline Guide to the Plastics Industry, Fairfield, NJ, 1982.

1.3.3 Baseline Estimates

Baseline estimates are used in this analysis to represent the economic characteristics of the PM&F industry in 1985-86 absent the PM&F effluent limitations guidelines and standards. The difference between the baseline estimates and the estimates of the economic characteristics of the PM&F industry with the regulation represents the incremental impacts that can be attributed to the regulation.

1.3.4 Cost Estimates of Treatment Technologies

The treatment technology control systems, costs, and effluent limitations guidelines and standards for the plastics molding and forming industry were derived in a separate analysis by EPA. A comprehensive description of the methodology and the recommended technologies and costs are provided in the EPA's Development Document for Effluent Limitations Guidelines and Standards for the Plastics Molding and Forming Point Source Category. EPA identified and considered several technology treatment options for BPT, BAT and NSPS as summarized above.

This report analyzes the economic impact of these costs on four groups of existing plants in the plastics molding and forming industry that are direct dischargers. These include: (1) those plants with processes only in the contact cooling and heating water subcategory; (2) those plants with processes only in the cleaning water subcategory; (3) those plants with processes in both the cleaning and the contact cooling and heating water subcategories; and (4) those plants with processes in both the cleaning and the finishing water subcategories. This report also analyzes the economic impacts of the pollution control costs on three groups of new sources: (1) plants with contact cooling and heating only; (2) plants with cleaning only, and (3) plants with finishing only.

The EPA estimated wastewater treatment costs for 112 direct discharging plants based on engineering estimates of treatment costs for each applicable option. Adjustments were made for those plants with treatment-in-place. Monitoring costs were added to the treatment system costs to obtain total costs per plant. The EPA estimates that the monitoring costs are $1200 per year for plants required to monitor toxic pollutants and $2600 per year for plants required to monitor conventional pollutants. For toxic pollutants, plants were assumed to monitor four times per year at a cost of $300 per sample, and for conventional pollutants, plants were assumed to monitor once a week, or 52 times per year, at a cost of $50 per sample. Capital costs are amortized assuming a cost of capital of 10 percent over 10 years for reasons explained in Section 3. The treatment costs for each industry group have been extrapolated from the plant-specific costs for direct discharging plants in the data base to estimate the costs for the all 558 direct dischargers in the PM&F industry.

Treatment technology costs for new sources were developed in a manner similar to that for existing plants. These estimated costs apply to all new sources regardless of whether they result from major modifications of existing facilities or are constructed as greenfield sites. The technologies considered for new sources are the same as those for existing sources.

Comparing estimated costs for the treatment technologies to expected revenues, the Agency developed a "normal" plant for each of the three subcategories.[1/] A normal plant is a theoretical plant that has the operations covered by the subcategory and production that is the average level of production in the subcategory. Section XII of the Development Document presents in detail the composition of the PM&F "normal" new source plants.

1.3.5 Liquidity Analysis

The liquidity analysis focuses on the ability of plants to finance capital investment from their current cash flow, without relying on outside sources of capital. An implicit assumption in this approach is that if a plant can invest in pollution control and still remain profitable, given the current cost of capital, the capital market would also be willing to provide the money for the pollution control investment. The liquidity analysis estimates pre-tax income before treatment costs and assumes that a pre-tax income greater than treatment costs enables a plant to pay for treatment costs from current cash flow.

1.3.6 Plant Closure Analysis

In general, the regulation will force a rational plant owner to decide: (a) whether to make an additional investment and incur additional fixed and operating costs or; (b) to sell the plant. The alternatives available to the owner are to:

- Sell the plant--either as an operating entity or as scrap; or
- Make the investment and realize the value of the cash flows expected from remaining open.

Because a plant will remain open for several years if the owner invests to meet the effluent limitation guidelines and standards, the analysis takes into account the present value of cash flow over the life of the plant (with treatment) plus the terminal salvage value (salvage value at the end of a plant's useful life) and compares that to the current liquidation value of equity for the plant. If the present value of the cash flow plus the terminal salvage value is greater than the current salvage value of the

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[1/] The Agency did not develop a normal plant for new sources with processes in more than one subcategory.

plant, then the plant is worth more open and operating than it is closed. However, if the current salvage value is greater, a rational plant owner will close the plant and sell it for the salvage value. To estimate salvage value, the Small Business Administration's FINSTAT data are used to obtain two ratios for the industry in SIC 3079: (1) total assets to sales; and (2) total liabilities to total assets. The ratio for the firms in the FINSTAT data are ranked. For reasons explained in detail in Section 3, the ratio at the 75th percentile (with a value of .685) is used to represent the industry-wide assets to sales ratio and the median of the total liabilities to assets ratio (with a value of .292) is used as the industry-wide value.

1.3.7 Other Impacts

Prices. Price changes are estimated for each of the groups of directly discharging PM&F plants. It is calculated as the ratio of treatment cost to plastics sales. This analysis assumes all cost changes are passed through to consumers. Thus, the price change is the maximum that would be estimated from this regulation.

Employment. Unemployment is estimated directly from the plant closure analysis. Community impacts are assumed to occur as a result of employment losses and plant or process line closures.

Foreign Trade. Impacts on the U.S. foreign trade balance are analyzed based on estimated changes in price and production resulting from treatment costs.

1.3.8 Small Business Analysis

Public Law 96-354, known as the Regulatory Flexibility Act, requires EPA to determine if a significant impact on a substantial number of small businesses occurs as a result of the regulation. If there is a significant impact, the act requires that alternative regulatory approaches that mitigate or eliminate economic impacts on small businesses must be examined. This section addresses these objectives by identifying whether or not small businesses in the plastics molding and forming industry are significantly impacted by the regulation.

The definition of a small business is not precise or universal. The Small Business Administration (SBA) definition of "small business" generally means a specific number of employees for each manufacturing industry by Standard Industry Classification (SIC). For non-manufacturing businesses, "small" is limited in SBA regulations by dollar amount of gross sales. In this analysis, number of employees is used to determine size.

The plants in this analysis have been ranked by total number of employees and by number of employees engaged in plastics molding and forming. These plant rankings are then compared with their corresponding measures of impacts

due to the regulation to determine whether a significant correlation exists between size and the seriousness of the economic impacts. For purposes of this analysis, a small plant is defined as one having 70 or fewer PM&F employees. Table 1-1 shows the characteristics of this plant among the §308 Survey plants.

Table 1-1.

PM&F Industry Small Plants

Number of Direct Discharge §308 Survey Plants		Typical Small PM&F Industry Plant (Based on Median Values) 1/		
Total	"Small"	Flow (gpm)	Employment	Sales ($1,000)
112	51	16.7	27	1,470

Source: §308 Survey.

1.4 Economic Impact Analysis Results

1.4.1 Existing Sources

The results of this analysis are presented for plant level impacts, price increases, closure, employment, community impacts, foreign trade, small businesses, and new sources. The impact of treatment costs at the plant level are measured by production cost increases, profitability changes, and a comparison of treatment costs to average annual investment. The results are shown in Table 1-2.

Only 558 out of an estimated 10,260 plants in the PM&F industry incur costs for pollution control as required by this regulation. The impacts on these plants are minimal and show that the regulation is "economically achievable". Due to the size of the industry, the impact on the entire PM&F industry is even less significant. The regulation potentially affects only about 5 percent of the total plants in the industry so that price changes, unemployment and PM&F operation line closures as a result of the regulation is minimal relative to the entire industry. Since the impacts are insignificant, plants are not expected to change discharge status or switch from wet to dry processes in an attempt to avoid the regulation.

1/ This typical small plant represents the entire industry and is based on employment.

Table 1-2. Summary of Estimated Economic Impacts of Treatment Costs[2/] on Existing Sources by Type of Plant

Industry Grouping	Pollution Control Technology (Direct Dischargers Only)									
	Plants with Contact Cooling and Heating Only			Plants with Cleaning Only	Plants with Cleaning, and Contact Cooling and Heating			Plants with both Cleaning and Finishing		
Technology Option	Option 1	Option 2*	Option 3	Option 1*	Option (1,1)	Option (1,2)*	Option (1,3)	Option (1,1)	Option (1,2)*	Option (1,3)
Number of Plants	478	478	478	30	40	40	40	10	10	10
Number of Plants Incurring Costs	0	0	319	30	0	40	40	10	10	10
Industry Treatment Capital Costs ($1,000)	0	0	28,694	2,123	0	3,902	6,900	209.5	291.3	490.8
Industry Treatment O&M Costs ($1,000)	0	0	6,359	612	0	2,208	2,786	163.4	185.3	238.2
Industry Treatment Annual Costs ($1,000)	0	0	11,028	958	0	2,843	3,909	197.5	232.7	318.0
Average Per Plant Annual costs ($1000)	0	0	34.6	31.9	0	71.1	97.7	19.8	23.3	31.8
Industry Production Cost Change (Percent)	0	0	0.22	0.26	0	0.31	0.43	2.0	2.3	3.2
Industry Median Profitability Reduction (Percent)	0	0	5.1	6.1	0	11.6	21.6	66.6[3/]	77.6[3/]	104.[3/]
Treatment Investment Costs Compared to Current Average Annual Plant Investment (Percent)	0	0	11.5	11.6	0	8.7	15.3	44.2	61.5	104.
Price Changes (Percent)	0	0	0.20	0.23	0	0.28	0.39	1.9	2.2	3.0
Median Ratio of Treatment Cost to Cash Flow (Percent)	0	0	6.8	6.7	0	12.5	27.3	84.7[3/]	100.[3/]	138.[3/]
Number of Plant Closures	0	0	3	0	0	0	0	0	0	0
PM&F Operation Line Closures [1/]	0	0	3	0	0	0	0	5	5	5
Industry Employment Loss	0	0	86	0	0	0	0	25	25	25
Community Impacts	None	None	Slight	None	None	None	None	Slight	Slight	Slight
Foreign Trade Impacts	None	None	Insignificant	Insignificant	None	Slight	Slight	Insignificant	Insignificant	Insignificant
Small Business	None	None	Slight	Insignificant	None	Insignificant	Slight	Insignificant	Insignificant	Insignificant

* Selected Option.

1/ The PM&F Operation line closures are in addition to the plant closures on the preceding line.

2/ In 1982 dollars.

3/ Data for this variable varies widely between two plants in sample, one of which is projected to have a line closure. Thus extrapolating the results may not accurately reflect the impact on this industry group.

Source: EPA estimates.

1.4.2 Small Business Analysis

Using the number of plastics employees to define the size of each plant, a comparison of plant size with the change in return on investment (ROI) due to compliance costs shows that for all technology options, and for all four industry groups, smaller plants generally have larger changes in ROI. Defining plant size as the number of total employees at a plant yields the same results. The closure analysis indicates that, for the §308 survey industry sample, 1 plant and 2 PM&F operation lines will close. Using the definition of 140 or more total employees as a large plant, two of the three affected plants are large. Upon further investigation, it was found that the third plant, though "small", was owned by a large company. The relationship between the small plant and the large company that owns it gives it certain advantages over the typical "small business" as defined by the SBA, regarding the ability of the plant to finance pollution treatment facilities. Based on this analysis of the seriousness of the economic impacts, small businesses in the four industry groups of existing sources that are direct dischargers do not appear to be significantly impacted. Therefore, a formal regulatory flexibility analysis of the plastic molding and forming industry is not pursued.

1.4.3 Economic Impact on New Sources

Since options considered for NSPS are the same as the options for existing sources, there are no barriers to entry caused by the regulation. The results of the new source analysis presented in Table 1-3 are indications of how three types of "normal" plants would perform with the addition of treatment costs under the regulatory options.

1.4.4 Limitations

The possible limitations of the methodology and data used in this analysis are reviewed. The magnitude of these possible limitations is examined using sensitivity analysis. The parameters tested in the sensitivity analysis are the profit rate, compliance costs, monitoring costs, cost of capital, and salvage value estimates. From the standpoint of plant closures, the only industry group affected by the sensitivity analysis is existing plants with cooling and heating under Option 3. This group is most sensitive to changes in profitability. The changes to other parameters have only a slight impact on the results.

1.5 Organization of the Study

The remainder of the study is organized in five sections. Section 2 provides a description of the plastics molding and forming industry as well as of the past and expected future performance of its firms. The complete methodology of the study is discussed in Section 3. Section 4 details the costs of the alternative treatment technologies being considered. Section 5 presents the findings of the economic impact analysis, and Section 6 summarizes the limitations of the analysis.

Table 1-3. Summary of Estimated Economic Impacts of "Normal" Plant Treatment Costs on New Sources

Industry Group 1/	Pollution Control Option	Normal Plant Flow (gpm)	Production Cost Increase (Percent)	Investment Costs Compared to Annual Investment (Percent)	Profitability Reduction (Percent)
Plants with Contact Cooling and Heating Only	Option 1	35	NA	NA	NA
	Option 2*	35	NA	NA	NA
	Option 3	35	0.27	12.9	3.9
Plants with Cleaning Only	Option 1*	13.5	1.3	85.2	18.5
Plants with Finishing Only	Option 1	3.15	0	0	0
	Option 2*	3.15	0.62	17.3	6.5
	Option 3	3.15	1.5	59.3	15.5

* Selected Option.

1/ Costs for a normal plant with processes in both subcategories were not developed for the new sources analysis.

Source: EPA estimates.

Section 2

Industry Profile

2.1 Industry Overview

This section examines the structure of the plastics molding and forming industry and prevailing market conditions for PM&F products because these factors influence the industry's ability to afford additional capital outlays for pollution control equipment.

For purposes of economic analysis, the plastics industry can be described as using three basic steps to produce a plastics product. The first step is synthesizing a resin or polymer from various chemical feedstocks and intermediate chemicals such as ethylene, ammonia, or methane. The feedstocks originate from raw materials such as petroleum, natural gas and coal. The second step involves formulating the resin(s) with other materials to produce an intermediate compound. The final step involves molding and forming these compounds into specific products using heat and/or pressure. The production of resins, polymers, and intermediate plastics compounds are regulated by other categorical effluent limitations guidelines. 1/ Only the molding and forming production processes, the final step above, are covered by the PM&F regulation.2/

This study concerns any plastics molding and forming process that discharges or may discharge pollutants to waters of the United States. Plastics molding and forming includes processes that blend, mold, form or otherwise process plastic materials into intermediate or final plastic products. They include commonly recognized processes such as extrusion, molding, coating and laminating, thermoforming, calendering, casting, foaming, and cleaning and finishing. All PM&F processes may use contact process water.

1/ The regulation on the organic chemicals, plastics and synthetic fibers category covers the synthesis of resins and polymers, and the formulation of intermediate plastic compounds.

2/ Excluded from the PM&F regulation are plastics molding and forming processes (e.g., extrusion and pellitizing) used by plastics resin manufacturers to process crude intermediate plastic material for shipment off-site. These processes are regulated under the organic chemicals, plastics, and synthetic fibers category. However, plastics molding and forming processes used by plastic resins manufacturers to process plastic materials, which are further processed on-site into intermediate or final plastics products by molding and forming, are controlled by the effluent limitations guidelines and standards for plastics molding and forming.

As illustrated in Figure 2-1, the plastics molding and forming industry is composed of three types of plants. Those that:

1. Primarily form and mold plastics products or parts;
2. Manufacture resins as well as form and mold plastics parts;
3. Form and mold plastics products, but whose primary products are not plastics.

The first type of plant is sometimes termed a "custom producer"[1] and has 3079 as a primary SIC. The second and third types are termed "captive producers"[2] and have 3079 as a secondary SIC. Based on a random five percent sample from State Industrial Guides [3] there are approximately 10,260 plastics molding and forming plants in the United States, of which 7,900 plants have a primary SIC of 3079, and 2,360 plants have 3079 as a secondary SIC. These 10,260 plants employ about 530,000 persons and have estimated annual sales of $36 billion. This economic analysis is based on the Agency's estimates that 18.5 percent of these plants have wet processes and 29.4 percent of the wet plants are direct dischargers. Thus, the Agency estimates that 558 PM&F plants have wet processes and are direct dischargers; these 558 plants may be affected by the limitations and guidelines standards. [4]

Many of these plastics molding and forming plants perform two or more processes. Based on information from the 1983 EPA §308 Surveys, on average there are two processes per plant. Extrusion and injection molding were the most frequently used processes among plants responding to EPA's §308 Survey. These two processes account for 66 percent of plastic resin consumption (see Table 2-1). Extrusion and injection molding also appear frequently in Table 2-2 which presents a list of major plastics molding and forming companies, including the number of plants they operate and the amount of resins they use.

Concentration ratios measure the degree to which production in a given industry is controlled by a few companies. These ratios are calculated in terms of value of shipments or number of plants. They are available for only that part of the plastics molding and forming industry which is represented

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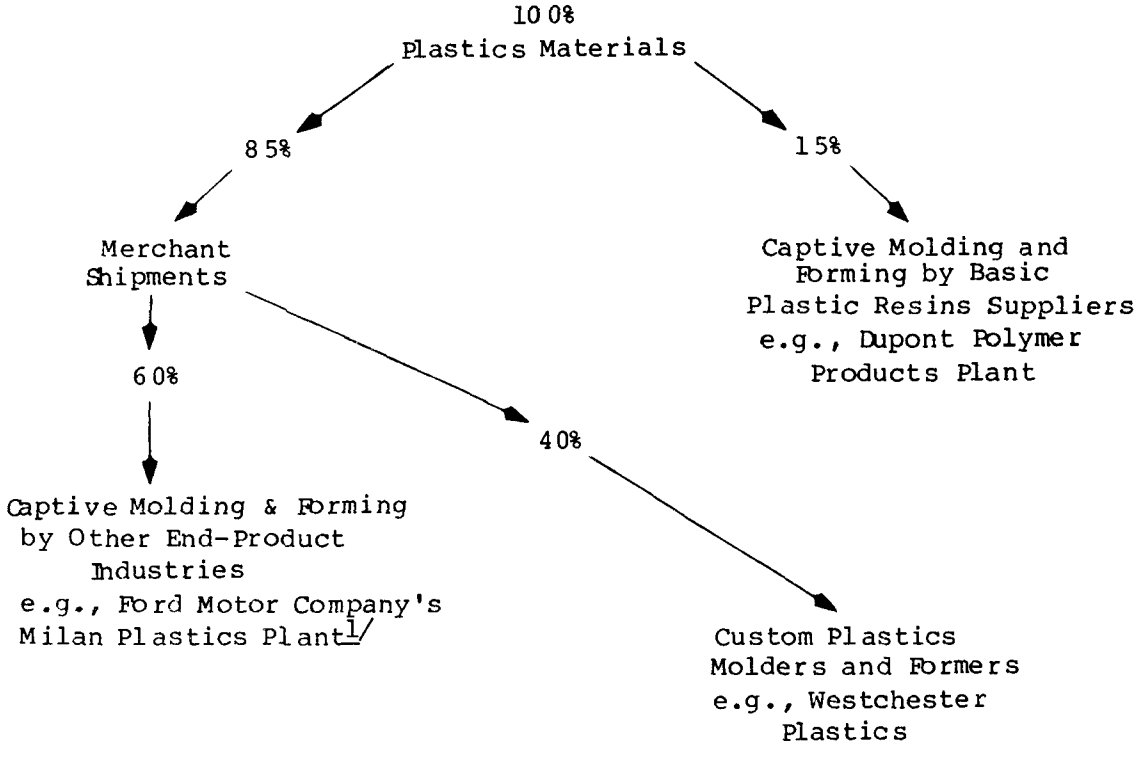
[1] "Custom" refers to manufacturing a product to a specific order for another company.

[2] There is no universally accepted definition of the term "captive producer". The 1982 Kline Guide identifies "captives" as those plants that manufacture resins and also produce some plastic parts. The Society of the Plastics Industries (SPI) uses the term "proprietary" instead of "captive." In this analysis, a "captive" is defined as any plant that forms or molds plastics, but whose primary product is something other than plastics products.

[3] These Guides list the companies and manufacturing facilities by state.

[4] See the Development Document for a discussion of how these percentages (18.5% and 29.4%) were derived.

Figure 2-1. Structure of the Plastics Molding and Forming Industry



1/ In addition to motor vehicles, these plants often are found in industries which manufacture metalworking machinery, electronic components, medical instruments and supplies, and toys and sporting goods.

Source: Adapted from C. H. Kline, 1982. The Kline Guide to the Plastics Industry. Fairfield, New Jersey.

Table 2-1. Consumption of Plastics Resins by Plastics Molders and Formers by Process

Process	Percent of Total Resin Consumption	Average Annual Percent Increase 1976-81	Major Market[a]
Extrusion	44.7	3.9	Pk, BC, CI, EE
Injection molding	21.7	2.0	CI, Pk, T
Blow molding	9.4	13.8	CI
Reinforced plastics (open molding)	4.3	5.2	T, BC, CI
Other molding	5.2	8.0	
Foaming	7.8	1.3	BC, CI
Calendering	2.7	(0.1)	CI
Casting	2.1	--	CI, Pk
Laminating (structural)	2.1	0.4	EE, T, F
Total	100.0%		

[a] Major Market Key:
CI = Consumer and Institutional
Pk = Packaging
T = Transportation
EE = Electrical and Electronics
BC = Building and Construction
F = Furniture and Furnishings

Source: C. H. Kline, 1982. The Kline Guide to the Plastics Industry. Fairfield, New Jersey.

Table 2-2. Major Plastics Molders and Formers by Company

(Million Lbs.)

Corporation (Number of PM&F Plants) 1/	Approximate Annual Consumption of Plastic Polymer (million lbs)	Principal Process	Principal Product
General Motors (11 plants)	455	Injection Extrusion RIM 2/	Auto parts
Western Electric (8)	395	Extrusion	Wire/cable
Mobil (10)	370	Extrusion	Film
Ford (7)	335	Injection Calendering RIM	Auto parts
Carlon (Indian Head) (7)	305	Extrusion	Conduit
Ethyl (16)	300	Extrusion Blow molding Injection	Film Bottles Jars, closures
Union Carbide (3)	285	Extrusion	Film
General Electric (4)	190	Injection	Appliance parts
Exxon (4)	180	Extrusion	Film
General Tire (6)	180	Injection	Auto parts
American Hoechst (5)	175	Extrusion	Packaging
Crown Zellerbach (4)	140	Extrusion	Film
Bemis	135	Extrusion	Packaging
St. Regis (5)	135	Extrusion	Film
Dart & Kraft (6)	130	Injection	Housewares
Amoco (Standard Oil, Indiana) (8)	120	Blow molding	Bottles
Borden (4)	120	Calendering	Wall coverings
W.R. Grace (2)	115	Extrusion	Film
Arco (4)	110	Extrusion	Film
Owens-Illinois (5)	105	Blow molding	Bottles
Firestone	100	Calendering	Film
Hancor	100	Extrusion	Pipe
Monsanto (2)	100	Extrusion	Film
Phillips Petroleum (6)	100	Extrusion	Pipe
Presto (Coca-Cola)	100	Extrusion	Film
3M	100	Casting	Film

1/ May not include all plastics forming plants of the listed corporations.

2/ RIM is reaction injection molding.

Source: C. H. Kline, 1982. The Kline Guide to the Plastics Industry. Fairfield, New Jersey.

in SIC 3079, custom producers. According to 1982 U.S. Census of Manufactures data, the custom plastics molding and forming industry is not very concentrated: the top four firms account for only 7 percent of shipments and 0.7 percent of all establishments.

2.2 Industry Structure Reflected in §308 Survey

The effluent limitations guidelines and standards apply to plastic molding and forming plants that have wet processes and are direct dischargers.[1] For regulatory purposes, as described in the Development Document, the wet process plants are divided into three subcategories based on water use and the wastewater characteristics. Subcategory 1 consists of contact cooling and heating water from PM&F processes. Subcategory 2 consists of cleaning water from PM&F processes. Subcategory 3 consists of finishing water from PM&F processes. Plants may fall into one or more of the subcategories, depending on the type of PM&F process water used and the associated wastewater characteristics at the plant.

Information from EPA's §308 Survey on the wet process plants used in the economic analysis is summarized in Table 2-3. The Development Document describes the §308 Survey and the sampling procedures used. As shown in the table, the majority of wet-process plants generate wastewater only from contact cooling and heating processes; slightly over one-quarter are direct dischargers; and over one-half attribute all their sales to plastics molding and forming.

Table 2-4 presents minimum, maximum and average measures of plant employment, production and sales as well as number of plastics materials used, processes, and products produced for plants responding to the §308 Survey. On average, each plant employs 119 plastics workers, and produces between one and two types of plastic products. The value of shipments per employee during 1982 is $89,000[2] and is lower than other sectors of the plastics industry. For example, the capital-intensive plastics materials and resins industry has a sales to employee ratio which is nearly three times larger.

A summary of the frequency distribution of manufacturing processes for the §308 Survey plants is presented in Table 2-5.

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[1] The Agency considered establishing categorical pretreatment standards for new and existing sources discharging pollutants to the POTWs. For reasons discussed in the preamble to the final rule (49 FR49026; Dec. 17, 1984), the Agency is not promulgating pretreatment standards for the PM&F industry.

[2] In contrast, SPI (1983) reports that the sales per employee is $63,000 during 1982. This discrepancy may be due to the fact that SPI estimates are calculated based on median data, while §308 Survey estimates are based on average data and are only for wet process plants.

Table 2-3. Summary of §308 Survey Data for Wet-Process Plants Used in the Economic Analysis[1/]

Table 2-3a. Distribution of §308 Survey Plants by Industry Group

	Plants With:							
	Contact Cooling and Heating Only	Cleaning Only	Finishing Only	Contact Cooling and Heating, and Cleaning	Contact Cooling and Heating, and Finishing	Cleaning and Finishing	Contact Cooling and Heating, Cleaning and Finishing	Total
Number	316	22	9	22	5	6	1	381
Percent	82.9	5.8	2.3	5.8	1.3	1.6	0.3	100

Table 2-3b. Distribution of §308 Survey Plants by Discharge Status

	Direct	Indirect Only	Zero Only	Both Zero and Indirect	Total Number of Plants
Number	112	160	100	9	381
Percent	30	42	26	2	100

Table 2-3c. Number of §308 Survey Plants with 100 Percent of Sales Attributable to Plastic Molding and Forming

	Yes	No	Total Number of Plants
Number	201	180	381
Percent	53	47	100

Table 2-3d. Number of Plastics Molding and Forming Employees in §308 Survey Plants

	Number of Plants with Employment Data	Mean Employment	Median Employment	Maximum Employment	Minimum Employment
Number	378	118	52	2,844	1

1/ Compiled from EPA §308 Survey data of the Plastic Molding and Forming Industry. The above tables include all plants with wet processes responding to the §308 Survey including those with wet processes that are not direct discharges and so are not impacted by this regulation.

Table 2-4. Plastics Molding and Forming Industry Data per Plant

	Maximum	Minimum	Average
Total Employment	8,672	2	428
Plastic-related Employment	2,600	1	119
Total Production (Thousands lbs.)	450,000	4	23,682
Total Sales (1,000 1982$)	570,216	106	32,809
Plastics Sales (1,000 1982$)	277,441	26	10,586
Plastics Sales per Plastics Employee (1,000 1982$)	107	26	89
No. Plastics Materials Used	10	1	2.2
No. Processes	9	1	1.7
No. Product Groups	6	1	1.4

Source: Compiled from EPA § 308 Survey data on 381 plants in the Plastics Molding and Forming Industry.

Table 2-5. Frequency Distribution of Wet Manufacturing Processes by Plant Discharge Status

Process	Number of Plants Reporting Use of This Process: Direct	Indirect	Zero	Total
Calendering	1	2	0	3
Casting	1	5	0	6
Coating and Lamination	2	7	4	13
Extrusion	127	132	105	364
Molding	6	18	8	32
Thermoforming	3	6	1	10
Cleaning	21	47	3	71
Finishing	2	14	6	22
Total	163	231	127	521

Source: Compiled from EPA §308 Survey.

2.3 History of the Plastics Molding and Forming Industry

Major plastics materials were initially developed in the 1930's and 1940's. The demand for plastics products increased greatly during World War II because they served as excellent substitutes for materials, such as natural rubber and copper, that were in short supply. Following the war, the plastics industry invested enormous sums in research and development of new and more efficient polymerization processes, new low-cost basic manufacturing processes, and faster, larger molding and forming equipment. These new processes and the versatility and unique properties of plastics led to the development of an array of new plastics products that penetrated major consumer markets. The major markets include: transportation, electrical and electronic products, furniture and furnishings, consumer and institutional products, and industrial products and machinery. Currently, the largest market for molded and formed plastic products is packaging (e.g., trash bags, liners, wraps, lids, cushioning and strapping) which accounts for 36 percent of plastic resin consumption. The second largest market is building and construction products (e.g., pipes, fittings, and conduits) which account for 21 percent of plastic resin consumption.

2.4 Growth Rates in the Plastics Molding and Forming Industry

During and immediately after World War II, production of plastics grew at a phenomenal rate. Within this period, the United States had secure access to ample and relatively inexpensive oil supplies, from which plastic materials could be synthesized. Plastics products provided stiff cost competition to products made out of traditional materials such as wood, metal, paper, and glass.

Growth rates declined during the most recent decade. The compound growth rate for the period 1956 to 1961 was 11.6 percent, and for the 1961 to 1966 period it was 15.4 percent. [1/] However, the compound growth rate fell to 8.3 percent in the next five year period and has been around 6.5 percent since 1971. The changes in the plastic industry's growth rate reflect its increasing maturity. Some major product markets, such as phenolic adhesives and coatings for building and construction products, are saturated.

The competition between products is intense. Not only do plastics forming and molding companies compete with each other for the same markets, but they compete with other industries producing highly differentiated products for the same applications. For example, plastic products compete with paper for packaging uses and with metal in transportation, industrial, and building construction uses.

[1/] These figures are based on production levels for plastic resins and materials since comparable figures for molded and formed plastic products are not available. Most of the plastics materials produced are used by the plastic molding and forming industry, so they have grown at similar rates.

Some of the change in growth rate is attributable to recent economic recessions. Two of the major markets for plastic products, (1) transportation and (2) housing and construction, are very closely tied to national business cycles. When these two markets decline, the demand for the plastic products by these sectors also declines. These factors, along with increasing material prices and foreign competition--especially from Japan, where a relatively new plastics industry benefits from modern production facilities--contributed to decreases in the PM&F industry's growth rate. Profitability also declined. For 1982, profits after taxes were barely 3 percent of sales and return on net worth was only 7 percent.[1/]

2.5 Financial and Operating Ratios

Based on information provided by SPI,[2/] plastics molding and forming companies enjoyed the best performance of recent decades in 1974 and 1977. Since 1978, profits after taxes have fallen even though sales have continued to increase, except in 1982 when sales also decreased. Table 2-6 presents the distribution of the PM&F industry sales dollar by major components for three years (1978, 1980, and 1982). The largest expense component is material costs (about 43 percent of sales), with factory overhead (about 27 percent) and direct labor (about 13 percent) ranked as second and third. The average after-tax income is about 2.9 percent of sales for the PM&F industry as a whole and is higher for captive (3.3 percent) than for custom (2.6 percent) operations. Aside from showing decreasing profits, the figures of the table reveal an upward trend in material costs and administrative expenses. Custom operations have higher direct labor and factory overhead than captive operations, while selling expenses are higher for captive operations. A comparison of SPI data on "taxes" and "after-taxes income" shows that the PM&F industry pays about 36 percent of its income for taxes. [3/]

The SPI also reports survey data by plant sales. Table 2-7 highlights some statistics for plants with sales below $5 million and for plants with sales of $5 million or more. Although "depreciation and other fixed expenses" data are not complete, available figures indicate that fixed costs represent about 4 to 6 percent of sales. Depreciation data are historical costs and, therefore, must be recapitalized for accurate interpretation. As a first approximation, assume a 60 percent upward adjustment to account for inflation[4/]; this results in fixed costs to sales ratios of about 7 to 10 percent. This indicates that the industry is not capital intensive.

[1/] The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Survey No. 21, 1982, New York, NY, 1983.

[2/] The Society of the Plastics Industry, Inc., Financial and Operating Ratios, 1978, 1980, and 1982.

[3/] The Society of the Plastics Industry, Inc., Financial and Operating Ratios, 1982.

[4/] 60% is the result of compounding an annual inflation rate of 6% over 8 years.

Table 2-6. Summary of Sales Dollar Distribution

Plastics Molding and Forming Industry

Date	Item	Type of Operation: Industry as a Whole	Captive 1/	Custom
1978	Material Costs	42.3	42.4	41.4
	Direct Labor	13.4	12.8	14.6
	Factory Overhead	26.8	23.5	27.2
	Selling Expenses	4.2	6.9	4.1
	Administrative Expenses	7.6	7.2	7.9
	Taxes	1.7	2.5	1.7
	After Taxes Income	4.0	4.7	3.4
1980	Material Costs	43.5	44.4	42.9
	Direct Labor	13.3	10.8	13.4
	Factory Overhead	26.9	26.9	27.7
	Selling Expenses	4.7	5.0	4.4
	Administrative Expenses	7.7	7.1	8.0
	Taxes	1.9	1.9	1.7
	After Taxes Income	2.1	2.1	2.4
1982	Material Costs	44.1	43.0	44.3
	Direct Labor	12.1	10.4	13.2
	Factory Overhead	26.6	27.1	26.3
	Selling Expenses	4.7	5.0	4.4
	Administrative Expenses	8.7	9.5	8.7
	Taxes	1.3	1.9	1.1
	After Taxes Income	2.5	3.1	2.0
Average	Material Costs	43.3	43.3	42.9
	Direct Labor	12.9	11.3	13.7
	Factory Overhead	26.8	25.8	27.1
	Selling Expenses	4.5	6.2	4.1
	Administrative Expenses	8.0	7.9	8.2
	Taxes	1.6	2.1	1.5
	After Taxes Income	2.9	3.3	2.6

1/ Called proprietary by SPI.

Source: The Society of the Plastics Industry, Inc., Financial and Operating Ratios, 1978, 1980, and 1982.

Table 2-7. Summary of Financial and Operating Ratios for PM&F Plants of Different Sales Levels

(Ratios of Financial Characteristics Expressed in Terms of Percent of Sales, except for Return on Equity which is Percent of Equity)

	PM&F Industry as a Whole				Captive Operations				Custom Operations			
Year	Depreciation and Other Fixed Exp	Production Costs	Profits After Taxes	Return on Equity	Depreciation and Other Fixed Exp	Production Costs	Profits After Taxes	Return on Equity	Depreciation and Other Fixed Exp	Production Costs	Profits After Taxes	Return on Equity
For Plants with Annual Sales Less than $5 Million												
1978	NA	94.8	4.0	NA	NA	91.7	4.8	NA	NA	95.4	3.3	NA
1980	4.8	93.9	1.8	7.0	5.7	91.3	1.5	5.1	4.7	93.9	2.2	9.4
1982	NA	93.3	2.8	10.0	NA	91.7	3.1	9.0	NA	93.6	2.8	10.3
Average		94.0	2.9	8.5		91.6	3.1	7.1		94.3	2.8	9.9
For Plants with Annual Sales of $5 Million or More												
1978	NA	90.8	4.3	NA	NA	89.3	4.3	NA	NA	92.5	3.6	NA
1980	4.3	93.2	2.6	10.4	4.4	92.9	2.7	10.0	4.2	93.6	2.5	10.2
1982	5.2	94.6	2.3	10.5	4.5	92.8	3.6	10.3	6.3	95.1	1.5	5.9
Average		92.9	3.1	10.5		91.7	3.5	10.1		93.8	2.6	8.1

Source: Compiled by EPA based on The Society of the Plastics Industry, Inc., data (1978, 1980, 1982).

Production costs in Table 2-7 are the expenses shown as the first five items in Table 2-6, except that freight out and warehousing, research and development, and miscellaneous income and expenses, as defined by the SPI, are subtracted. Table 2-7 shows that plants with sales of $5 million or more are less costly to operate and are more profitable than plants with lower sales.

Return on equity varies between 5.1 and 10.5 percent with an industry-wide average of 8.5 percent for plants with sales less than $5 million and 10.5 percent for plants with sales of $5 million or more. Overall, the captive plants are more profitable than custom operations.

2.6 Balance of Trade

In terms of exports and imports of plastics materials, [1] the balance of trade surplus that has characterized the industry is shrinking as imports increase at 17 percent per year while exports rise at a rate of 13 percent per year. [2] In 1981, the value of exports of plastics materials and resins was $2.5 billion, while the value of imports was $285 million. [3] The United States share of total world production has declined from 41 percent of total production in 1965 to 34 percent in 1980, although it remains the world's largest producer. Imports of plastic molded and formed products have risen significantly over the past decade, due in part to improved industrial technology and low costs of labor in foreign countries. A large portion of the plastic product imports are coming from Japan, where a relatively new plastics industry benefits from modern and efficient plant equipment and operations.[4] Furthermore, increased plastic product imports from Japan accompanies their market advancements in products in which plastics are essential components (e.g., automobiles, appliances, televisions, computers). American automotive and business machine products appear to face the greatest foreign competition, followed by bags, sheeting, appliances, and medical equipment.

2.7 Markets and Growth Forecasts--Base Case

As discussed earlier in this section, the plastic molding and forming industry has leveled off from its enormous expansion during the 1950's and 1960's. Many current markets such as certain kinds of packaging, plus areas of phenolics, building and construction, are saturated, and expansion in new

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[1] Export values are not available for specific plastic products. Therefore, exports and imports levels for plastic resins and materials are presented instead as an indicator of the overall position and trends of the U.S. in the production of plastics since all plastic material eventually becomes plastic products.

[2] C.H. Kline, 1982. Kline Guide to the Plastics Industry. Fairfield, NJ.

[3] U.S. Industrial Outlook, 1982.

[4] Plastics World, January 1982.

ones is proceeding at slower rates. The cost advantage of plastics has diminished, as raw material and production costs have increased and thus the industry is more susceptible to price competition from other materials (e.g., corrugated paper and wood for packaging). There is also intense competition within the plastics industry itself, such as between the relatively new polyurethane foams and the older molded forms.

In the past, the plastics industry has been influenced by a variety of market and financial forces, including materials prices and availability, inflation rates, inter- and intra-market competition, and buyers' behavior. These market forces continue to direct and influence the growth of the industry. Figure 2-2 illustrates the trends since 1970 in some of the major markets for plastics products. For example, as car sales increase so do the sales of plastic products used in cars. Based on a trend analysis of data from the past decade, one analyst 1/ predicts that the value of domestic shipments will increase at a rate of 5.6 percent per year, reaching a level of $165.8 billion in 1986. However, higher growth rates are predicted for several of the plastic product markets (see Table 2-8).

Several developments should contribute to future increased growth of the plastics molding and forming industry. One of the more important factors will be the development of new molding and forming technologies which will improve the efficiency and precision of production, and which, in turn, will affect plastics product penetration of the market place through reduced costs, and improved quality and new uses. Technological developments include: (1) increased use of high speed, automated processing and forming, plus on-line equipment automation in smaller plants; (2) new plastic blends and copolymers, including the ability to blend materials as part of the injection molding process; and (3) advances in molding and forming processes, such as improved blow film, blow molding and reaction injector molders (RIM).2/ New product developments, contributing to sustained growth include: (1) plastic products that are superior to other kinds of insulation; (2) the use of plastic housings for computer terminals and business machines; (3) plastic foams that replace metal components; (4) the application of high density foam furniture parts; and (5) the use of the plastic bottles as liquor and soft drink containers.

Following is a brief discussion of the potential growth for each major plastics product market.

2.7.1 Plastic Packaging

The predicted growth rate per year for the 1981-1986 period is 4.6 percent, which is lower than the industry average of 7.0 percent because of saturation of some of the major markets and price competition from wood and paper. However, some packaging products will exhibit greater than average

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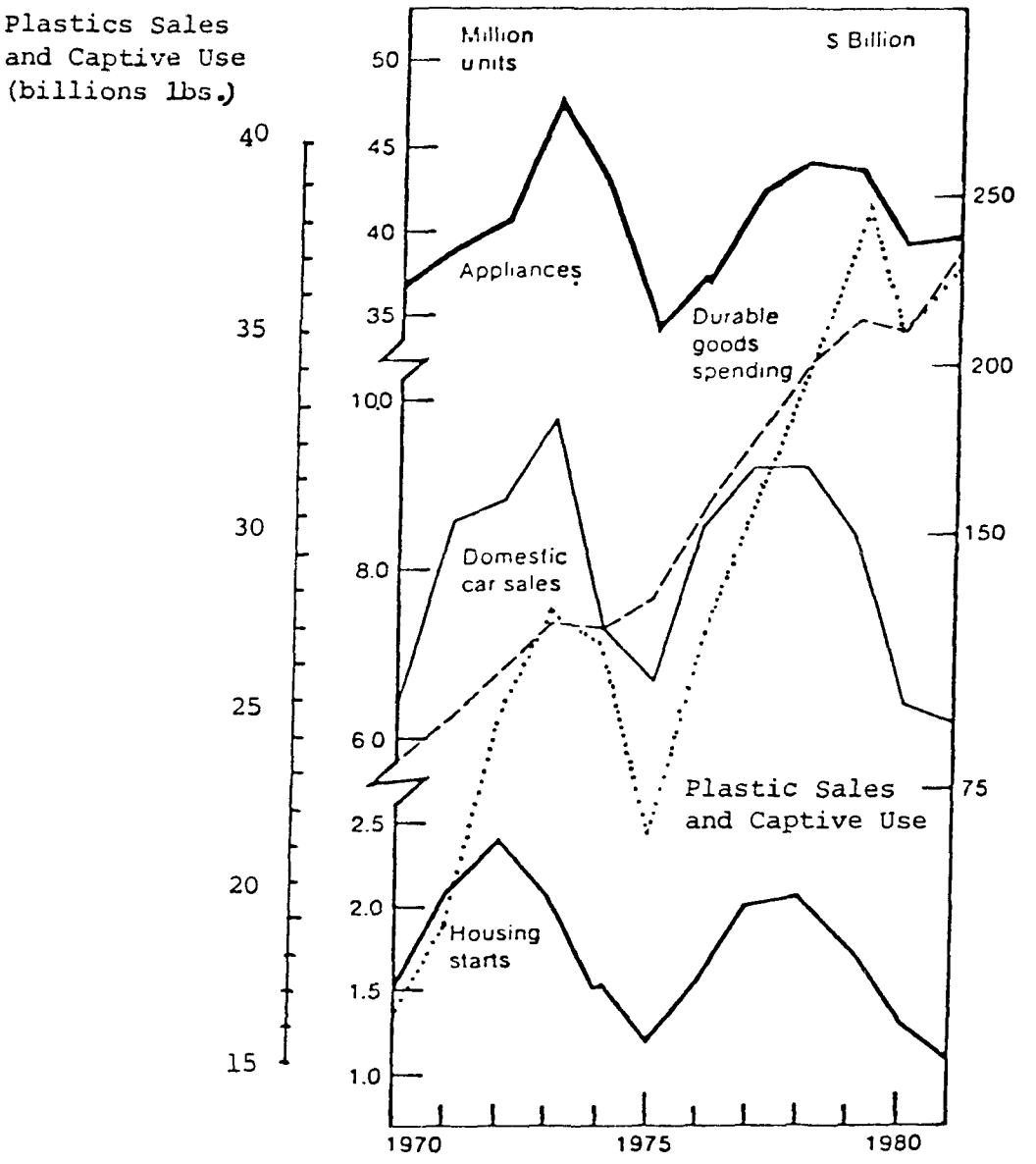
1/ C.H. Kline, 1982. Kline Guide to the Plastics Industry. Fairfield, NJ.

2/ C.H. Kline, 1982. Kline Guide to the Plastics Industry. Fairfield, NJ, and Modern Plastics, April 1983.

Figure 2-2. Major Economic Factors Affecting Plastics Production 1970-1981



Source: The Kline Guide, 1982.

Table 2-8. Growth Rates for Major Plastics Product Markets in Terms of Sales and Amount of Plastics Materials Used

Market	Million lb. Consumption[a]	% of Total	% Change in Sales 1981/1980[b]	% Change in Sales 1982/1981[c]	Growth Rate/yr (lbs.) 1976-1981[b]	Predicted Growth Rate/Yr (lbs.) 1981-1986[b]
Packaging	10,497	35.7	4.6	0.2	7.3%	4.6%
Building and Construction	7,154	24.4	13.0	6.4	9.8	9.4
Consumer and Institutional	3,269	11.1	3.3	6.3[d]	5.5	6.9
Electrical and Electronics	2,275	7.8	8.8	2.9	1.1	11.2
Transportation	1,392	4.7	-2.0	2.9	-2.7	9.0
Furniture and Furnishings	1,556	5.3	1.5	NA	0.7	5.1
Other	3,229	11.0	6.7	NA	8.6	7.0
Subtotals	29,372	100.00			Total:	7.0%

[a] Plastics World, August, 1983.

[b] C. H. Kline, 1982. The Kline Guide to the Plastics Industry, Fairfield, NJ.

[c] The Society of the Plastics Industry, Inc., Financial Operating Ratios, 1983.

[d] Calculated by averaging percentage change for appliances (2.2 percent) and medical (10.4 percent).

growth. These include products used as cushioning and protective packaging, merchandise bags, and beverage containers. Considerable improvements in strength-to-weight ratios have enabled disposable packaging, such as plastic produce and grocery bags, to remain competitive with traditional paper materials. One analyst[1] states that a major driving force behind growth in plastic packaging is the demand for protective packaging for electronic instruments to reduce shipping damage and repair costs. It is estimated that demand by the electronics industry for plastic packaging will increase by 13 percent per year through 1987. However, cushioning is a relatively small part of packaging. As discussed previously, a large growth potential exists for plastic bottles because the recent approval of the use of PET (polyethylene terephthalate) bottles as liquor containers. The 1.75 liter bottle is expected to have penetrated the glass-dominated market by 10 to 15 percent by the end of 1984 and 80 to 90 percent by 1987, assuming widespread consumer aesthetic acceptance of this non-traditional use of plastics.[2]

2.7.2 Plastic Building and Construction Products

The predicted growth rate per year for the 1981-1986 period is 9.4 percent. The use of plastics products in building and construction is very closely tied to national business cycles, and thus the recent increase in housing starts, and predicted increases in future years, are major factors in the predicted sustained growth of the industry. However, plastics have not deeply penetrated certain parts of this market because plastics products generally cannot match wood and metal products in meeting heavy load carrying demands. Therefore, the greatest growth markets exist for pipes, fittings, and conduits since they are cheaper, lighter in weight and less subject to corrosion than competing copper and other metal products. However, questions concerning plastic pipe fire hazards may adversely affect growth in this area. In addition, expansion into newer markets is expected for insulation products and institutional equipment such as handrails.

2.7.3 Plastic Consumer and Institutional Products

The predicted annual growth rate for the 1981-1986 period is 6.9 percent. Many of the plastics products in this group are items which are used daily (such as kitchenware, and toys) and thus growth in this market will closely parallel that of the national economy. The major growth areas of this segment are expected to be medical-related products (such as plastic I.V.'s), reinforced dishes, containers for use in microwave ovens, and recreational items.

2.7.4 Plastic Electrical and Electronics Products

The predicted annual growth rate for the 1981-1986 period is 11.2 percent. The high growth rate predicted for this sector is a function of the changes in product design which favor plastics parts over other materials,

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1/ Plastics World, June 1983.
2/ Plastics World, January 1983.

such as metal and wood, in products such as business machines and office equipment, communication equipment, and small appliances. One analyst[1] expects that business machine use of plastics will grow 16 percent per year through 1988. This increase is primarily due to the increasing demand for plastics housings in personal computers, printers, typewriters, and photocopying machines.

2.7.5 Plastic Transportation Products

The predicted growth rate per year for the 1981-1986 period is 9.0 percent. Over 90 percent of the plastics molded and formed for the transportation field are used in automobiles. Therefore, the growth of the PM&F products for the transportation market is very closely tied to the automobile industry which, in turn, closely follows the national economy. The demand for smaller, lighter weight, more fuel-efficient cars has been a major factor in plastics penetration of this once metal-dominated market, and such demand will continue to significantly affect plastics application. Currently, plastics are the leading choice for body panels and structural components, because of their greater corrosion resistance and lower manufacturing costs. Under-the-hood components include electrical housing and wiring, battery cases, and fan shrouds. Plastics products will continue to be preferred for interior uses such as seatbelts, cushioning and dashboards.

2.7.6 Plastic Furniture and Furnishings Products

The predicted growth rate per year for the 1981-1986 period is 5.1 percent. The majority of plastics in this market are used as flexible foams for cushioning, carpet backing, and bedding. Consumption of plastics in the retail furniture market has shown no sustained growth since 1974.[2] This is a result of the quality image of plastics and stiff competition from wood. However, some growth is expected because of penetration into newer markets such as outdoor furniture and institutional furniture for hospitals.

2.8 Baseline Projections

While for the past few years the plastic molding and forming industry has not shown much growth, the industry studies reported above predict a growth rate of about 7 percent between 1981 and 1986. (See Table 2-8) Capacity utilization figures are not available, although the down-turn in recent years has undoubtedly resulted in decreased capacity utilization. It is assumed that the financial performance, in terms of profitability, through 1986 will equal the median profitability for the 1973 to 1982 period, and new sources will be built in order to meet the increasing demand for plastics products.

1/ Plastics World, June 1983.
2/ C.H. Kline, 1982, Kline Guide to the Plastics Industry. Fairfield, NJ.

These baseline projections of the economic conditions that are likely to exist in the PM&F industry markets through 1986 provide a benchmark against which the impacts of the PM&F regulation can be measured. The projected profitability rates are incorporated into the economic impact methodology presented in Section 3 of this analysis.

Section 3

Economic Impact Methodology

3.1 Introduction

The economic impact methodology consists of a baseline estimate and a subsequent impact analysis. The initial baseline values provide a basis against which the impact of potential treatment costs can be assessed. Baseline values are calculated for production costs, profitability, annual plant investment, and salvage (or liquidation) value of equity assets.

The assessment of the impact of treatment costs on specific plants is performed in a series of steps. The first of these is to estimate wastewater treatment costs for each plant on the basis of its water use, treatment-in-place, and subcategorization. Monitoring costs are added to the treatment costs. The monitoring costs are $1200 per year for plants required to monitor toxic pollutants and $2600 per year for plants required to monitor conventional pollutants. The EPA assumes that for toxic pollutants plants will monitor four times per year at a cost of $300 per sample, and for conventional pollutants plants will monitor once a week, or 52 times per year, at a cost of $50 per sample. (In the following discussion, unless otherwise specified, "treatment costs" refer to treatment costs that include monitoring costs.) Next, the increases to production costs and the profitability reduction due to the treatment costs are determined. Treatment costs are compared to pre-tax income to assess the impact on liquidity; then a closure analysis is performed to predict plant or process line closure. This closure analysis compares the current liquidation (or salvage) value of equity of the plant's assets with the sum of the present values of cash flow over the life of the plant (with treatment) plus the salvage value of the plant's assets at the end of their useful life (terminal salvage value). From the projections of closures and changes in production cost and prices, the effects of the treatment costs on employment, foreign trade, production and small businesses and the effects on the entire PM&F industry, including plants that are not direct dischargers, are assessed.

As discussed in the previous section, EPA estimates there are 10,260 plants in the PM&F industry. Of these, 1,898 are estimated as wet process plants. The impacts of the proposed effluent limitations guidelines and standards are first analyzed on a plant-by-plant basis for the §308 Survey plants included in the economic analysis. Then, the results are extrapolated to the 558 direct dischargers and represent the impacts on the PM&F industry as a whole.

Data from the §308 Survey contains detailed technical and financial information on each plant's PM&F operations. Even though a plant may produce

other products, this study is concerned with the PM&F operations only. Therefore, SPI's financial and operating characteristics of custom processors were applied to the surveyed plants and the results extrapolated to represent the entire industry impacted by this regulation.

To assess treatment cost impacts on new sources, the Agency developed a "normal" plant for each of the subcategories using §308 Survey plant data and assuming no change in wet processes distribution.[1]

3.2 Baseline Estimates

Production costs, profitability, and average annual investment, without additional treatment costs, serve as a baseline against which the impacts of the regulatory action are determined. Baseline estimates are derived by applying publicly available data to each plant. The Society of the Plastics Industry, Inc. (SPI) reports financial and operating ratios of plastics molding and forming companies.[2] These ratios are the basic data used for estimating production costs and profitability based on plant sales. The Census of Manufactures provides information relating annual investment for capacity expansion to plant sales. For better resolution, SPI divided plants into two groups, with 5 million dollars annual sales as a point of demarcation. This analysis applied SPI's financial ratios to the survey of plants according to plant sales.

3.2.1 Production Costs

Production costs included in the calculation are the expenditures for:

1. Direct Materials
2. Direct Labor
3. Indirect Labor
4. Utilities
5. Depreciation
6. Other Manufacturing Expenses
7. Net on Tool Transactions
8. Selling Expenses
9. Administrative Expenses
10. Interest
11. Engineering Expenses
12 Direct Packaging and Shipping Supplies
13. Lease Expenses

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[1] For details on the "normal plant" see Section XII of the Development Document.

[2] The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Plastics Processing Companies, Survey No. 17, (1978), No. 19 (1980), and No. 21 (1982). Data for 1983 become available after the data collection portion of this study was completed. Upon comparison it was found that the 1983 data were not significantly different from that which was used in the analysis.

The SPI reports these line items regularly as a percentage of plant sales.[1] The baseline data used in this analysis correspond to the "median" condition between 1973 and 1982.

3.2.2 Profitability

Profitability is an obvious factor in determining economic impacts. It provides a way to judge the ability of a plant to absorb treatment costs in order to comply with the effluent limitations guidelines and standards. Plant level profit is estimated using ratios of profit to sales that represent the baseline condition. This is equal to the "median" condition between 1973-1982 based on the SPI's data. After-tax profits are used.

3.2.3 Annual Investment

Annual plant investment is used to determine the impact of additional treatment costs on the annual capital expenditures of a plant. Average annual investment is estimated from data reported in the 1982 Census of Manufactures at the four digit SIC level. The most appropriate group to use is SIC 3079 (Miscellaneous Plastics Products). The ratio of average annual investment to sales is taken as the ratio of new capital expenditures to the value of shipments from the 1982 Census of Manufactures data and has a value of 4.451 percent.

3.2.4 Discount Rate, Time Horizon, and Depreciation

This analysis assumes an 8 percent return on equity and a 13 percent interest rate on borrowed capital. This return on equity is comparable to observed values of return in this industry, and the interest rate for capital is based on forecasts of industrial bond rates. According to FINSTAT data,[2] the industry generally funds 30 percent of its capital expenditures from loans and 70 percent from equity. Therefore, the appropriate interest rate for capital expenditures is a weighted average of the two: $(.3)(.13) + (.7)(.08) = 0.095$ or roughly 10 percent. The 10 percent cost of capital rate is used to amortize capital treatment costs. A discount rate of 8 percent (about equal to the return on equity)[3] is assumed in the present value calculation for the closure analysis. The time horizon (or planning period) is 10 years in all calculations with one exception. The exception is that four years is used to amortize treatment costs for small plants when liquidity impacts are being assessed. Four years is used to take into account perceived higher risk, and more limited sources of funds available to small plants. Waste treatment systems are depreciated uniformly over 10 years.

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[1] The Society of the Plastics Industry, Inc., Financial & Operating Ratios, Survey No. 21, 1982.

[2] FINSTAT is a U.S. Small Business Administration (SBA) data base derived from Dun & Bradstreet's Financial Profiles data base and compiled by Social and Scientific Systems, Inc., a contractor to SBA.

[3] Based on SPI's survey of 1980 and 1982 Plastics Processing Companies.

3.3 Impact Projections

The addition of treatment costs affects the cost of production and has an impact on profitability, liquidity, plant closures, employment and prices.

3.3.1 Plant Level Impacts

The analysis of plant level economic impacts utilizes plant specific information obtained from the Agency's §308 Survey, such as current PM&F process water use rate, treatment-in-place, discharge status and sales. From the values of these variables, the projected impacts of treatment costs of the regulation are assessed. The methodology focuses on four measures: changes in production costs, changes in profitability, stress on cash flow (liquidity), and a comparison of wastewater treatment capital investment with average annual investment for capacity expansion.

3.3.1.1 Changes in Production Costs

The increases in production costs are calculated for each plant and summarized by industry group. The increase is calculated as the ratio of annual treatment costs to production costs.

3.3.1.2 Comparison to Annual Investment

The capital investment portion of treatment costs is compared to the average annual plant investment. It is calculated as the ratio of capital treatment costs to annual investment for each plant and summarized by industry group.

3.3.1.3 Profitability

Change in profitability due to treatment costs is calculated as the ratio of annual treatment costs to plant profit. When no price change is assumed (i.e., zero cost pass through), the change in profitability represents the maximum reduction in profits due to treatment. Plants with treatment costs greater than 15 percent of profit are considered to have potentially significant impacts. Profits after taxes are the focus; likewise treatment costs estimates used here must include tax consequences. A 40 percent tax rate is assumed. 1/

1/ The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Survey No. 21, 1982. SPI's data shows a PM&F tax rate of about 36 percent. In the economic analysis to estimate after tax profits conservatively, we have used a 40% tax rate.

3.3.1.4 Liquidity Impacts

The purpose of the liquidity analysis is to determine a plant's ability to finance wastewater treatment from current income. The analysis estimates pre-tax income before treatment costs and assumes that a pre-tax income greater than treatment costs enables a plant to pay for annual treatment costs out of current cash flow. A pre-tax income less than treatment costs in a particular year does not necessarily mean a plant is unable to pay for or to finance treatment costs. It is not uncommon for plants to have negative pre-tax income years from time to time. But if the annual treatment costs exceed a plant's current cash flow, that may be an indication of the stress that the plant experiences from incurring treatment costs.

3.3.2 Closure Analysis

A decision to close a plant is extremely complex, involving an array of factors, many of these subjective. Some of the more important factors to consider are:

- Present and expected profitability of the plant;
- Current market or salvage value of the plant, i.e., the opportunity costs of keeping the plant open;
- Required pollution control investment;
- Expected increase in annual costs due to pollution control requirements;
- Expected product price, production costs, and profitability of the plant after pollution control equipment is installed and operating; and
- Other major economic developments expected for the plant (i.e., change in the competitive position, increase/decrease in market growth).

Each of these factors is addressed to some extent in this plant closure analysis. Our efforts at this stage are aimed at identifying the plants that may close under the regulatory options.

In general a plant owner faced with pollution control requirements must decide whether to make the additional investment in pollution control or to sell the plant. A rational owner would decide to keep the plant if the before-and-after pollution control cash flows are greater than the salvage value of the plant's assets. If the expected cash flows are less than the salvage value of the plant's assets, the owner would be better off selling the plant. Since the plant will remain open for many years if the investment is

made in pollution control, the analysis takes into account the cash flow expected over the life of the plant and equipment plus the salvage value at the end of the last period. The present value of future cash flows is calculated discounting the expected income stream by the current return on equity. The plant will remain open if the present value of the expected cash flows less the costs of investing in pollution control exceeds the expected salvage value. If the expected cash flows are less, the owner will sell the plant.

For salvage value estimation, the Small Business Administration's FINSTAT data are used to obtain two ratios for the industry in SIC 3079: total assets to sales; and total liabilities to total assets. The ratios are ranked from smallest to largest. The ratio at the 75^{th} percentile (with a value of .685) is used to represent the industry-wide assets to sales ratio. The value at the 75^{th} percentile is chosen so as to overestimate a plant's assets and hence give a conservative (high) estimate of salvage value. The median of the total liabilities to assets ratio (with a value of .292) is used as the industry-wide value. The median is chosen to insure that assets are not underestimated.

Using these values, the plant specific salvage values are calculated in the following manner:

$$S_e = S - L$$

where:

S_e = salvage value of equity

S = salvage value of the plant's assets

L = total liabilities of the plant

and:

S = (.685 x sales) x .60

L = (.685 x sales) x .292

in which:

.685 = industry-wide assets to sales ratio

.292 = industry-wide total liabilities to assets ratio

.60 = scale factor to reflect the fact that any plant is probably only 60 percent convertible to another use.[1/]

[1/] Taken from EPA's Industrial Economic Impact Guidance, Draft November 13, 1981, page 18.

The present value (PV) of cash flow plus the terminal salvage value is the sum of the cash flow over the life of the plant (with treatment) and the after-tax discounted liquidation value at the end of the plant's useful life. It is calculated as follows:

$$PV\ (CF) = \sum_{i=1}^{n} \frac{CF}{(1+r)^i} + \frac{S_e \cdot (1-t)}{(1+r)^n}$$

where n is the life of the investment, CF is the cash flow of the plant with treatment, and r is the rate of return on the investment. It is assumed that the terminal salvage value is equal to S_e. The life of the investment, n, is assumed to be 10 years. An eight percent value is used for r. Parameter t denotes the tax rate charged to the terminal salvage value. It is assumed that the terminal salvage value will be treated as a long term capital gain in which case an appropriate tax rate of 0.25 is used in the calculation. For a valid comparison, S_e on the left-hand side must also consider tax consequences. The cash flow with treatment is approximated as CF = profits after income taxes -0.6 x (annual treatment costs), in which the factor 0.6 reflects the 40 percent tax rate and shows the treatment costs actually born by the plant after income tax consideration.

The baseline value of the ratio of salvage value to the present value of cash flow without treatment is 0.45 for plants with sales of $5 million and over and 0.51 for plants with sales of less than $5 million.

3.3.3 Extrapolation of Impacts of the Closure Analysis

The results of the plant-by-plant economic impact analysis performed on the §308 Survey plants is extrapolated to the estimated 558 direct discharging plants in the PM&F industry. Using the §308 Survey plants included in the Economic Analysis as an accurate representation of the direct discharging plants in the PM&F industry, the changes in production costs, profitability, and the comparison of capital treatment costs to annual plant investment for the industry, are taken to be proportional to the impacts calculated for the surveyed plants. The ratio of the total number of direct discharging plants in each of the four industry groups of PM&F plants to the number of plants from the §308 Survey is taken to obtain appropriate extrapolation factors for the industry. The extrapolation of Option 3 costs for plants with only contact cooling and heating processes is based on the Agency's estimate that only 6/9ths of such plants will have to treat for phthalates in their effluent. The estimate is based upon §308 sampling data showing phthalates detected at or above treatability level in 6/9ths of the plants sampled. The extrapolation of costs for plants with cleaning and contact cooling and heating, however, assumes that all of these plants will have to treat for phthalates in their contact cooling and heating effluent. For this industry group, the estimate of total treatment costs is conservative. A summary of the number of plants by industry group for both the entire industry and the survey is presented in Table 3-1.

Table 3-1. PM&F Plants in the §308 Survey

Included in the Economic Analysis and Overall Industry Estimates

Discharge Status	Industry Group 1/							
	Plants with Contact Cooling and Heating (only)	Plants with Cleaning (only)	Plants with Finishing (only)	Plants with Cleaning and Contact Cooling, and Heating	Plants with Contact Cooling and Heating, and Finishing	Plants with Cleaning and Finishing	Plants with Contact Cooling and Heating, Cleaning and Finishing	Total
Survey Plants								
Direct	96	6	0	8	0	2	0	112
Indirect only	123	15	5	9	4	3	1	160
Zero only	92	1	4	2	1	0	0	100
Indirect/zero	5	0	0	3	0	1	0	9
Total	316	22	9	22	5	6	1	381
Industry								
Direct	478	30	0	40	0	10	0	558
Indirect only	612	75	25	45	20	15	5	797
Zero only	458	5	20	10	5	0	0	498
Indirect/zero	25	0	0	15	0	5	0	45
Total	1,573	110	45	110	25	30	5	1898

Source: Compiled by EPA from §308 Survey data and extrapolated to the industry.

1/ For direct dischargers in the §308 Survey, plants were observed to occur in only four of the seven industry groups.

Using the extrapolation factors developed above, the impacts on the plastics molding and forming industry are assessed. PM&F Operation line closures are assumed to occur if plastic employment is less than 50 percent of total plant employment. Otherwise the entire plant is assumed to close.

3.4 Price Increases

Price increases are estimated for each industry group as the ratio of annual treatment cost to plastics product sales. This analysis assumes a full cost pass through so the result is the maximum expected price increase.

3.5 Employment

Unemployment resulting from plant or process line closures is estimated directly from the plant closure analysis. Estimates of the employment loss resulting from price increases and the subsequent production decreases are beyond the scope of the economic analysis; and in the case of the PM&F regulation, where price and production changes are expected to be minimal, it is the Agency's judgment such employment losses are insignificant.

3.6 Impacts on Entire PM&F Industry

The regulation only affects wet direct discharging PM&F plants. These plants comprise only about 5 percent of the total plants in the industry. The other 95 percent of the PM&F plants either have dry processes or are indirect or zero dischargers. Depending upon the severity of the economic impacts, these plants may be affected by the regulation due to possible production shifts as a result of price changes and/or plant closures.

3.7 Community Impacts

Community impacts result primarily from employment and earnings losses. For example, the economic conditions of a geographic area would be potentially affected if this regulation were to close a PM&F plant that employed a large percentage of a community's work force. If employment and earnings losses are important, their secondary effects are assessed relative to a community's total employment and earnings using data on community employment and earnings available through the Bureau of the Census and the Bureau of Labor Statistics.

3.8 Balance-of-Trade Impacts

A regulation may adversely affect the balance-of-trade depending on 1) the extent the product price increases, and 2) the extent to which the domestic production losses are replaced by imports. If the changes in these variables are minimal, then import substitution for domestic products are small, export losses are also minimal, and balance-of-trade impacts are insignificant.

3.9 Small Business Analysis

The Regulatory Flexibility Act (RFA) (PL 96-354) requires Federal regulatory agencies to consider small businesses throughout the regulatory process. A small business analysis of the plastics molding and forming industry is performed to determine if small plants are significantly affected by the effluent regulations and to ascertain if a regulatory flexibility analysis is needed for this industry. The economic impact analysis of this regulation included both small and large PM&F plants and found the impact on small plants is not significant. Therefore, a formal Regulatory Flexibility for small PM&F plants is not persued.

3.10 New Sources

The impact of the NSPS regulation on new direct discharge sources is analyzed by examining the effects of the expected treatment costs on a set of normal plants. A "normal" plant is a theoretical plant developed by EPA to represent the anticipated characteristics of typical plants constructed in the baseline period (i.e., 1986). A normal plant is examined for each of the three subcategories. The sales and flow values for the three normal plants are the median values observed in the § 308 Survey plants for the three groups presented in Table 3-2.1/

Data on the "More Profitable Plants" as reported by the SPI 2/ are adapted for the normal plants with the following adjustment. It is assumed that replacement costs are higher than the aging assets at an existing plant; hence, the depreciation costs of a new plant are more than that of published data pertaining to existing plants whose median construction date is 1976 (based on §308 Survey plant data). Assuming new construction starting in 1982 for baseline plants, the GNP deflator is used to update the depreciation costs from 1976 to 1982. This upward adjustment of depreciation costs is subtracted from the profits. The resulting financial and operating ratios for these normal plants are presented in Tables 3-3 and 3-4.

The control options identified for new sources are the same as those for existing plants. Treatment costs for new sources are estimated in the same manner as for existing sources by industry group and water use but assume no treatment-in-place. The impacts, including production cost increases and profitability reduction, are calculated to determine possible barriers to all new sources including new "greenfield site" plants entering the market as well as major modifications to existing plants.

1/ See the Section XII of the Development Document for details on the "normal" plant.

2/ The Society of the Plastics Industry, Inc., Financial & Operating Ratios, Survey No. 21, 1982.

Table 3-2. Normal Plant Flow Size Characteristics by Subcategory

Subcategory	Flow (gpm)	Employment	Sales ($1,000) 1/
Plants with Contact Cooling and Heating	35.0	83	7,267
Plants with Cleaning	13.5	102	6,353
Plants with Finishing	3.15	24	1,068

1/ 1982 dollars.

Source: § 308 Survey and Section XII of Development Document.

Table 3-3. Baseline Financial and Operating Ratios (as Percent of Sales) - Existing Sources

Ratio	Plant Category (Annual Plastics Sales)	
	Less Than 5 Million Dollars	5 Million Dollars or More
Production Costs	93.2	90.0
Profits Before Taxes	5.5	6.2
Profits After Taxes	3.5	4.1
Annual Capital Investment	4.451	4.451

Sources: The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Survey No. 21, 1982; and U.S. Department of Commerce, Bureau of the Census, 1982 Census of Manufacturers.

Table 3-4. Financial and Operating Ratios

(as Percents of Sales) - New Sources

Ratio	Plant Category (Annual Plastics Sales)	
	Less Than 5 Million Dollars	5 Million Dollars or More
Production Costs	92.5	91.2
Profits Before Taxes	7.0	6.1
Profits After Taxes	5.3	3.8

Source: The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Survey No. 17, (1978), No. 19, (1980), and No. 21, (1982).

Section 4

Effluent Limitations Options and Compliance Costs

4.1 Introduction

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)). To implement the Act, EPA was to issue effluent limitations guidelines, pretreatment standards, and new source performance standards for industrial dischargers. The Act included a timetable for issuing these standards. However, EPA was unable to meet many of the deadlines and, as a result, in 1976, was sued by several environmental groups. In settling this lawsuit, EPA and the plaintiffs executed a court approved "Settlement Agreement" which required EPA to develop a program and to adhere to a schedule in promulgating effluent limitations guidelines, new source performance standards, and pretreatment standards for 65 "priority" or toxic pollutants and classes of pollutants for 21 major industries. (See, Natural Resources Defense Council, Inc. v. Train, 8 ERC 2120 (D.D.C. 1976), modified, 12 ERC 1833 (D.D.C. 1979), modified by orders dated October 26, 1982; August 2, 1983, January 6, 1984; and July 5, 1984.)

Many of the basic elements of this Settlement Agreement program were incorporated into the Clean Water Act of 1977. Under the Act, the EPA is required to consider several effluent limitations guidelines and standards. The following is a brief summary:

4.1.1 Best Practicable Control Technology Currently Available (BPT)

BPT applies to existing direct dischargers. The effluent limitations guidelines are generally based on the average of the best existing performance at plants of various sizes, ages and unit processes.

4.1.2 Best Available Technology Economically Achievable (BAT)

BAT also applies to existing direct dischargers. These effluent limitations guidelines, in general, represent the best existing performance in the industrial sub-category or category.

4.1.3 Best Conventional Pollutant Control Technology (BCT)

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants (BOD_5, TSS, oil and grease, and pH). EPA must find that limitations are reasonable under a two part "cost-reasonableness" test

before establishing them as BCT. The Agency is promulgating BCT effluent limitations guidelines for the contact cooling and heating subcategory equal to BPT because EPA could not identify any technology that further reduces the concentration of conventional pollutants in contact cooling and heating water. BCT effluent limitations guidelines for the cleaning water subcategory and the finishing water subcategory are reserved until promulgation of the final BCT methodology.

4.1.4 New Source Performance Standards (NSPS)

NSPS apply to new facilities that discharge directly into the navigable waters and are based on the best available demonstrated technology.

4.1.5 Pretreatment Standards for Existing Sources (PSES) and New Sources (PSNS)

PSES and PSNS control the discharge of pollutant to publicly-owned treatment works (POTW) which pass-through, interfere with, or are otherwise incompatible with the operation of a POTW. These limitations are to be technology-based, with PSES analogous to BAT and PSNS analogous to NSPS. For the plastics molding and forming industry, the Agency is not proposing to establish PSES or PSNS.1/ Even though the Agency is not establishing categorical pretreatment standards for the PM&F industry, indirect dischargers must comply with the General Pretreatment Regulations (40 CFR part 403).

4.2 Treatment Technology Options

This report analyzes the economic impact of wastewater treatment costs on plants in the plastics molding and forming industry. For regulatory purposes, the PM&F industry is divided into three subcategories based on water use and wastewater characteristics: (1) processes that use contact cooling and heating water; (2) processes that use cleaning water; and (3) processes that use finishing water. This economic impact analysis divides existing wet, direct discharging PM&F plants into four industry groups based on the regulatory subcategories: 1) plants with processes only in the contact cooling and heating water subcategory; 2) plants with processes only in the cleaning water subcategory; 3) plants with processes in both the cleaning and contact cooling and heating water subcategories; and 4) plants with processes in both the cleaning and the finishing water subcategories.2/ The economic impact analyis regroups the three subcategories of PM&F processes used for the development of technical options into four industry groups. Each industry

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1/See the discussion in the preamble to the final rule (49 FR 49026; Dec. 17, 1984).

2/ For purposes of brevity throughout the economic analysis, these four PM&F industry groups are referred to as 1) plants with contact cooling and heating only; 2) plants with cleaning only; 3) plants with cleaning and contact cooling and heating; and 4) plants with cleaning and finishing.

group represents wet, direct discharging PM&F plants in the data base that have in common one or more of the PM&F processes. This regrouping was necessary because the economic impact analysis is based on the ability of economic entities to bear the costs of pollution control equipment and practices. In the PM&F industry, plants, not processes are the economic entities to be analyzed.

EPA identified and considered several options for each subcategory for BPT, BAT and NSPS.[1] They are summarized below.

Contact Cooling and Heating Water Subcategory

Option 1: No regulation.

Option 2: Continuation of current good housekeeping practices. Plants are not required to install any additional treatment nor are they expected to remove any treatment that is currently in place. Limitations are based on the pollution concentrations currently discharged by plants employing good housekeeping techniques.[2]

Option 3: Activated carbon treatment for phthalates only.

Cleaning Water Subcategory

Option 1: pH control and nutrient addition, followed by primary settling, flow equalization, and final treatment in a package activated sludge treatment system.

Finishing Water Subcategory

Option 1: No regulation.

Option 2: Settling.

Option 3: Settling followed by activated carbon treatment for phthalates only.

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[1] EPA is promulgating BAT and NSPS for both the contact cooling and heating and the finishing subcategories for all pollutants except for phthalates. The Agency believes that activated carbon will effectively control phthalates, but at this time, the Agency does not have treatability data for phthalates for that treatment process. EPA plans to study the treatment of phthalates by the activated carbon process. Depending on the results of that study, EPA may propose and promulgate limitations guidelines for phthalates. If limitations guidelines are to be proposed and promulgated, the Agency will reexamine the costs for phthalate control and, at that time, analyze the economic impacts of changes--if any--in the costs.

[2] Although some plants may incur costs under this option, they are considered to be minimal and are represented as zero.

The technology treatment options for each of the three subcategories are applied to the four industry groups in the economic analysis of existing sources as summarized below:

Plants with Contact Cooling and Heating Only

Option 1: No regulation.

Option 2: Continuation of current good housekeeping practices.

Option 3: Activated carbon treatment for phthalates only.

Plants with Cleaning Only

Option 1: pH control and nutrient addition, followed by primary settling, flow equalization, and final treatment in a package activated sludge treatment system.

Plants with Cleaning and Contact Cooling and Heating

Option (1, 1): Segregation of the waste streams followed by Option 1 for the cleaning subcategory and Option 1 for the contact cooling and heating subcategory.

Option (1, 2): Segregation of the waste streams followed by Option 1 for cleaning and Option 2 for contact cooling and heating.

Option (1, 3): Segregation of the waste streams followed by Option 1 for cleaning and Option 3 for contact cooling and heating.

Plants with Cleaning and Finishing

Option (1, 1): Segregation of the waste streams followed by Option 1 for the cleaning subcategory and Option 1 for the finishing subcategory.

Option (1, 2): Segregation of the waste streams followed by Option 1 for cleaning and Option 2 for finishing.

Option (1, 3): Segregation of the waste streams followed by Option 1 for cleaning and Option 3 for finishing.

For new sources there are three industry groups, one for each of the three subcategories. The technology treatment options for each of the three subcategories is the same as the options for each of the three new sources industry groups. A more comprehensive description of these treatment technology options and associated compliance costs is contained in the Development Document.

4.3 Current Treatment and Treatment Costs

4.3.1 Current Treatment

Of the §308 Survey plants used in the economic analysis, 112 are direct dischargers. Some direct dischargers have wastewater treatment-in-place as shown in Table 4-1. Those plants with activated sludge systems are large integrated plants where PM&F process wastewater is co-treated with wastes from other industrial processes.

4.3.2 Treatment Costing

The control costs used in the impact assessment consist of two parts: wastewater treatment costs and monitoring costs. These costs were developed by EPA's Industrial Technology Division (ITD) and reported in Section IX of the Development Document.

Monitoring costs are added to the treatment system costs to obtain total costs per plant. The EPA estimates that the monitoring costs are $1200 per year for plants required to monitor toxic pollutants and $2600 per year for plants required to monitor conventional pollutants. For toxic pollutants, plants were assumed to monitor four times per year at a cost of $300 per sample, and for conventional pollutants, plants were assumed to monitor once a week, or 52 times per year, at a cost of $50 per sample. The total annual costs are the sum of the amortized capital costs, the operation and maintenance costs (O&M), and the monitoring costs. Capital costs are amortized assuming cost of capital of 10 percent and an equipment life of ten years for reasons discussed in Section 3.

4.3.2.1 Plant-Specific Costs

The analysis of potential economic impacts uses plant-specific treatment costs developed by EPA's Industrial Technology Division (ITD) for each of the 112 direct discharging plants from the §308 Survey used in the economic analysis. Estimated investment costs for the treatment options are reduced for those plants with appropriate treatment-in-place (see Table 4-1). However, the estimated operation and maintenance (O&M) costs are for each plant's entire PM&F effluent treatment system and include O&M for treatment-in-place.

The estimated treatment costs for plants in the §308 Survey used in the economic analysis have been extrapolated for each industry group to estimate the costs for all 558 direct discharging plants in the PM&F industry in the manner described in Section 3. These costs are shown in Table 4-2 for §308 Survey plants and in Table 4-3 for all direct dischargers in the PM&F industry.

Table 4-1. Number of Plants With Wastewater Treatment-in-Place in §308 Survey

Industry Group	pH Adjustment	Sedimentation	Activated Sludge	Lagoon[1/]
Plants with Contact Cooling and Heating only	2	5	3	1
Plants with Cleaning only	0	1	1	0
Plants with Cleaning and Contact Cooling and Heating	2	1	2	0
Plants with Cleaning and Finishing	1	1	1	0
Total	5	8	7	1

Source: Compilation based on the §308 Survey data.

4.3.2.2 Treatment Costs for New Sources

Treatment costs for the three new source "normal" plants[2/] are obtained using the costs in the same manner as for existing plants. However, existing source costs are adjusted to reflect the fact that new sources do not have treatment-in-place. New source treatment costs are summarized in Table 4-4.

[1/] A lagoon is a large settling pond where evaporation and some biological breakdown takes place.

[2/] For definition of "normal" new plants, see section 3-10 above.

Table 4-2. Treatment Costs (in 1982 $1,000) for 112 Direct Discharge Plants in §308 Survey

Industry Group	Option	Capital Cost	O&M Cost	Annual Cost
Plants with Contact Cooling and Heating only	Option 1	NA	NA	NA
	Option 2*	0	0	0
	Option 3	8,640	1,915	3,320
Plants with Cleaning only	Option 1*	426	123	192
Plants with Cleaning and Contact Cooling and Heating	Option (1,1)	783	443	571
	Option (1,2)*	783	443	571
	Option (1,3)	1,385	559	785
Plants with Cleaning and Finishing	Option (1,1)	42.0	32.8	39.7
	Option (1,2)*	58.5	37.2	46.7
	Option (1,3)	98.5	47.8	63.8

* Selected Option.

NA = Not applicable.

Source: EPA estimates.

Table 4-3. Treatment Costs (in 1982 $1,000) for All Direct Discharge Plants in PM&F Industry

Industry Group	Option	Capital Cost	O&M Cost	Annual Cost
Plants with Contact Cooling and Heating only	Option 1	NA	NA	NA
	Option 2*	0	0	0
	Option 3	28,694	6,359	11,028
Plants with Cleaning only	Option 1*	2,123	612	958
Plants with Cleaning and Contact Cooling and Heating	Option (1,1)	3,902	2,208	2,843
	Option (1,2)*	3,902	2,208	2,843
	Option (1,3)	6,900	2,786	3,909
Plants with Cleaning and Finishing	Option (1,1)	209.5	163.4	197.5
	Option (1,2)*	291.3	185.3	232.7
	Option (1,3)	490.8	238.2	318.0

* Selected Option.

NA = Not applicable

Source: EPA estimates.

Table 4-4. Treatment Costs (in 1982 Dollars) for Each Normal New Source

(Direct Dischargers)

Industry Group	Plant Flow (gpm)	Option 1 Capital Cost	Option 1 O&M Cost	Option 1 Annual Cost	Option 2 Capital Cost	Option 2 O&M Cost	Option 2 Annual Cost	Option 3 Capital Cost	Option 3 O&M Cost	Option 3 Annual Cost
Plants with Contact Cooling & Heating Only	35	0	0	0	0	0	0*	41,600	10,000	17,970
Plants with Cleaning Only	13.5	241,000	32,800	74,610*	NA	NA	NA	NA	NA	NA
Plants with Finishing Only	3.15	0	0	0	8,200	2,200	6,140*	28,200	6,300	14,690

* Selected Option.

NA = Not applicable.

Source: EPA estimates.

Section 5

Results of Analysis

5.1 Introduction

The economic impacts of the effluent limitations guidelines and standards for the plastics molding and forming industry were analyzed using the methodology described in Section 3 above. The results of this analysis as presented here include price changes, liquidity impacts, plant and process line closures, and impacts on employment and on all PM&F plants as well as impacts on communities, foreign trade, small businesses, and new sources.[1/]

5.2 Impacts on §308 Survey Plants

The impact of treatment costs at the plant level on 112 direct discharging plants is measured by production cost changes, profitability changes, and a comparison of treatment investment costs to current average annual plant investment.

5.2.1 Production Cost Changes

The changes in production costs due to the addition of annual treatment costs, for each of the three industry groups are shown in Table 5-1 for each control option. Production cost changes are generally small. Plants with cleaning and finishing potentially are affected the most with cost changes ranging from an increase of 2.0 percent under Option (1,1) to an increase of 3.2 percent under Option (1,3).

[1/] The results reflect the impacts of the effluent limitations guidelines for the PM&F industry promulgated in December 1984. These limitations guidelines include BAT and NSPS for both contact cooling and heating and the finishing subcategories for all pollutants except for phthalates. The agency believes that activated carbon will effectively control phthalates, but at this time the Agency does not have treatability data for phthalates for that treatment process. The costs in this document for the treatment of phthalates by activated carbon are the result of EPA's best estimates of costs and treatability based on its use for other similar pollutants in other industries. EPA plans to study the treatment of phthalates by the activated carbon process. Depending on the results of that study, EPA may propose and promulgate limitations guidelines for phthalates. At that time the Agency will re-examine the costs for phthalate control and, at that time, analyze the economic impacts of changes--if any--in the costs of the third Option for both the cooling and heating and the finishing subcategories.

Table 5-1. Industry Production Cost Changes by Control Option

Industry Group	Production Costs Increases (percent) Option 1 (or 1,1) 1/	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating only	0	0 *	0.22
Plants with Cleaning only	0.26 *	NA	NA
Plants with Cleaning and Contact Cooling and Heating	0.31	0.31 *	0.43
Plants with Cleaning and Finishing	2.0	2.3 *	3.2

Source: EPA estimates.

Table 5-2. Profitability Change by Control Option 2/

Industry Group	Profitability Reduction (percent) Option 1 (or 1,1) 1/	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating only	0	0 *	5.1
Plants with Cleaning only	6.1 *	NA	NA
Plants with Cleaning and Contact Cooling and Heating	11.6	11.6 *	25.6
Plants with Cleaning and Finishing	66.6 3/	77.6 *3/	104.0 3/

Source: EPA estimates.
NA = Not applicable.
* Selected Option.

1/ If plant combines two processes.
2/ No treatment cost pass-through asssumed.
3/ Profitability reduction varies widely between the two plants in sample, one of which is projected to have a line closure; so mean change may not accurately reflect the impact on this industry group.

5.2.2 Profitability

The results of the profitability analysis are presented in Table 5-2 for each option and each industry group, assuming no pass-through of treatment costs to consumers. The median profitability reduction for each PM&F plant group was selected for presentation as an indication of the expected profitability impacts on the plants by type under each option. The median of plant profitability reduction due to the addition of treatment costs is the largest for plants with cleaning and finishing; the greatest median profitability reduction is 104 percent for plants in this group under Option (1,3). On an individual plant basis, the changes in profitability range from -16 percent, to -181 percent. Since there are only two plants in the sample for this industry group, and the measure of profitability change varies greatly, the median value may not accurately reflect the impact on this industry group.

5.2.3 Treatment Investment Costs Compared to Current Annual Plant Investment

The ratio of the sum of the capital investment portion of treatment costs to the sum of the current average annual plant investment is shown in Table 5-3 for each industry group and each option. These ratios show that of the dollars plants now spend annually on capital equipment, the treatment technology options require plants to invest less than 16 percent of it on new treatment facilities except for the plants with cleaning and finishing. For this group, the investment ratio is as high as 104 percent. However, this group is based on a sample of only two plants, one of which is a candidate for PM&F line closure. Excluding this plant, the investment ratio is only as high as 24 percent for the selected option. In addition, the Agency estimates that there are only 10 plants with cleaning and finishing processes that are direct dischargers among the 10,260 PM&F plants in the United States.

5.3 Price Changes

The results of the maximum price changes possible under the technology options are shown in Table 5-4. As this table illustrates, the price changes are small even under this worst case analysis, the highest increase being 3.0 percent for plants with cleaning and finishing under Option (1,3). As noted above, industry group comprises only 10 plants with cleaning and finishing processes.

5.4 Impact on Liquidity

The median ratio of the treatment cost to plant pre-tax income for each type of plant and each option is shown in Table 5-5. The highest median ratio is 138 percent for plants with cleaning and finishing. However, as mentioned before, these numbers are distorted because of the small sample size. On an individual plant basis, the annual treatment cost exceeds the plant's income in only two instances for all four industry groups in the §308 survey plants

Table 5-3. Treatment Investment Costs Compared to Current Average Annual Plant Investment

Industry Group	Treatment Investment Costs Compared to Current Average Annual Plant Investment (percent)		
	Option 1 (or 1,1)	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating Only	0	0 *	11.5
Plants with Cleaning only	11.6 *	NA	NA
Plant with Cleaning and Contact Cooling and Heating	8.7	8.7 *	15.3
Plants with Cleaning and Finishing	44.2 1/	51.5 * 1/	104.0 1/

Source: EPA estimates.

Table 5-4. Price Changes by Plant Type (percent)

Industry Group	Option 1 (or 1,1)	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating Only	0	0 *	0.21
Plants with Cleaning Only	0.23 *	NA	NA
Plants with Cleaning and Contact Cooling and Heating	0.28 *	0.28 *	0.39
Plants with Cleaning and Finishing	1.7	2.2 *	3.0

Source: EPA estimates.
NA = Not applicable.
* Selected Option.

1/ The investment ratio varies widely between the two plants in sample one of which is projected to have a line closure; so mean change may not accurately reflect the impact on this industry group.

under any option (i.e., the ratio is less than 100 percent for all but two plants). These two plants correspond to eight plants in the industry, all of which are projected to close in the closure analysis.

5.5 Closure Analysis

The baseline ratio of salvage value to the present value of cash flow is 0.45 for plants with sales of $5 million and over and 0.51 for plants with sales of less than $5 million (i.e., there are no baseline closures). With the addition of annual treatment costs under the regulatory options, only one of the 112 plants in the §308 Survey, a plant with contact cooling and heating, shows a salvage value exceeding the present value of cash flow under Option 3, which indicates that this plant is a closure candidate. Other closures are PM&F operation line closures. The two PM&F operation line, as opposed to plant, closures are determined to occur at plants where less than 50 percent of the total employees at the plant are engaged in plastic molding and forming activities. For these plants, plastic molding and forming is considered a secondary operation and so only the PM&F operation line will close, not the entire plant. The plant and PM&F operaton line closures are summarized in Table 5-6.

5.6 Employment

Employment impacts for the 112 PM&F plants in the §308 Survey, estimated from the results of the closure analysis and calculated as the sum of the PM&F or total employment at these plants (depending on whether it is a process line or total plant closure) are as follows:

- For plants with contact cooling and heating only the employment loss is 26 under Option 3; and
- For plants with cleaning only, no loss of jobs is projected.
- For plants with cleaning and contact cooling and heating, no employment loss is projected.
- For plants with cleaning and finishing the loss is 5 jobs under Options (1,1); (1,2); or (1,3).

5.7 Industry Impacts Including Closure, Employment, Community, and Foreign Trade

Since the §308 Survey is assumed to be an accurate representation of the PM&F industry, the industry-wide impacts of treatment costs on production costs, profitability, annual investment, prices, and liquidity are equal to the impacts, expressed as percentages, calculated for the §308 Survey plants. These results are presented in Tables 5-1 to 5-5. The industry-wide closure of plants and PM&F operation lines and employment impacts scaled up from the §308 Survey plant impacts are summarized in Tables 5-7 and 5-8.

Table 5-5. Liquidity Impacts

Industry Group	Median Ratio of Annual Treatment Costs to Plant Income (percent)		
	Option 1 (or 1,1)	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating Only	0	0 *	6.8
Plants with Cleaning Only	6.7 *	NA	NA
Plants with Cleaning and Contact Cooling and Heating	12.5	12.5 *	27.3
Plants with Cleaning and Finishing	84.7 1/	100.1* 1/	138 1/

Source: EPA estimates.

Table 5-6. Summary of Closure Analysis for the §308 Survey Plants

Industry Group	Number of Plant and PM&F Operation Line Closures					
	Option 1 or (1,1)		Option 2 or (1,2)		Option 3 or (1,3)	
	Plant	PM&F Operation Line	Plant	PM&F Operation Line	Plant	PM&F Operation Line
Plants with Contact Cooling and Heating Only	0	0	0 *	0 *	1	1
Plants with Cleaning Only	0 *	0 *	NA	NA	NA	NA
Plants with Cleaning and Contact Cooling and Heating	0	0	0 *	0 *	0	0
Plants with Cleaning and Finishing	0	1	0 *	1 *	0	1
Totals	0	1	0	1	1	2

Source: EPA estimates.
NA = Not applicable
* Selected Option

1/ This ratio varies widely between the two plants in sample one of which is projected to have a line closure; so median change may not accurately reflect the impact on this industry group.

Table 5-7. Number of Plant and PM&F Operation Line Closures

(Industry-Wide)

Industry Group	Number of Plant and PM&F Operation Line Closures					
	Option 1 or (1,1)		Option 2 or (1,2)		Option 3 or (1,3)	
	Plant	PM&F Operation Line	Plant	PM&F Operation Line	Plant	PM&F Operation Line
Plants with Contact Cooling and Heating Only	0	0	0 *	0 *	3	3
Plants with Cleaning Only	0 *	0 *	NA	NA	NA	NA
Plants with Cleaning and Contact Cooling and Heating	0	0	0 *	0 *	0	0
Plants with Cleaning and Finishing	0	5	0 *	5 *	0	5
Total	0	5	0	5	3	8

Source: EPA estimates

Table 5-8. Plastics Industry Employment Loss 1/
(Industry-wide)

Industry Group	Option 1 (or 1,1)	Option 2 (or 1,2)	Option 3 (or 1,3)
Plants with Contact Cooling and Heating Only	0	0 *	86
Plants with Cleaning Only	0 *	NA	NA
Plants with Cleaning and Contact Cooling and Heating	0	0 *	0
Plants with Cleaning and Finishing	25	25 *	25
Total	25	25	111

Source: EPA estimates.
NA = Not applicable.
* Selected Option.

1/ Employment losses include plastics molding and forming production workers only when there are PM&F Operation line closures and total plant employment when there are plant closures.

The results of the industry-wide closure analysis show that three plants and five PM&F operation lines exhibit a current liquidation value exceeding the present value of the future benefits stream, as summarized in Table 5-7, and therefore are considered to be closure candidates. These include plastics molding and forming operation lines in five plants with cleaning and finishing that are expected to close under all three options. The three remaining closure candidates are plants with contact cooling and heating only impacted under Option 3. These three plants represent 0.5 percent of the total number of wet process direct dischargers in the PM&F industry. The percentage of projected operation line closures in 0.9 percent.

Employment impacts resulting from the closure analysis show that the largest employment losses occur under Option 3 (or 1,3). These losses total 111 jobs, a very small amount when compared to total direct wet process employment of 32,000 and an even smaller loss when compared to industry employment of 530,000.

The results of the economic impact show, that for the 558 direct discharging plants potentially affected by the regulation, the impact on these plants is minimal. The impact of the regulation on the entire PM&F industry, which comprises about 10,260 plants, is even less significant. The price changes are calculated assuming the worst case of 100 percent pass through to consumers. Even though the estimated price changes are small, the treatment costs probably cannot be totally passed on to consumers because products made by the 558 plants affected by the regulation may also be produced by the other plants in the industry. The impact analysis predicts for the selected options only five PM&F operation line closure with an employment loss of 25 jobs. Given the size of the industry, the production lost from these five lines due to the regulation is easily absorbed by existing plants in the industry.

The regulation only affects direct discharging plants with wet processes. The other plants in the industry, which include both indirect and zero dischargers, incur no additional costs as a result of the regulation. This is not to say that these plants have no costs associated with wastewater treatment. Indirect dischargers already bear costs to meet the General Pretreatment Standards and often are required to pay user fees (these are not consequence of PM&F regulation so they arent't considered in this analysis). Also, zero dischargers, in order to attain this status, must have some sort of on-site treatment system (such as a septic system or deep well injection) or contract haul their waste, both of which have associated costs. As a result, direct dischargers are not considered to be at a competitive disadvantage because of the regulation.

Due to the costs of relocation and the relative insignificance of the economic impacts, the direct discharging plants affected by the regulation are not expected to relocate in order to change discharge status as a way to avoid the regulation. Likewise because of the costs of changing processes and equipment these wet direct discharging plants are not expected to change to dry processes.

Community impacts caused by any regulatory option are insignificant for all industry groups as the estimated employment loss is small when compared to the total community employment level.

No foreign trade impacts are expected as a result of the treatment costs. Since the estimated production losses and price increases are so small, the impacts on imports, exports and the balance of trade would be negligible.

5.8 New Sources

Since options considered for NSPS are the same as the options for existing sources, there are no barriers to entry caused by the regulation. The results of the analysis presented in Table 5-9 and discussed below are an indication of how "normal" new plants 1/ would perform with the addition of treatment costs under the three technology options. The performance of normal new plants is shown for three industry groups: (1) contact cooling and heating only, (2) cleaning only, and (3) finishing only.

For normal new plants with contact cooling and heating only, the production cost increase is 0.27 percent, the reduction in after-tax profitability is 3.9 percent and the ratio of treatment investment costs to annual plant investment is 12.9 percent. For normal new plants with cleaning only, the production cost increase is 1.3 percent, profitability reduction is 18.5 percent and investment ratio is 85.2 percent. For plants with finishing only, production cost increases range from 0.62 to 1.5 percent, profitability reductions from 6.5 to 15.5 percent and investment ratios from 17.3 to 59.3 percent.

For comparison purposes, Table 5-9 also includes these same impacts for existing sources by subcategory. The largest difference in impacts occurs in the cleaning subcategory. The ratio of treatment investment costs to annual plant investment is 9.8 for existing sources and 85.2 percent for new sources. This is due to the fact that many of the existing sources have some degree of treatment-in-place. The significance of this difference is lessened if you consider the profitability reduction, where the new sources have the advantage. As this table further indicates, the other new source impacts are not significantly different from existing sources. Thus, no barriers to entry in the PM&F industry are posed by this regulation. These results apply to all new sources whether they are "greenfield sites" plants entering the market or major modifications to existing sources.

1/ For the definition of a "normal" new plant, see Section 3-10 above.

Table 5-9. Performance of New Sources with a Comparison to Existing Sources

NEW SOURCES

Industry Group	Pollution Control Option	Plant Flow (gpm)	Production Cost Increase (Percent)	Treatment Investment Costs Compared to Annual Plant Investment (Percent)	Profitability Reduction (Percent)
Plants with Contact Cooling and Heating Only	Option 1	35	NA	NA	NA
	Option 2 *	35	0	0	0
	Option 3	35	0.27	12.9	3.9
Plants with Cleaning Only	Option 1*	13.5	1.3	85.2	18.5
Plants with Finishing Only	Option 1	3.15	0	0	0
	Option 2*	3.15	0.62	17.3	6.5
	Option 3	3.15	1.5	59.3	15.5

EXISTING SOURCES

Plants with Contact Cooling and Heating	Option 1	NA	NA	NA
	Option 2*	0	0	0
	Option 3	0.21	11.0	4.8
Plants with Cleaning	Option 1*	0.31	9.8	11.0
Plants with Finishing	Option 1	0	0	0
	Option 2*	0.62	17.3	19.0
	Option 3	1.5	59.4	45.6

Source: EPA estimates.
* Selected option.
NA = Not Applicable.

5.9 Small Business Analysis

Public Law 96-354, known as the Regulatory Flexibility Act, requires EPA to determine if a significant impact on a substantial number of small businesses occurs as a result of proposed regulations. If there is a significant impact, the act requires that alternative regulatory approaches that mitigate or eliminate economic impacts on small businesses must be examined. This section addresses these objectives by identifying whether or not small businesses in the plastics molding and forming industry are significantly impacted by the proposed regulation.

5.9.1 Definition of a Small Business

The Small Business Act, Section 3, defines a small business in the following statement:

> ". . . a small business concern shall be deemed to be one which is independently owned and operated and which is not dominant in its field of operation. In addition to the foregoing criteria, the Administration (of the SBA), in making a detailed definition may use these criteria, among others: Number of employees and dollar volume of business."

The definition of a small business is not precise nor universal. The Small Business Administration (SBA) definition of "small business" generally means a specific number of employees for each manufacturing industry by Standard Industry Classification (SIC). For service, wholesale, retail, and other non-manufacturing businesses, "small" is limited in SBA regulations by dollar amount of gross sales. In this analysis, the number of employees per plant is used to determine size.

The Society of the Plastics Industries, Inc.,(SPI) uses $5 million of annual plant plastics sales as a dividing point between small and large businesses for the purpose of reporting financial and operating ratios for the plastics industry. Examining the same dividing point here, the PM&F plant with $5 million of annual plastics sales typically has 70 employees engaged in plastic molding and forming. The §308 Survey data show that generally about one-half of the employees in the plants surveyed are engaged in PM&F activities. So, assuming that plastic molding and forming activities account for one-half the manufacturing activities at an average integrated or captive plant, the PM&F activities at the captive plant would be one-half of $10 million in total sales and one-half of a total of 140 employees. The other half of sales would be due to non-PM&F products and the other half of the employees would be engaged in the manufacture of non-PM&F products.

The plants in this analysis have been ranked by total number of employees and by number of employees engaged in plastics molding and forming. These plant rankings are then compared with their corresponding measures of impacts

due to the regulation to determine whether a significant correlation exists between size and the seriousness of the economic impacts.

5.9.2 Baseline Conditions

A comparison of plant size to financial and operating ratios shows that small plants in the PM&F industry generally have a smaller profit to sales ratio than larger plants. According to 8 years of plastics industry statistics provided by SPI, plants with less than 5 million dollars in plastics sales have a median profit after tax equal to 3.5 percent of sales. 1/ Plants with annual plastics products sales greater than $5 million have a median profit after tax equal to 4.1 percent of sales. These are the baseline conditions assumed to hold for the PM&F industry through 1986 for the small business analysis. The impacts of the regulation are defined as only the incremental impacts associated with the treatment costs and are therefore independent of any adverse economic impacts caused by other factors.

5.9.3 Economic Impacts On Small Businesses

Forty-six percent of the 112 direct discharging wet PM&F plants in the §308 Survey that were used in the economic impact analysis have less than 140 employees. The comparison of impact measures with plant size shows that for the impact measures used in Section 5.2, 5.3 and 5.4, such as changes in production prices and liquidity, smaller businesses are more adversely affected than larger businesses. For example, a comparison of plant size with the change in profitability due to compliance costs shows that for all three regulatory options, smaller plants generally have larger profitability decreases than larger ones. Thus, for these kinds of impacts, smaller plants are more heavily impacted due to their generally lower profit to sales levels, as mentioned above in the discussion of baseline conditions.

The closure analysis, presented in Section 5.5, indicates that, for the §308 survey industry sample, one plant and the PM&F operation lines in two plants will close. All of these three affected plants are owned by large companies (company employment is greater than 140) and plant employment in two of the three plants is greater than 140. Based on this analysis of the economic analysis the impact on small PM&F businesses in the four industry groups do not appear to be significant or different than the impact on large PM&F businesses. Therefore, a formal regulatory flexibility analysis of the plastic molding and forming industry is not persued.

1/ The Society of the Plastics Industry, Inc., Financial and Operating Ratios, Survey No. 21, 1982.

Section 6

Limits of the Analysis

6.1 Introduction

The baseline analysis assumes compliance with existing environmental regulations and OSHA requirements. This section discusses possible limitations of the data and the methodology used in the analysis. It also discusses the magnitude of these possible limitations using sensitivity analysis.

6.2 Methodology Limitations

6.2.1 Cost Pass-Through

The economic impact analysis assumes no treatment cost pass-through to consumers in estimating profitability impacts and 100 percent cost pass-through in assessing product price changes. While in reality the pass-through levels in both cases are likely to be less than 100 percent, estimation of the actual amount of pass-through requires the measurement of the elasticity of supply and demand for the industry. By assuming the extreme cases of pass-through, the analysis identifies the worst case impacts. As shown in Section 5, both price increases and profitability reductions are small and affect a very small percentage of the total number of plants in the PM&F industry; therefore, impacts calculated using improved estimates of pass-through would also be insignificant.

6.2.2 Closure Analysis

The closure analysis is based on a comparison between the current liquidation value of equity assets and the present value of the future time stream of cash flow including treatment costs. The comparison assumes a plant owner's decision to close is based upon the factors quantified in this analysis. But in practice, there are many other reasons that a plant or process line may close or change its operations. For example, if a more profitable product or opportunity is developed in the future, operations of a plant projected to close may be shifted to the new market, and that plant would remain open.

6.3 Data Limitations and Evaluation

6.3.1 Profit Rate

The plant-level analysis assumes that the median performance condition observed between 1973 and 1982 in the industry is prevailing by the year 1985-86. The 1985-86 time period is used for purposes of the economic analysis to reflect the fact that pollution equipment can not be installed immediately. Since there are no assurances that any particular plant will perform as specified, some plants will be better off and others will underperform; however, on an aggregate level, the assumption is appropriate for most plants. To evaluate the consequences on the impact analysis of a recurrence of the poor condition observed in 1982, a sensitivity analysis was conducted. The performance in 1982 is 21 percent lower than the baseline performance, as expressed in profits after tax.

6.3.2 Compliance Costs

The economic impact analysis calculates compliance costs in two components: wastewater treatment costs and monitoring costs. Wastewater treatment costs are engineering estimates. Their accuracy is normally within a 20 percent range.

EPA estimates that facilities covered under this regulation will monitor their effluent for all treatment options. Our analysis reflects EPA's Industrial Technology Division's estimates of monitoring requirements. These estimates assume plants with toxic pollutant removals would monitor their wastewater four times a year at a cost of $1,200 per year and plants with conventional pollutant removals would monitor their waste streams only once a week at a cost of $2,600 per year.

Local authorities and permit writers have discretion in specifying monitoring frequencies. It is possible that the plants with toxic pollutant removals would be required to monitor their effluent more often, thus incurring higher costs than were estimated in the study. A sensitivity analysis was conducted to determine the impacts of higher monitoring costs on these plants. This analysis assumed that these plants would have to monitor their waste streams once a month at a cost of $3,600 per year.

6.3.3 Annualization of Capital Costs

The impact analysis has assumed a cost of capital of 10 percent and 10 years to annualize the treatment investment costs. This cost of capital is based on the assumption that the treatment costs are financed 70 percent by equity with an 8 percent return on investment and 30 percent by borrowed capital with a nominal interest rate. If borrowed capital is used to finance the whole, a 13 percent interest rate and 10 years must be used. The consequences of this change is evaluated in the sensivitity analysis.

6.3.4 Salvage Value Estimates

The closure analysis estimates the current liquidation value of plant equity and the plant salvage value at the end of the ten year project life. The estimates are based on observed relationships among financial variables of plastics processing companies. Based on available information, the terminal salvage value is assumed to be equal to the current salvage value. This assumption, as well as the salvage value estimates, involves uncertainties. To evaluate the importance of these uncertainties to the closure analysis, the salvage value is increased by 20 percent in the sensitivity analysis.

6.4 Sensitivity Analysis

The methodology and data limitations described above are evaluated by sensitivity analysis. In the sensitivity analysis, each parameter is varied independently. The results are compared to the estimated impacts for the selected technology option as presented in Section 5 above. From the standpoint of plant closures, the only industry group affected by the sensitivity analysis is the existing plants with contact cooling and heating under Option 3. This group is most sensitive to the change in profitability, which results in 13 plant and 6 PM&F process line closures with an employment loss of 448. This is still only 1.4% of the total direct discharge PM&F industry employment. The changes to the other parameters have only a slight impact on the results.

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