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Economic Impact Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry (Phase 1)

Dr. Lynne G. Tudor, Economist
Economic and Statistical Analysis Branch

Engineering and Analysis Division
Office of Science and Technology

U.S. Environmental Protection Agency
Washington, DC 20460

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Executive Summary

Introduction

This Economic Impact Analysis (EIA) assesses the economic impact of proposed effluent limitations guidelines and standards for the Metal Products and Machinery Industry, Phase I (MP&M industry). The MP&M Phase I regulations apply to 7 industrial sectors that are of substantial importance in the US economy: Hardware, Aircraft, Electronic Equipment, Stationary Industrial Equipment, Ordnance, Aerospace, and Mobile Industrial Equipment. The proposed regulation includes limitations for Best Practicable Control Technology (BPT), Best Conventional Pollutant Control Technology (BCT), Best Available Technology Economically Achievable (BAT), New Source Performance Standards (NSPS) and Pretreatment Standards for Existing and New Sources (PSES and PSNS). The EIA estimates the economic effect of compliance with the proposed regulation in terms of closures among existing MP&M facilities and associated losses in employment. In addition, the EIA analyzes additional impact categories, including: community impacts, international trade effects, firm-level impacts, labor requirements of compliance, and effects on new facilities. The EIA also presents a Regulatory Flexibility Analysis detailing the small business impacts of the proposed regulation.

This Executive Summary summarizes the major elements of the EIA, including a review of: (1) major data sources for the analysis; (2) the MP&M industry and the facilities potentially subject to regulation; (3) regulatory options considered and selection of the proposed options; (4) methodology and findings for the facility impact analysis; (5) findings of the other impact analyses — labor requirements, community level impacts, international trade effects, firm-level impacts, and new source impacts; and (6) the Regulatory Flexibility Analysis (small business impacts).

Data Sources for the Economic Impact Analysis

The most important data for the economic impact analysis are the responses to the technical and economic questionnaire distributed to 1,020 MP&M facilities under the authority of Section 308 of the Clean Water Act (the Data Collection Portfolio or DCP). After detailed data cleaning and validation activities, the responses for 396 facilities, representing an estimated population of 10,601 water-discharging facilities in the MP&M industry, were used in the industry impact analysis. EPA analyzed the economic impacts of the regulatory options on the basis of these sample facilities. The sample facility impacts were extrapolated to the level of the MP&M industry population using facility sample weights that are based on the sample design for the Section 308 survey.

Data obtained from the DCP include: three years (1987-89) of income statements and balance sheets at the facility level; the composition of revenues by customer type and MP&M business sector; estimated value of facility assets and liabilities in liquidation; borrowing costs; ownership of the facility business and total revenues of the owning entity (if separate from the facility); and a characterization of the competition faced in various markets. Secondary sources supplemented these data for characterizing background economic or financial conditions in the MP&M industry. Important secondary sources included the *Census* and *Annual Surveys of Manufactures*, published by the Department of Commerce.

Other vital data for the economic analysis are the estimates of capital and operating costs for complying with regulatory options. EPA developed these estimates from engineering studies of the sample facilities. These studies took into account the characteristics of effluent discharges and existing treatment systems at the facilities and estimated the additional pollution prevention and treatment system needs for complying with the alternative regulatory options. The estimated capital costs and annual operating and maintenance costs for pollution prevention and treatment systems provided the basis for assessing how an effluent guideline would be likely to affect the financial performance and condition of MP&M facilities and whether those facilities might be expected to incur significant economic impacts.

Overview of the MP&M Industry and the Facilities Potentially Subject to Regulation

From secondary source data (Department of Commerce), EPA estimates that approximately 90,000 establishments or facilities participated in the MP&M Phase I business sectors as of 1987. Thus, the estimated 10,601 water-discharging facilities (from Section 308 Survey data) that would potentially be affected by this regulation represent about 11 percent of the total facilities in the MP&M Phase I business sectors. Of the 10,601 water-discharging facilities, EPA estimates that 8,706 facilities are indirect dischargers (i.e., they discharge effluent to a POTW) and would thus be subject to Pretreatment Standards for Existing Sources (PSES). The remaining 1,895 facilities are estimated to be direct dischargers (i.e., they discharge effluent directly to a waterway under a NPDES permit) and will thus be subject to Best Available Technology Economically Achievable (BAT) and Best Practicable Control Technology Currently Available (BPT) requirements.

The MP&M facilities that are expected to be subject to this regulation contribute significantly to the U.S. economy. Table ES-1, below, summarizes important economic data for the estimated 10,601 water-discharging facilities that are potentially subject to regulation. These data show that, in 1989, the

Table ES-1: Summary Data for 1989 for Facilities Subject to Regulation in MP&M Phase I Sectors Estimated Revenue, Value Added and Payroll in Millions of 1989 Dollars					
Sector	**Facilities**	**Employment**	**Revenue**	**Value Added**	**Payroll**
Hardware	4,197	379,000	44,327	9,463	5,845
Aircraft	856	552,000	96,715	24,858	15,148
Electronic Equipment	1,280	700,000	155,101	80,502	12,503
Stationary Industrial Equipment	2,769	419,000	52,918	12,815	6,306
Ordnance	190	131,000	21,666	7,059	4,006
Aerospace	545	580,000	54,430	19,454	9,660
Mobile Industrial Equipment	764	275,000	65,914	14,101	8,151
All Phase I Sectors	10,601	3,036,000	491,071	168,252	61,620
Total U.S. Manufacturing		19,492,000	2,793,000	1,308,000	533,000
Phase I Facilities as a Percent of Total U.S. Manufacturing		15.58%	17.58%	12.86%	11.56%
Source: U.S. Environmental Protection Agency, Section 308 Survey Data, 1989, and *Statistical Abstract of the United States*, 1992, Department of Commerce					

10,601 facilities potentially subject to regulation employed over 3,000,000 persons or approximately 16 percent of the total U.S. manufacturing employment of 19.5 million.[1] Total revenues for the 10,601 facilities are estimated at $491 billion or about 18 percent of the total shipments for U.S. manufacturing of $2,793 billion. Value added, a more meaningful measure of the value of production activity, is estimated to amount to about $168 billion or approximately 13 percent of the total value added of $1,308 billion for U.S. manufacturing. The estimated payroll for the 10,601 facilities is about $62 billion or approximately 12 percent of the total of $533 billion for U.S. manufacturing in 1989.

Table ES-1 also shows economic activity data for the seven MP&M Phase I sectors. In terms of number of facilities, the Hardware, Stationary Industrial Equipment, and Electronic Equipment sectors are the largest sectors subject to regulation. These three sectors account for over 75 percent of the facilities expected to be subject to regulation. However, in terms of employment and dollar measures of activity, the Hardware sector is less dominant. A ranking on both employment and value added shows that Electronic Equipment is the largest sector in terms of economic contribution followed by Aircraft, Aerospace, Stationary Industrial Equipment, Mobile Industrial Equipment, Hardware, and Ordnance.

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[1] Although the MP&M Phase I sectors include non-manufacturing activities and employment, nearly 95 percent of the revenue received by facilities affected by the regulation is estimated to be derived from manufacturing activities. Thus, the comparison of employment and other economic values with totals for the U.S. manufacturing sector provides a relevant basis for understanding the economic significance of the industries and facilities expected to incur costs under the regulation.

Overview of Options Considered for Proposal and Selection of the Proposed Options

In developing the regulatory proposals, EPA defined and evaluated a number of PSES regulatory options for indirect dischargers and BAT/BPT options for direct dischargers. The following discussion defines the options that were considered for proposal and outlines the rationale for the regulatory proposals.

PSES Options for Indirect Dischargers

EPA initially evaluated three PSES regulatory options for indirect dischargers:

Option 1: Under this option, PSES would be established on the basis of the application of ***lime and settle treatment*** without any pollution prevention and flow controls imposed. In implementing Option 1, Control Authorities would likely impose concentration-based standards on facilities.

Option 2: Option 2 adds ***in-process flow reduction to lime and settle treatment.*** This option would establish PSES such that all facilities should comply with mass-based standards based on the proposed concentration standards and an appropriate flow that should reflect good pollution prevention and water conservation practices. Thus, Option 2 embodies a requirement for pollution prevention and water conservation in conjunction with lime and settle treatment. The flow basis would be determined by the relevant Control Authority, using site specific factors and flow guidance.

Option 3: Option 3 includes all of the ***Option 2 technologies plus advanced end-of-pipe treatment.*** Reverse osmosis or ion exchange would remove additional suspended and dissolved solids and yield a treated wastewater that can be recycled as process water.

EPA initially selected Option 2, *In-Process Flow Reduction and Pollution Prevention and Lime and Settle Treatment*, as the preferred PSES regulatory option. Option 2 imposed relatively small economic impacts and achieved considerably greater pollutant removals than Option 1, while costing less than Option 3. However, additional analyses of Option 2 identified three issues that weighed against its proposal as the basis for PSES effluent guidelines:

Impact on small business. In the Regulatory Flexibility Analysis, EPA found that Option 2 would disproportionately burden small business-owned facilities in terms of facility closures and financial requirements. This higher burden arose from Option 2's technology requirements for pollution prevention as well as treatment systems.

Cost effectiveness. For indirect discharging facilities with smaller discharge volumes, EPA found that Option 2 would not be cost effective. That is, for facilities with smaller discharge volumes, Option 2 would not achieve sufficient additional reductions in pollutant discharges beyond those achieved by Option 1 to support its higher cost relative to Option 1.

Impact on permitting authorities. By requiring mass-based permits for all indirect discharging facilities, Option 2 could substantially burden permitting authorities. In particular, as part of the public participation in the regulation development process, the Association of Metropolitan

Sewerage Agencies commented that covering small discharge facilities under mass-based limitations would unduly burden permitting authorities.

On the basis of these findings, EPA defined and evaluated two additional PSES regulatory options for indirect discharging facilities: Option 1a and Option 2a.

Option 1a: This option would establish a ***tiered PSES requirement depending on the annual discharge volume*** at a given MP&M facility. For "low" flow facilities, defined as discharging less than 1 million gallons per year (gpy), PSES would require that they comply with the **concentration standards** proposed. For "large" flow facilities, with discharge volumes of 1 million gpy or greater, PSES would require that **mass-based standards** be imposed, based on the proposed concentration standards and an appropriate flow volume that should reflect good pollution prevention and water conservation practices.

Option 2a: To further reduce the regulatory burden associated with smaller facilities, EPA developed an option based on ***in-process reduction and pollution prevention and lime and settle treatment for large flow sites.*** This option would establish the same PSES requirements as specified in Option 2, but would apply to only the large flow facilities with discharge volumes of at least 1 million gpy. Facilities with discharge volumes of less than 1 million gpy would not be subject to PSES requirements, thus exempting over 75 percent of the estimated 8,706 indirect dischargers from PSES requirements.

EPA found that both options addressed the issues described above and presented superior alternatives to Options 1, 2, or 3, alone, for regulatory proposal. However, EPA found that Option 2a provided a better solution than Option 1a for each of the issues concerning Option 2. Accordingly, EPA is proposing Option 2a as the preferred PSES option for indirect discharging facilities.

BAT/BPT Options for Direct Dischargers

EPA evaluated three BAT/BPT regulatory options for direct discharging facilities:

Option 1: Under this option, BAT/BPT would be established on the basis of the application of ***lime and settle treatment*** without any pollution prevention and flow controls imposed.

Option 2: Option 2 but adds ***in-process pollution prevention and flow to the lime and settle treatment***, which is the technology basis of Option 1.

Option 3: Option 3 includes the same treatment technology and in-process pollution prevention and flow controls as set forth in Option 2 *plus* ***advanced end-of-pipe treatment*** through reverse osmosis or ion exchange to achieve additional removals and produce a treated wastewater that can be recycled back to the facility for reuse as process waters.

Of these options, EPA selected Option 2 as the proposed BPT/BAT regulation for direct existing discharging facilities. Option 2 embodies best available technology for reducing effluent discharges and is expected to impose modest economic impacts in terms of facility closures, employment losses, and financial

requirements. EPA also found that Option 2 is cost effective. Finally, EPA concluded that Option 2 (in combination with Option 2a for indirect dischargers) would impose a modest and manageable burden among small business-owned, direct discharging facilities.

Analysis of Regulatory Impacts on Existing MP&M Facilities

The analyses supporting the determination of economic achievability for the proposed regulation include a facility impact analysis, which assesses how facilities are expected to be affected financially by the proposed regulation. Key outputs of the facility impact analysis include expected facility closures, and associated losses in employment and economic output in those facilities. The findings from the facility impact analysis provide the basis for the other analyses concerning economic achievability.

The evaluation of facility-level impacts includes three separate analyses:

1. Baseline Closure Analysis, which identifies facilities that are in jeopardy of financial failure *regardless of the promulgation of effluent guidelines*. Facilities failing this analysis are excluded from the post-compliance analyses.

2. Post-Compliance Closure Analysis, which identifies facilities that are likely to close instead of implementing the pollution prevention and treatment systems needed for regulatory compliance. The post-compliance closure analysis differs from the baseline analysis by accounting for the capital and operating costs of these systems. Facilities failing this analysis are projected to close as the result of regulation, a severe economic impact

3. Analysis of Financial Stress Short of Closure, which identifies facilities with limited ability to finance the pollution prevention and treatment systems needed for effluent guidelines compliance. Facilities failing this analysis are likely to experience financial weakness as the result of regulation, a moderate economic impact

The Baseline and Post-Compliance Closure Analyses involve a two-part test. The first part compares a facility's going concern value to its liquidation value. The second part assesses whether after-tax cash flow is negative. Facilities with negative cash flow and a liquidation value that exceeds going concern value are designated as estimated facility closures. The Analysis of Financial Stress Short of Closure compares measures of facility profitability and debt burden to industry standards to estimate the number of facilities that are likely to experience moderate impacts short of closure. These analyses were performed separately for direct and indirect dischargers and also under two different cases regarding the ability of facilities to pass compliance costs on to customers. The findings from the analysis of sample facilities were extrapolated to the MP&M population level using facility sample weights. The findings from the facility impact analysis are summarized below.

Baseline Closure Analysis

Of the estimated 10,601 discharging facilities, 13.9 percent or 1,471 facilities were assessed as baseline closures. The 1,471 baseline closures include 1,413 indirect dischargers, or 16.2 percent of indirect dischargers, and 58 direct dischargers, or 3.1 percent of direct dischargers.

Post-Compliance Impact Analysis

The findings from the post-compliance analyses are summarized below: for the PSES options considered for indirect discharging facilities; for the BAT/BPT options considered for direct discharging facilities; and in aggregate for the proposed PSES and BAT/BPT options for both discharger classes. The following discussion is based on the conservative zero-cost-pass-through analysis, in which facilities were assumed to recover none of their compliance costs by increasing prices to consumers. The EIA also contains a more realistic partial-cost-pass-through analysis, which generally yields fewer impacts than the zero-cost-pass-through analysis. However, EPA found the facility impacts of the proposed options to be very modest under the zero-cost-pass-through case and based its selection of the proposed options on the findings from this case.

Indirect Dischargers

For indirect discharging facilities, EPA analyzed the impacts of five possible PSES regulatory options — the initially defined Options 1, 2, and 3, and the subsequently defined Options 1a and 2a — as discussed above. As shown in Table ES-2, the estimated total annual after-tax costs of compliance ranged from a low of $142 million under the proposed Option 2a to a high of $616 million under Option 3 (all compliance cost and impact values are in 1994 dollars). Estimated facility closures follow a similar pattern, ranging from a low of 7 facilities under Option 2a to a high of 227 under Option 3. The accompanying employment losses range from 540 full-time equivalent jobs (FTEs) under Option 2a to 18,215 FTEs for Option 3. As described above, from this analysis, EPA found that both Options 1 and 2 were economically achievable. However, other considerations led EPA to consider Options 1a and 2a. As summarized in Table ES-2, the impacts of the proposed Option 2a in terms of facility closures, employment losses, and total compliance cost are small in relation to the other options, including Option 1a.

Direct Dischargers

For direct discharging facilities, EPA analyzed the impacts of three possible BAT/BPT regulatory options: Options 1, 2, and 3. As shown in Table ES-3, the estimated total annual after-tax costs of compliance ranged from a low $16 million for Option 1 to $64 million for Option 3. Under both Options 1 and 2, EPA estimated 18 facility closures with accompanying employment losses of 158 FTEs. Under

Table ES-2: Estimated Impacts of Regulatory Compliance, Indirect Dischargers (Zero-Cost-Pass-Through Case, all dollar values in $000, 1994)					
	Options Initially Considered for Proposal			Subsequent Options	
	Option 1	Option 2	Option 3	Option 1a	Option 2a
Facilities in Analysis	7,293	7,293	7,293	7,293	1,792
Severe Impacts (closing facilities)					
Number of Facilities	161	151	227	151	7
Percent of Class	2.20%	2.07%	3.11%	2.07%	0.40%
Employment (FTEs)	3,001	2,354	18,215	2,354	540
Value of Shipments	$369,997	$235,852	$2,350,346	$235,852	$133,678
Moderate Impacts (financial stress short of closure)					
Number of Facilities	42	124	184	54	12
Financial Impacts on Complying Facilities					
Capital Cost	$275,798	$436,293	$1,174,721	$437,209	$350,853
Total Annual Compliance Cost					
Tax-adjusted*	$202,115	$213,530	$615,530	$208,639	$142,467
No adjustments†	$271,020	$267,544	$783,691	$259,994	$171,134

* "Tax-adjusted" compliance costs are an estimate of the annual cash compliance cost to industry and reflect private costs of capital and expected tax treatment of capital outlays and annual expenses.
† Compliance costs with "No adjustments" are an estimate of the total annual cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate.
Source: U.S. Environmental Protection Agency

Option 3 closures, EPA estimated 90 facilities would close with employment losses of 7,339 FTEs. From this analysis, EPA found that both Options 1 and 2 would be economically achievable and selected Option 2 for proposal because, by including in-process pollution prevention, it embodies treatment technology and performance that is superior to Option 1.

Aggregate Impacts of the Combined Regulatory Proposal for Existing Facilities: Option 2a for Indirect Discharging Facilities and Option 2 for Direct Discharging Facilities

Aggregate impacts for both indirect and direct discharging facilities are summarized in Table ES-4 for the proposed regulatory options applicable to existing facilities: Option 2a for indirect dischargers (PSES) and Option 2 for direct dischargers (BAT/BPT).[2] Overall, 3,629 facilities passed the Baseline Closure analysis (1,837 direct discharging facilities and 1,792 "large flow" indirect discharging facilities) and thus are expected to be subject to regulation. Of this population, 25 facilities or 0.7 percent are expected to close as a result of regulation. The total employment loss amounts to 698 FTEs (0.03 percent of the total employment in facilities passing the baseline analysis and thus potentially subject to regulation) and the associated value of lost shipments amounts to $140 million (0.03 percent of the total shipments in

[2] The impact analysis results for Option 2a/2 are the same throughout for both the zero-cost-pass-through and partial-cost-pass-through cases.

Table ES-3: Estimated Impacts of Regulatory Compliance, Direct Dischargers (Zero-Cost-Pass-Through Case, dollar values in $000, 1994)	Option 1	Option 2	Option 3
Facilities in Analysis	1,837	1,837	1,837
Severe Impacts (closing facilities)			
Number of Facilities	18	18	90
Percent of Class	0.96%	0.96%	4.92%
Employment (FTEs)	158	158	7,339
Value of Shipments	$6,161	$6,161	$883,577
Moderate Impacts (financial stress short of closure)			
Number of Facilities	6	0	0
Financial Impacts on Complying Facilities			
Capital Cost	$47,363	$63,269	$127,369
Total Annual Compliance Cost			
Tax-adjusted	$16,297	$18,136	$63,979
No adjustments	$18,181	$19,137	$80,523
Source: U.S. Environmental Protection Agency			

facilities passing the baseline analysis and thus potentially subject to regulation). In addition to the estimated closures, a modest 12 facilities are expected to encounter financial stress short of closure. Summed over both indirect and direct discharging facilities, the total capital costs of compliance amount to $414 million. Total annualized costs of compliance are estimated at $161 million, when calculated on an after-tax basis using private costs of capital.

Other Impact Measures

EPA also analyzed the additional impact measures — labor requirements, community impacts, foreign trade impacts, firm-level impacts, and new source impacts — for the proposed regulation: Option 2a for indirect dischargers and Option 2 for direct dischargers (Option 2a/2).

Labor Requirements of Compliance

The manufacturing, installation, and operation of equipment and processes for complying with the MP&M regulation will require labor resources. To the extent that these labor requirements translate into employment increases in complying firms, the regulation may generate employment benefits that offset employment losses in closing facilities. Accordingly, EPA estimated the labor requirements of compliance taking into account both primary labor needs for manufacturing, installing and operating compliance equipment and secondary requirements in other affected industries. From this analysis, EPA estimated an annual direct labor requirement of 1,594 FTEs with corresponding payments to labor of $90 million ($1994). Thus, the additional labor requirements for complying with the proposed regulation may exceed the estimated 698 job losses in closing facilities. Taking into account both primary and secondary

Table ES-4: Estimated Aggregate Impacts of Regulatory Compliance Proposed Regulatory Options 2a and 2 for Indirect and Direct Dischargers (dollar values in $000, 1994)	Option 2a (Indirect Dischargers)	Option 2 (Direct Dischargers)	Sum for Both Classes of Facilities
Facilities in Analysis	1,792	1,837	3,629
Severe Impacts (closing facilities)			
Number of Facilities	7	18	25
Percent of Class	0.39%	0.96%	0.69%
Employment (FTEs)	540	158	698
Value of Shipments	$133,678	$6,161	$139,839
Moderate Impacts (financial stress short of closure)			
Number of Facilities	12	0	12
Financial Impacts in Complying Facilities			
Capital Cost	$350,853	$63,269	$414,122
Total Annual Compliance Cost			
Tax-adjusted	$142,467	$18,136	$160,602
No adjustments	$171,134	$19,137	$190,270
Source: U.S. Environmental Protection Agency			

employment effects, EPA estimated that the total labor requirements of the proposed Option 2a/2 would range from 3,900 to 6,400 FTEs.

Community Impacts

The employment losses from facility closures affect not only the people that were employed by the facility, but may also cause broader employment impacts in the communities in which the closing facilities are located. EPA assessed community impacts by comparing community- and state-wide employment losses to the total employment in the communities and states in which estimated facility closures are located. The estimated employment losses include both primary employment effects among MP&M facilities and, by applying Department of Commerce multipliers, secondary employment effects in linked industries and in consumer-oriented retail and service industries. From this analysis, EPA found that no affected communities or states would be expected to incur employment losses exceeding one percent of total employment, the threshold of significant impact. Indeed, when possible labor requirements of compliance were taken into account, all states but California, which has an estimated net employment loss of 69 FTEs, showed net gains in employment as a result of the proposed regulation.

Foreign Trade Impacts

EPA assessed foreign trade impacts in terms of the change in net exports (i.e., exports minus imports) by allocating revenues lost by closing facilities between domestic and foreign producers according to a range of possible outcomes. The worst-case outcome allocated all the former exports of closing

facilities to foreign producers, and all the former domestic sales of these closing facilities to imports from abroad. The best-case outcome assumed that domestic facilities would retain all the domestic and export revenues lost by closing facilities. An intermediate case allocated the closing facilities' lost revenues between domestic and foreign facilities in proportion to measures of the historical competitiveness of domestic facilities in international markets. EPA assigned facilities to one of these cases based on Department of Commerce trade data for the MP&M industry and Survey data characterizing competition in export and domestic markets. From this analysis, EPA estimates that exports will not be measurably affected by compliance with the proposed regulation, while imports are estimated to increase by approximately $5.3 million, or 0.01 percent of the 1991 imports of the MP&M Phase I industry commodities. The net effect on the trade balance is therefore a decline of $5.3 million, or approximately 0.01 percent of the current trade balance in MP&M Phase I industry commodities.

Impacts on Firms Owning MP&M Facilities

Because the impacts at the level of the firm may exceed those assessed at the level of the facility, particularly when a firm owns more than one facility that will be subject to regulation, EPA also conducted a firm-level impact analysis for the MP&M regulation. EPA estimated financial impacts on firms based on sampled facility impacts and on a range of the total possible share of firm revenues earned by activities subject to the effluent guideline. Because the sample of facilities was not designed to be a random sample of firms, EPA performed this analysis for sampled firms only and did not make national estimates of firm-level impacts. Of those firms passing the baseline firm financial analysis, EPA found that only one firm failed the post-compliance analysis under Option 2a/2. The single adversely affected firm is a single facility firm and accounts for less than 0.0001 *percent* of revenues earned by all 255 sampled firms in the firm-level impact analysis. From this analysis, EPA finds that firm-level impacts are not likely to be significant.

Impacts on New Sources

Because the proposed regulation includes limitations that will apply to new direct and indirect discharging sources within the MP&M Phase I category, EPA also examined the impact of these new source regulations to determine if they would impose an undue economic and financial burden on new sources seeking to enter the MP&M Phase I industry.

EPA proposes to set *New Source Performance Standards* (NSPS), which apply to new facilities that discharge directly to receiving waters, on the basis of the Best Achievable Technology (BAT) limitations as specified by the proposed Option 2 for existing direct dischargers. Thus, the new source limitations for direct dischargers are the same as those proposed for existing direct discharge facilities.

Because new sources can include compliance equipment and related processes in plant designs before construction and generally at lower cost than for retrofit applications, EPA believes that new sources will be able to comply at costs that are similar to or less than those for existing sources. Accordingly, EPA concludes that the Option 2 requirement for new source direct dischargers will be economically achievable.

In addition, EPA proposes to set *Pretreatment Standards for New Sources* (PSNS), which apply to new indirect discharging facilities (i.e., that will discharge to POTWs), on the basis of the discharge limitations in PSES Option 2, as analyzed for existing indirect discharging facilities. However, for *new* indirect dischargers, the proposed PSNS limitations will apply the mass-based limitations of Option 2 *regardless of the new facility's discharge volume*. Thus, the new source limitations for indirect discharging facilities will differ from the PSES limitations proposed for existing indirect discharge facilities by not exempting low flow dischargers (i.e., with flow of less than 1,000,000 gallons per year) from regulation. However, in its analysis of regulatory impacts on existing facilities, EPA found that the mass-based limitations of PSES Option 2 would be economically achievable by indirect discharging facilities regardless of discharge volume. For this reason, EPA concludes that the new source limitations applicable to new indirect discharging facilities will also be economically achievable by *new* low flow indirect discharging facilities.

Regulatory Flexibility Analysis

In accordance with the requirements of the Regulatory Flexibility Act (Public Law 96-354), EPA performed a Regulatory Flexibility Analysis of the proposed regulation. The purpose of the Regulatory Flexibility Act is to ensure that, while achieving statutory goals, government regulations do not impose disproportionate impacts on small entities.

In developing the proposed regulation, EPA balanced several factors, including: the need for additional reduction in effluent discharges from the MP&M industry; the fact that the MP&M industry is largely comprised of small business entities; and the need to achieve additional reduction in effluent discharges without imposing unreasonable burdens on small entities. As a result of these considerations, EPA expressly framed the proposed regulation to reduce impacts on small entities. Specifically, EPA settled on the proposed regulation for indirect dischargers, Option 2a, after considering and rejecting the initial Option 2. On the basis of the facility impact analyses, EPA determined that Option 2 would be economically achievable by indirect discharging facilities. In accordance with this finding, EPA initially considered adopting the mass-based requirements of Option 2 for all indirect discharging facilities. However, further analysis indicated that Option 2 would place substantial financial burdens on smaller

facilities and, moreover, could burden permitting authorities by requiring that mass-based standards be written for all indirect discharging facilities, regardless of size and amount of discharge reduction to be achieved. For these reasons, EPA defined and evaluated two additional options: Option 1a, which applies the Option 2 requirements to large flow facilities and the modestly less stringent Option 1 requirements to low flow facilities; and Option 2a, which applies the requirements of Option 2 to large flow facilities while exempting low flow indirect discharging facilities from regulation. EPA found that both of these additional options would mitigate the burden of regulation on small businesses and permitting authorities. However, EPA found that the latter option, Option 2a, much more substantially reduced the closure impacts and financial burdens among MP&M facilities owned by small business and, as well, the regulatory implementation burden on permitting authorities. After considering other factors that also favored Option 2a — namely, cost effectiveness — EPA decided to propose Option 2a as the PSES option for indirect discharging facilities.

In performing the Regulatory Flexibility Analysis, EPA found that the MP&M Phase I industry is largely comprised of small business entities and, accordingly, the regulation is expected to apply to a substantial number of small entities. On the basis of Small Business Administration (SBA) firm-employment size criteria, EPA estimated that over 75 percent of the estimated 10,601 water discharging facilities in the MP&M Phase I industries are owned by a small business. With over 75 percent of the facilities to which the regulation is expected to apply defined as small businesses, EPA also examined the employment size distribution of the MP&M *facilities* to gain provide additional insight into how *smaller facilities* are likely to be affected by the proposed regulation. From the analysis of the facility employment distribution, EPA estimated that 25 percent of water-discharging facilities have 9 or fewer employees and that 50 percent of water-discharging facilities have 79 or fewer employees. For its analysis, EPA used both the estimated business-size classification of the firms owning MP&M facilities and the facility employment-size classifications to gauge the extent of impacts among small entities.

To gauge whether the proposed regulation would have a significant impact on a substantial number of small entities, EPA considered the level of closure impacts and compliance costs expected to be imposed on small entities.

Closure Impacts

While finding that closure impacts are concentrated among small entities, EPA also found that the expected level of closures under the proposed Option 2a/2 is extremely low for the small entity categorizations analyzed: 0.4 percent of small business-owned facilities; 0.9 percent of facilities with 9 or

fewer employees; and 0.2 percent of facilities with 10 to 79 employees. In addition, closures among the small entity categorizations were substantially higher for all the other options analyzed. Overall, EPA finds that the rate of expected facility closures among small business entities is well within acceptable bounds.

Compliance Cost Impacts

EPA assessed compliance cost impacts in terms of (1) the total annual compliance costs expected to be imposed on facilities according to business size and (2) total annual compliance cost as a percentage of facility revenue as a measure of the relative burden of compliance costs. Both of these analyses showed that the financial burdens on small business entities will be very modest under the proposed Option 2a/2. Specifically, the aggregate compliance cost burden on small business entities ranged from 40 percent to 90 percent less (based on small entity definition) under Option 2a/2 than under the combined Option 2 for indirect dischargers and direct dischargers. In terms of cost as a percentage of revenue, EPA estimated that total annual compliance costs among small business-owned would average only 0.11 percent of revenue for the proposed Option 2a/2. Moreover, EPA found that a very small percentage of small business-owned facilities, only 0.26 percent, are expected to incur total annual compliance costs exceeding 5 percent of revenue under Option 2a/2.[3]

Small Business Impact Finding

In view of this analysis and in recognition of the Agency's efforts, as summarized above, to define the proposed option in a way that would reduce impacts to small entities, EPA concluded that the facility closure impacts and compliance cost burdens of the proposed option will not constitute an undue impact on small business entities. Pursuant to Section 605(b) of the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Administrator certified that the proposed regulation will not have a significant economic impact on a substantial number of small entities.

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[3] In previous regulations, EPA has judged annual compliance costs that are less than five percent of facility revenue as not likely to impose a significant financial burden on the complying entity

Chapter 1

Introduction and Overview

1.1 Overview and Definitions

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 these amendments, the U.S. Environmental Protection Agency (EPA) issues effluent limitations guidelines and standards for categories of industrial dischargers. The regulations that the EPA establishes are:

- *Best Practicable Control Technology Currently Available* (BPT). These rules apply to existing industrial direct dischargers, and generally cover discharge of conventional pollutants.[1]
- *Best Available Technology Economically Achievable* (BAT). These rules apply to existing industrial direct dischargers and the control of priority and non-conventional pollutant discharges.
- *Best Conventional Pollutant Control Technology* (BCT). BCT rules are an additional level of control beyond BPT for conventional pollutants.
- *Pretreatment Standards for Existing Sources* (PSES). These rules apply to existing indirect dischargers (i.e., facilities whose discharges enter Publicly Owned Treatment Works, or POTWs). They generally cover discharge of toxic and non-conventional pollutants that pass through the POTW or interfere with its operation. They are analogous to the BAT controls.
- *New Source Performance Standards* (NSPS). These rules apply to new industrial direct dischargers and cover all pollutant categories.
- *Pretreatment Standards for New Sources* (PSNS). These rules apply to new indirect dischargers and generally cover discharge of toxic and non-conventional pollutants that pass through the POTW or interfere with its operation.

This Economic Impact Analysis (EIA) assesses the economic impact of the proposed effluent limitation guidelines and standards for the Metal Products and Machinery (MP&M) Phase I Category (40 CFR 438). This rulemaking proposes limitations for Best Practicable Control Technology (BPT), Best Conventional Pollutant Control Technology (BCT), Best Available Technology Economically Achievable (BAT), New Source Performance Standards (NSPS) and Pretreatment Standards for Existing and New Sources (PSES and PSNS).

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[1] Conventional pollutants are defined as biochemical oxygen demand (BOD), total suspected solids (TSS), fecal coliform, oil and grease, and pH. Other pollutants may also be regulated at the BPT level.

The proposed MP&M regulation incorporates pollution prevention and applies to discharges from plants or portions of plants within MP&M Phase I industries that manufacture, maintain or rebuild finished metal parts, products or machines from any base metal. Of an estimated 10,601 water discharging facilities in the MP&M Phase I industries, EPA estimates that a total of 3,629 facilities will be subject to the proposed regulatory options. These facilities include 1,792 indirect discharging facilities (i.e., which discharge effluent to a publicly owned treatment works, or POTW) that will be subject to Pretreatment Standards for Existing Sources (PSES), and 1,837 direct discharging facilities (i.e., which discharge effluent directly to a waterway under a NODES permit) that will be subject to Best Available Technology Economically Achievable (BAT) and Best Practicable Control Technology Currently Available (BPT) requirements. The proposed PSES regulation for indirect dischargers is expected to exempt from regulation 5,501 facilities with smaller effluent discharge volumes.[2]

1.2 Summary of the Proposed Regulation

The proposed regulations include BPT, BAT and BCT, PSES, NSPS and PSNS regulations. These are discussed below.

Best Practicable Control Technology (BPT)

EPA proposes to establish concentration-based BPT limitations that reflect the best practicable technology performance. The technology basis for BPT is end-of-pipe treatment using chemical precipitation and sedimentation, commonly referred to as lime and settle technology. This treatment technology is widely used for metal-bearing wastewaters. EPA also includes, as a basis of its BPT limits, treatment for oily wastes, consisting of emulsion breaking and oil skimming, treatment to reduce hexavalent chromium to less soluble trivalent form, and cyanide destruction. These preliminary treatment technologies are expected to be applied when necessary. EPA also expects that BPT technology will reflect the pollution prevention controls to conserve water usage and thus reduce the pollutant load on the discharge. Therefore, EPA proposes that BPT-based NPDES permits be written to control the mass of pollutant discharged.

Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT)

EPA proposes to establish BAT and BCT limitations equivalent to BPT limitations.

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[2] EPA estimates that 1,471 of the 10,601 MP&M Phase I water discharging facilities are in significant jeopardy of financial failure independent of the regulation. These facilities were excluded from the tally of facilities that are expected to be subject to the proposed regulation or that are expected to be exempt from the proposed regulation.

Pretreatment Standards for Existing Sources (PSES)

EPA proposes to establish PSES equivalent to BAT limitations. However, PSES are proposed to be incorporated into industrial user permits as mass-based standards for "large volume" facilities (facilities that discharge 1,000,000 gallons or more annually). Facilities with an annual discharge volume less than 1,000,000 gallons are not subject to the proposed PSES regulation.

New Source Performance Standards (NSPS)

EPA proposes to establish NSPS limitations equivalent to BAT limitations.

Pretreatment Standards for New Sources (PSNS)

EPA proposes to establish PSNS limitations equivalent to BAT limitations. The PSNS limitations apply to all new indirect discharging sources regardless of discharge volume.

1.3 Selection of the Proposed Regulatory Options

EPA originally developed three regulatory options, but then, on the basis of further analysis, developed two more options to apply specifically to existing indirect dischargers, described in the Pretreatment Standards for Existing Sources section below.

Best Practicable Control Technology Options and Selection

EPA considered three regulatory options on which to base BPT limitations:

Option 1: Option 1 consists of end-of-pipe treatment with chemical precipitation followed by clarification. The metals industry has widely and effectively used this treatment, commonly called **lime and settle treatment.** Option 1, as well as the other regulatory options, requires lime and settle end-of-pipe treatment for all process wastewaters, since all waters are assumed to have metal pollutants in treatable concentrations. All of the options include some preliminary treatment when needed to remove certain specific pollutants. EPA has also included the contract hauling of any wastewaters associated with organic chemical degreasing.

Option 2: Option 2 includes the end-of-pipe **lime and settle treatment** indicated in Option 1. Option 2 then adds **in-process pollution prevention controls** that allow for recovery, reuse of materials and water conservation. Recovery techniques or technologies, such

as centrifugation or skimming for metal working fluids, or ion exchange for surface treatment baths, can save money for companies, since they allow materials to be used for a longer time before being discarded, or, in some instances, recover metal or metal treatment solutions. Using these techniques along with water conservation generates less pollution and results in more effective treatment of the wastewater that is generated. Many of these techniques are already widely used in the MP&M industry, and some have been incorporated into current regulations in the industry.

Option 3: Option 3 includes all of the **Option 2 technologies plus advanced end-of-pipe treatment.** Advanced end-of-pipe treatment would remove significant amounts of suspended and dissolved solids and yield a treated wastewater that can be recycled as process water.

EPA proposes to establish concentration-based limitations based on Option 2 technology. Lime and settle treatment is the best technology widely practiced by MP&M facilities, and flow reduction technologies have been an integral part of the technology basis in many effluent guidelines issued in the 1980's. EPA proposes to require permit writers to convert the concentration-based limitations into mass-based limitations based on MP&M flow guidance from the technical Development Document.

EPA did not select Option 1 because it excludes pollution prevention and therefore does not reflect the best technology performance. EPA did not select Option 3 because of its high costs.

Best Conventional Pollutant Control Technology Option Selection

EPA considered whether or not to establish BCT effluent guidelines for MP&M Phase I facilities that would attain larger reductions in total suspended solids (TSS) than the proposed BPT option (Option 2). The primary technology identified to attain this further reduction in conventional pollutant discharges was the addition of multi-media filtration to existing BPT systems.

EPA evaluated the costs of installing a polishing multi-media filter to remove an estimated additional 45 percent of the TSS discharged after lime and settle treatment. This estimated additional removal reflects the reduced TSS concentrations seen when MP&M facilities used filters. Depending on effluent flow volume, the

cost per pound of TSS removed ranged from $28 to $813 per pound.[3] Since these costs exceeded EPA's POTW cost test threshold of $0.25 per pound, EPA determined that multi-media filtration did not pass the cost test for BCT regulations development. Therefore, EPA proposes to set BCT limitations equal to BPT Option 2 limitations.

Best Available Technology Economically Achievable Options and Selection

The BAT technology level represents the best existing and economically achievable performance. To determine this technology, EPA considers factors such as the age of process equipment and facilities, the processes employed, process changes, the engineering aspects of applying various types of control techniques, the costs of applying the control techniques, economic impacts associated with the regulation, non-water quality environmental impacts such as energy requirements, air pollution and solid waste generation, and other factors that the Administrator deems appropriate.

The proposed BAT effluent guidelines apply to five priority pollutant metals, cyanide and two nonconventional pollutant metals. EPA considered the same three options as the BPT options. EPA rejected Option 1 because it did not include the pollution prevention and water conservation technologies that are widely demonstrated at MP&M sites and have been included in the BAT technology for numerous previous effluent guidelines in the metals industries. EPA rejected Option 3 because of the high cost.

Therefore, EPA proposes BAT limitations on the basis of Option 2. As with BPT, permit writers will implement the concentration-based limits as mass-based limits based on flow guidance and an analysis of water conservation and pollution prevention practices in use at the MP&M facility.

Pretreatment Standards for Existing Sources Options and Selection

In developing PSES for the MP&M Phase I indirect dischargers, the Agency originally considered three options that were based on the same same treatment system and pollution technologies as the BPT/BAT options considered for direct dischargers.

As with BPT/BAT, EPA initially selected Option 2, In-Process Flow Reduction and Pollution Prevention and Lime and Settle Treatment, as the preferred PSES regulatory option Option 2 imposed relatively small economic impacts and achieved considerably greater pollutant removals than Option 1, while costing less than

[3] Estimated in 1976 constant dollars for representative facilities with flow volumes of greater than 1,000,000 gallons per year and less than 10,000 gallons per year, respectively.

Option 3. However, additional analyses of Option 2 identified three issues that weighed against proposing Option 2 as the basis for PSES effluent guidelines:

Impact on small business. In the Regulatory Flexibility Analysis, EPA found that Option 2 would disproportionately burden small business-owned facilities in terms of facility closures and financial requirements.[4] This higher burden arose from Option 2's technology requirements for pollution prevention as well as treatment systems.

Cost effectiveness. For indirect discharging facilities with smaller discharge volumes, EPA found that Option 2 would not be cost effective.[5] That is, for facilities with smaller discharge volumes, Option 2 would not achieve sufficient additional reductions in pollutant discharges beyond those achieved by Option 1 to support its higher cost relative to Option 1.

Impact on permitting authorities. By requiring mass-based permits for all indirect discharging facilities, Option 2 could substantially burden the authorities that administer the permit requirements. In particular, as part of the public participation in the regulation development process, the Association of Metropolitan Sewerage Agencies (AMSA) commented that the permit administration requirements of covering small discharge facilities under mass-based limitations would unduly burden permitting authorities. EPA estimated that over 75 percent of the estimated 6,700 indirect discharging facilities discharge less than 1 million gallons of effluent annually. Thus, EPA acknowledged that Option 2 would require a large number of permits to be written for these smaller discharge volume facilities and could therefore impose a substantial burden on permitting authorities.[6]

To address these issues, EPA developed two additional PSES regulatory options for indirect discharging facilities: Option 1a and Option 2a.

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[4] Chapter 10 presents the definitions and methodologies associated with the regulatory flexibility analysis.

[5] See *Cost-Effectiveness Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry (Phase I).*

[6] See Chapter 6 and Appendix E of *Regulatory Impact Assessment of Proposed Effluent Limitations Guidelines and standards for the Metal Products and Machinery Industry (Phase I)* for a detailed discussion of the administrative burden of the proposed regulation on permit writing and enforcement authorities.

Option 1a: This option would establish a **tiered PSES requirement depending on the annual discharge volume** at a given MP&M facility. For "low" flow facilities, defined as discharging less than 1 million gallons per year (gpy), PSES would require that they comply with the **concentration standards** proposed. For "large" flow facilities, with discharge volumes of 1,000,000 gpy or greater, PSES would require that **mass-based standards** be imposed, based on the proposed concentration standards and an appropriate flow volume that should reflect good pollution prevention and water conservation practices.

Option 2a: To further reduce the regulatory burden associated with smaller facilities, EPA developed an option based on **in-process reduction and pollution prevention and lime and settle treatment for large flow sites.** This option would establish the same PSES requirements as specified in Option 2, but would apply to only large flow facilities with discharge volumes of at least 1 million gpy. Facilities with discharge volumes of less than 1 million gpy would not be subject to PSES requirements, thus exempting over 75 percent of the estimated 8,706 indirect dischargers from PSES requirements.

EPA found that both options addressed the issues described above and presented superior alternatives to Options 1, 2, or 3, alone, for regulatory proposal. However, EPA found that Option 2a provided a better solution than Option 1a for each of the issues concerning Option 2. Because Option 2a would cover fewer facilities, Option 2a would further reduce the burden on permit-writing authorities. In addition, low flow facilities would bear no costs as a result of regulation, substantially reducing financial burdens and closure impacts among small business-owned facilities. Finally, EPA found that Option 2a would achieve substantially better cost-effectiveness than the other regulatory options, while embodying best available technology for reducing the industry's discharges.

Accordingly, EPA chose Option 2a as the proposed PSES option for indirect dischargers because it presents a balanced regulatory approach for reducing MP&M Phase I effluent discharges while not imposing undue burdens on the industry or on permit-writing authorities.

Pretreatment Standards for New Sources and New Source Performance Standards Selection

EPA proposes to set New Source Performance Standards (NSPS), which apply to new facilities that discharge directly to receiving waters, on the basis of the Best Achievable Technology (BAT) limitations as specified by the proposed Option 2 for existing direct dischargers. Thus, the new source limitations for direct dischargers are the same as those proposed for existing direct discharge facilities. Because new sources can include compliance equipment and related processes in plant designs before construction and generally at lower cost than for retrofit applications, EPA believes that new sources will be able to comply at costs that are similar to or less than those for existing sources. Accordingly, EPA found that the Option 2 requirement for new source direct dischargers will be economically achievable.

In addition, EPA proposes to set Pretreatment Standards for New Sources (PSNS), which apply to new indirect discharging facilities (i.e., that will discharge to POTWs), on the basis of the discharge limitations in PSES Option 2, as considered for existing indirect discharging facilities. However, for new indirect dischargers, the proposed PSNS limitations will apply the mass-based limitations of Option 2 regardless of the new facility's discharge volume. Thus, the new source limitations for indirect discharging facilities will differ from the PSES limitations proposed for existing indirect discharge facilities by not exempting low flow dischargers (i.e., with flow of less than 1,000,000 gallons per year) from regulation. However, in its analysis of regulatory impacts on existing facilities, EPA found that the mass-based limitations of PSES Option 2 would be economically achievable by indirect discharging facilities regardless of discharge volume. For this reason, EPA concluded that the new source limitations applicable to new indirect discharging facilities will also be economically achievable by *new* low flow indirect discharging facilities.

1.4 Structure of the Economic Impact Analysis

This EIA describes both the methodology employed to assess impacts of the proposed rules and the results of the analyses. The overall structure of the impact analysis is summarized in Figure 1-1. The two main inputs to the analysis are: 1) data on industry baseline financial and operating conditions, and 2) projected costs of complying with the proposed regulations. The industry baseline financial and operating data are based principally on the *1989 Machinery Manufacturing and Rebuilding Data Collection Portfolio* (the Survey)[7] conducted under Section 308 of the Clean Water Act.

[7] Machinery Manufacturing and Rebuilding is the original designation of the Metal Products and Machinery Industry. EPA later changed the name to better describe the industry.

A sample of 396 facilities responding to the Survey form the basis for estimating certain characteristics of the MP&M Phase I population of 10,601 effluent discharging facilities. The Survey asked for balance sheet and income statement information, as well as quantitative and qualitative information regarding each facility's dependence on market sectors, types of customers and business activity. Facilities were asked to characterize the competition they faced in various markets. The Survey also gathered data regarding facility liquidation value, cost of capital and the facility's owning firm. A copy of the economic portion of the Survey is attached as Appendix A to the accompanying profile document, *Industry Profile for the Metal Products and Machinery Industry (Phase I)*. Secondary sources supplemented the Survey in providing financial data used for the EIA and general industrial information presented in the Phase I profiles. The most important secondary source was the *Census* and *Annual Surveys of Manufactures*.

The second major data input to the analysis is the projected costs associated with compliance with the regulatory options. EPA developed these estimates based on engineering analysis of the sample facilities. They were incorporated into the economic impact analysis by adding an annualized portion of the estimated capital cost of compliance to the estimated annual operating and monitoring costs of compliance to yield a single, total annualized compliance cost. The annualization of capital costs accounts for the facility's use of debt as well as equity financing, and the tax effects associated with debt financing.

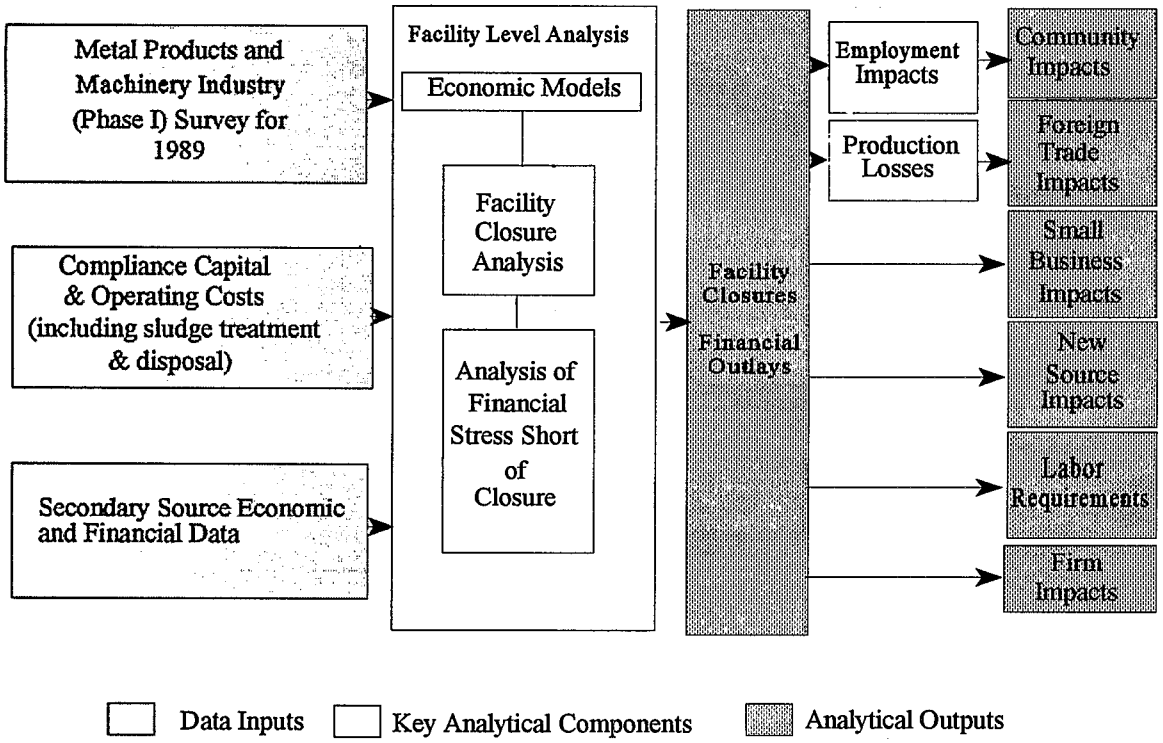
To evaluate the expected impacts of the regulatory options, six measures of impact are examined in the EIA:

- Impacts on MP&M Phase I facilities;
- Employment increases associated with implementation of pollution prevention and control and treatment technologies;
- Employment losses and associated community effects;
- Impacts on the U.S. balance of trade;
- Impacts on firms owning one or more Phase I facilities expected to incur compliance costs;
- Effects on the construction of new facilities and expansion of existing facilities, and
- Impacts on MP&M facilities owned by small businesses.

The EIA methodology relies foremost on a facility-level impact analysis, the results from which then drive the other components of the EIA (See Figure 1-1). The facility-level economic model estimates baseline and post-compliance measures of profitability, debt burden and cash flow. The Baseline Closure Analysis and Post-Compliance Closure Analysis yield estimates of the number of closures associated with the proposed options

by applying a two-part test. The first part compares each facility's present value of future cash flow to its liquidation value. The second part assesses whether or not a measure of total, after-tax cash flow is negative or not. Facilities that have negative cash flow and whose liquidation value exceeds its present value of cash flow are designated estimated facility closures. The Analysis of Financial Stress Short of Closure compares measures of facility profitability and debt burden to industry standards to estimate the number of facilities that are likely to experience moderate impacts short of closure.

Figure 1-1
Economic Impact Analysis of Metal Products and Machinery (Phase I)
Industry Effluent Limitations Guidelines: Analytic Components



To the extent that facilities purchase equipment or services to comply with the regulations, the proposed guidelines may generate employment in industries that provide the equipment or services. For instance, equipment installation, operations, maintenance and design and monitoring services are all associated with jobs. The *labor requirements analysis* uses input-output coefficients calculated by the Department of Commerce to estimate the increase in employment induced by regulatory compliance expenditures.

Employment losses due to projected facility closures affect not only the people that were employed by the facility, but they may also cause broader employment impacts in the communities in which the closing facilities are located. EPA assessed *community impacts* by comparing geographically defined community-wide employment losses to the size of total employment in the communities and states in which estimated facility closures are located. The estimated community-wide employment losses included both primary employment effects among MP&M facilities and, by applying Department of Commerce multipliers, secondary employment effects in linked industries and in consumer-oriented retail and service industries.

Changes in domestic MP&M activity may cause *foreign trade impacts* by decreasing export-related activity and increasing Phase I imports. EPA estimated the change in net exports (i.e., exports minus imports) by allocating revenues lost by closing facilities between domestic and foreign producers according to a range of possible outcomes. The worst-case outcome allocated all the former exports of closing facilities to foreign producers, and all the former domestic sales of these closing facilities to imports from abroad. The best-case outcome assumed that domestic facilities would retain all the domestic and export revenues lost by closing facilities. An intermediate case allocated the closing facilities' lost revenues between domestic and foreign facilities in proportion to measures of the historical competitiveness of domestic facilities. EPA assigned facilities to one of these outcomes according to Department of Commerce trade data for the MP&M industry and Survey data characterizing competition in export and domestic markets.

EPA also performed a *firm-level impact analysis* to determine whether the firms owning MP&M facilities would experience significantly greater impacts than facilities. Such firms might also own an unknown number of other facilities that were not surveyed but would also be subject to the proposed regulation. EPA estimated impacts on firms based on sampled facility impacts and on a range of possible shares of firm revenues earned by activities subject to the effluent guideline. For each firm that owned at least one facility in the Survey, the firm-level impact analysis compared baseline and post-compliance pre-tax return on assets and interest coverage ratio to industry thresholds. Firms that failed to meet either threshold were projected to experience serious adverse impacts. Because the sample of facilities was not designed to be a random sample of firms, EPA reached its finding for sampled firms only and did not make national estimates of firm-level impacts.

Since the proposed regulation includes limitations that will apply to new direct and indirect discharging sources within the MP&M Phase I category, EPA also examined the impact of these regulations on new dischargers to determine if the limitations would impose an undue economic and financial burden on new sources seeking to enter the MP&M Phase I industry.

Finally, EPA assessed the regulatory impact on small entities, in accordance with the requirements of the Regulatory Flexibility Act. For this analysis, EPA defined small entities on the basis of both the estimated business-size classification of firms owning MP&M facilities (based on Small Business Administration firm-level criteria) and on the employment-size class of MP&M facilities. To gauge whether the proposed regulation would have a significant impact on a substantial number of small entities, EPA considered the level of facility impacts and compliance costs expected to be imposed on small entities, according to these definitions.

1.5 Organization of the Economic Impact Analysis Report

The remaining parts of the Economic Impact Analysis are organized as follows. Chapter 2 describes the data sources consulted for this EIA. Chapter 3 profiles the MP&M Phase I industry and examines the economic and financial structure and performance of markets within the Phase I industry.

Following the background material in Chapters 2 and 3, Chapters 4 through 10 each describe the data and methodology used to estimate one type of potential impact, and the resulting impact estimates. The analyses presented in these chapters are based on the 369 facilities in the Survey sample. Except for the firm-level impact analysis, results presented in these chapters are extrapolated to the estimated national population of 10,601 effluent discharging Phase I facilities by applying sample weights. Chapter 4 details the methodology used to estimate facility impacts and presents the results. Facility impacts are the foundation on which other parts of this EIA build. Chapter 4 estimates the magnitude of facility closures in the baseline and post-compliance business environments, as well as the accompanying changes in employment and earnings. For complying facilities, the facility impact analysis measures the aggregate costs of compliance and assesses financial stresses on these facilities short of closure.

Chapter 5 presents the labor requirements analysis. Chapter 6 describes the methodology for and results of the community impact analysis, based on the results of the facility analysis. Methods for estimating international trade effects, and the expected effects, are described in Chapter 7. Chapter 8 assesses firm-level financial impacts for firms owning one or more MP&M facilities that are expected to incur costs in complying with the proposed regulation. Chapter 9 describes the expected effects of the regulation on new MP&M facilities. Chapter 10 contains the small business impact and Regulatory Flexibility Analysis. A list of references to the economic impact analysis follows this chapter.

Two appendixes follow this document. Appendix A, Methodology for Estimating the Cost of Capital, describes how capital costs were imputed from primary and secondary source data to account for the variations

in risk and debt structure. Appendix B, Summary of Threshold Values for Analysis of Financial Stress Short of Closure, details the sources, methodology and results associated with calculating minimum financial performance thresholds used in the facility impact analysis.

This EIA is one of four documents associated with the economic analyses supporting the development of the MP&M Phase I effluent guidelines. One companion document, the *Cost-Effectiveness Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry (Phase I)*, conducts a cost-effectiveness analysis of the various regulatory options considered. The profile document, *Industry Profile for the Metal Products and Machinery Industry (Phase I)*, presents a more detailed profile of the Phase I industries than Chapter 3 contains. This profile document provides useful supplementary information about the Phase I category to help understand the likely impacts of the proposed effluent guidelines. The fourth document, *Regulatory Impact Assessment of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry (Phase I)*, contains the regulatory impact analysis.

Chapter 2
Data Sources

2.1 Introduction

This chapter describes the primary and secondary sources that provided economic and financial data used to assess the expected economic impact of MP&M Phase I effluent guidelines.

2.2 Primary Source Data

The most important data for the analysis are primary source data obtained by a survey issued under the authority of CWA Section 308[1] (the Survey) to a stratified random sample of 1,020 facilities in the subject industries. After data cleaning, responses from 396 facilities, representing 10,601 water-discharging facilities in the MP&M Phase I population, were used for the economic impact analysis. This questionnaire obtained information on the technical and financial characteristics of facilities to estimate how facilities would be affected by an effluent guideline.

The technical data obtained by this questionnaire include information on facility operating processes that use water, the quantities of water and pollutants discharged by the various processes, the treatment systems that are currently in place for managing discharge of pollutants and other data. These data provided the basis for estimating treatment system and process change costs for complying with various regulatory options for the MP&M industries. The estimated technical costs for compliance in turn yielded estimates of the capital and operating costs of treatment systems and any production costs or savings that would accompany installation and operation of a treatment system. For a detailed description of the technical data obtained by the Survey and the related engineering and cost analyses leading to estimates of technical compliance costs, see the MP&M Data Collection Portfolio Report and Technical Development Document.

The Survey also obtained a variety of financial data from the facilities. These data include: three years (1987-89) of income statements and balance sheets at the surveyed facility level; the composition of revenues by kind of customer (government, export and domestic non-government) and by line of business (manufacturing, rebuilding and repair); estimated value of facility assets and liabilities in liquidation; borrowing costs; and ownership of the facility business and total revenues of the owning entity (if separate from the facility). Appendix

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[1] *U.S. Environmental Protection Agency 1989 Machinery Manufacturing and Rebuilding Data Collection Portfolio,* 1991.

A of the accompanying profile document contains a copy of the financial section of the Survey [2]. The financial data obtained in the Survey provided the basis for assessing how facilities are likely to be affected financially by effluent guidelines.

Complete financial data were obtained from over 750 facilities, and data from all of these observations were used during preliminary statistical analyses. However, the number of observations that were used in the assessment of facility-level and other economic impacts was less than the total because of sample definition considerations.

Some additional data from Form 10Ks, which publicly reporting firms file with the Securities and Exchange Commission, provided supplementary data regarding firm financial characteristics, near-term business prospects and the industrial classification of products sold by the firm.

Facility financial data contributed directly to the facility- and firm-level financial analyses in Chapters 4 and 8. Facility technical data regarding employment and discharge flow volumes contributed directly to the facility, labor requirements, community and regulatory flexibility analyses. Facility data concerning competition in sales to export and to domestic customers contributed to the foreign trade impact analysis in Chapter 7.

The Survey also collected some financial data regarding the parent firms of sampled facilities. These data directly contributed to the firm-level and regulatory flexibility analyses.

2.3 Secondary Source Data

In addition to enabling numerous analytical tools in the economic impact analyses in this document, secondary source data helped to characterize background economic and financial conditions in the national economy and in the MP&M industries. For example, secondary source data were used to define capital market conditions underlying the cost-of-capital analysis. Secondary source data also figured prominently in the analysis of cost pass-through potential for the MP&M sectors (see Appendix B, *Partial-Cost-Pass-Through Methodology,* of the accompanying profile document). Secondary sources used in the analysis include:

- U.S. Department of Commerce economic census and survey data including the *1987 Census of Manufacturers, 1988-1991 Annual Surveys of Manufacturers, Concentration Ratios in*

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[2] See *Industry Profile for the Metal Products and Machinery Industry (Phase I).*

Manufacturing, and the *1987 Enterprise Statistics: Company Summary.* These sources provided output, employment and financial time series at the 4-digit SIC group level of aggregation used throughout the Economic Impact Analysis and in the industry profiles.

- The *1982 Benchmark Input-Output Tables of the United States*, published by the Bureau of Economic Analysis in the Department of Commerce, by 6-digit industry group. This recently-released, latest version of the input-output tables provided data necessary for estimating the cost pass-through capability of MP&M industries.

- Value of U.S. imports and exports, by 4-digit SIC group, from the Department of Commerce, used in the profiles and in the Foreign Trade Impact Analysis.

- Price index series from the Bureau of Labor Statistics, Department of Labor, by 4- and 6-digit SIC group, which were used to estimate cost pass-through abilities and to deflate economic and financial data.

- *1987 to 1992 U.S. Industrial Outlook*s, published by the Department of Commerce, which supplied information for the Chapter 3 and the accompanying profile document.

- Small business thresholds, by 4-digit industry group from the Small Business Administration, used in the Regulatory Flexibility Analysis and in the preliminary statistical analyses.

- Regional income multipliers generated by the Regional Impact Modeling System (RIMS model), developed by the Department of Commerce, and used in the Community Impact Analysis.

Industry sources and trade publications, which contributed to the MP&M profile presented in Chapter 3 and in the accompanying profile document.

Financial publications, including the *Value Line Investment Survey,* Robert Morris Associates' *Annual Statement Studies,* Standard & Poor's *New York- American-* and *NASDAQ Stock Exchange Reports* and Dun & Bradstreet's *Million Dollar Directory.* These sources provided

key financial ratios and firm-level and industry financial measures, including measures of risk, debt structure, capital costs and income statement and balance sheet items.

- The *FY 1993 Economic Report of the President* provided macro-economic measures, such as gross domestic product (GDP) and its components, employment and aggregate deflator series, such as the GDP, and Consumer and Producer Price Indices. The Employment Cost Index from this source also complemented price series provided by the Bureau of Labor Statistics in estimating cost pass-through abilities.

The contributions of these sources to each component of the Economic Impact Analysis are discussed in detail within the corresponding chapters. A specific list of references also follows at the end of this report.

Chapter 3

Profile of the MP&M Phase I Industry

3.1 Introduction

The MP&M Phase I industry includes 99 4-digit SIC groups that are allocated, for this economic impact analysis, among seven clusters of closely related SIC groups, called sectors. This chapter presents selective profiles of the seven MP&M Phase I sectors. It emphasizes industry characteristics that relate to the ability of producers to increase prices in order to recover any cost increases that may accompany effluent guideline compliance. A separate document, *Industry Profile for the Metal Products and Machinery Industry (Phase I),* provides more detailed analyses of these sectors, plus an overview of the entire MP&M category, a description of the cost pass-through methodology, and an analysis of the sensitivity of the economic impact analysis to the time period over which data were collected .

The profile in this chapter refers to data from a Section 308 survey (the Survey) as well as from secondary sources. The Survey targeted Phase I effluent dischargers that were expected to incur compliance costs under the proposed effluent guidelines. A stratified random sample of 396 facilities was selected and assigned sample weights relating survey data to the entire population of 10,601 Phase I effluent discharging facilities. The economic portion of the Survey, attached as *Appendix A* to the profile document, asked for facility and firm financial information from 1987 to 1989, descriptions of the level of competition in various kinds of markets in 1989 and dependence on various types of customers in 1989, among other information.

Secondary sources provided supplementary data about Phase I industries, including both dischargers and non-dischargers. In addition to the 10,601 dischargers represented by the Survey sample, secondary source data also applied to approximately 80,300 non-discharging facilities. This chapter draws upon data from the *Census* and *Annual Surveys of Manaufactures*, the *U.S. Industrial Outlook*, non-published trade data from the Department of Commerce and the *Economic Report of the President*. As described in the cost pass-through methodology (see Appendix B of the profile document), the cost pass-through coefficients draw upon input price series from the Bureau of Labor Statistics and input-output coefficients from the Bureau of Economic Analysis' *1982 Benchmark Input-Output Tables of the United States*. Time series data generally spanned the years 1982 through 1991, inclusive.

The first section of this chapter (3.1) examines the entire MP&M Phase I industry in aggregate. The following section (3.2) examines the differences between sectors according to financial and economic parameters that affect the ability of firms to pass on cost increases to customers by increasing prices. The chapter then compares the seven sectors according to these key parameters. The concluding section also summarizes the partial-cost-pass-through methodology. All of the data presented in this profile constitute a *baseline* description of the MP&M Phase I industries, exclusive of the effects of proposed effluent guidelines.

3.2 Overview

The Metal Products and Machinery (MP&M) Phase I industry encompasses a large and diverse group of industries that principally manufacture intermediate goods used by other industries, as well as lesser amounts of final goods such as household electronics. In addition to manufacturing, the MP&M Phase I industry also includes some maintenance and repairing activities. Table 3-1 lists the seven Phase I sectors and their associated 4-digit SIC industry groups. The profile gathered secondary source data by 4-digit SIC industry and then aggregated the data according to the definitions in Table 3-1. However, rather than classifying themselves by SIC code, Survey respondents classified themselves according to a partially subjective judgment about what sector most closely described their activities. Therefore, primary source data from the Survey accurately distinguishes between the seven Phase I sectors only as well as the respondents distinguished between those sectors based on the descriptions in the Survey.[1]

While final consumers buy some MP&M products, the largest part of the demand for MP&M output comes from construction and manufacturing industries, which are both pro-cyclical components of the economy. MP&M output changes generally coincide with but also show greater amplitude than fluctuations in the general economy. During recessionary years, customer industries can disproportionately reduce their purchases of many new MP&M products by deferring purchases and increasing maintenance and repair activities on existing capital goods. Thus, economic downturns tend not only to decrease MP&M revenues disproportionately but also to shift revenues between activities. Similarly, robust economic growth has historically accompanied disproportionately strong growth in MP&M output.

In 1989, Phase I producers accounted for $275 billion in value added, which constituted 5.7 percent of U.S. real gross domestic product (GDP). Table 3-2 shows real and nominal value of shipments and value of

[1]See Appendix A of the profile document, *Industry Profile for the Metal Products and Machinery Industry (Phase I)*, for the economic portion of the Survey.

Table 3-1: Phase I and Phase II MP&M Sectors and SIC Codes			
Number of SIC Groups			
Total	By Sector	4-Digit Standard Industrial Classification Groups	
Sector 1, Hardware			
1	1	2796	Platemaking & Related Services
2	2	3398	Metal Heat Treating
3	3	3412	Metal Shipping Barrels, Drums, Kegs, Pails
4	4	3421	Cutlery
5	5	3423	Hand & Edge Tools, Except Mach. Tools, Saws
6	6	3425	Hand Saws and Saw Blades
7	7	3429	Hardware NEC
8	8	3433	Heating. Equipment Except Electric. & Warm Air Furnaces.
9	9	3441	Fabricated Structural Metal
10	10	3442	Metal Doors, Sash & Frames
11	11	3443	Fabricated Plate Work (Boiler Shops)
12	12	3444	Sheet Metal Work
13	13	3446	Architectural and Ornamental Metal Work
14	14	3448	Prefabricated Metal Buildings & Components
15	15	3449	Miscellaneous Metal Work
16	16	3451	Screw Machine Products
17	17	3452	Bolts, Nuts, Screws, Rivets, and Washers
18	18	3462	Iron and Steel Forgings
19	19	3466	Crowns and Closures
20	20	3469	Metal Stamping NEC
21	21	3492	Fluid Power Valves & Hose Fittings
22	22	3493	Steel Springs
23	23	3494	Valves & Pipe Fittings, Except Brass
24	24	3495	Wire Springs
25	25	3496	Miscellaneous Fabricated Wire Products
26	26	3498	Fabricated Pipe and Fabricated Pipe Fitting
27	27	3499	Fabricated Metal Products NEC
28	28	3541	Machine Tools, Metal Cutting Types
29	29	3542	Machine Tools, Metal Forming Types
30	30	3544	Special Dies & Tools, Die Sets, Jigs, Etc.
31	31	3545	Machine Tool Access & Measuring Devices
32	32	3546	Power Driven Hand Tools
33	33	3965	Fasteners, Buttons, Needles, etc
Sector 2, Aircraft			
34	1	3721	Aircraft
35	2	3724	Aircraft Engines and Engine Parts
36	3	3728	Aircraft Parts and Auxiliary Equipment
37	4	4581	Airports, Fields & Terminals
Sector 3, Electronic Equipment			
38	1	3661	Telephone & Telegraph Apparatus
39	2	3663	Radio & TV Broadcasting & Communications Equipment
40	3	3669	Communications Equipment NEC
41	4	3671	Electron Tubes
42	5	3675	Electronic Capacitors

Table 3-1: Phase I and Phase II MP&M Sectors and SIC Codes			
Number of SIC Groups			
Total	By Sector	4-Digit Standard Industrial Classification Groups	
Sector 3, Electronic Equipment, continued,			
43	6	3677	Electronic coils and Transformers
44	7	3678	Connectors for Electronic Applications
45	8	3679	Electronic Components NEC
46	9	3699	Electronic Mach., Equipment, & Supplies. NEC
Sector 4, Stationary Industrial Equipment			
47	1	3511	Steam, Gas, Hydraulic. Turbines, Gen. Units
48	2	3519	Internal Combustion Engines NEC
49	3	3533	Oil Field Machinery and Equipment
50	4	3534	Elevators and Moving Stairways
51	5	3535	Conveyors and Conveying Equipment
52	6	3543	Industrial Patterns
53	7	3547	Rolling Mill Machinery and Equipment
54	8	3548	Electric & Gas Welding & Smoldering Equipment
55	9	3549	Metal Working Machinery NEC
56	10	3552	Textile Machinery
57	11	3553	Woodworking Machinery
58	12	3554	Paper Industries Machinery
59	13	3555	Printing Trades Machinery and Equipment
60	14	3556	Food Products Machinery
61	15	3559	Special Industry Machinery NEC
62	16	3561	Pumps and Pumping Equipment
63	17	3562	Ball and Roller Bearings
64	18	3563	Air and Gas Compressors
65	19	3564	Blowers and Exhaust and Ventilation Fans
66	20	3565	Industrial Patterns
67	21	3566	Speed Changers, High Speed Drivers & Gears
68	22	3567	Industrial Process Furnaces and Ovens
69	23	3568	Mechanical Power Transmission Equipment NEC
70	24	3569	General Industrial Machinery NEC
71	25	3581	Automatic Merchandising Machines
72	26	3582	Commercial Laundry Equipment
73	27	3585	Refrigeration & Air and Heating Equipment
74	28	3586	Measuring and Dispensing Pumps
75	29	3589	Service Industry Machines, NEC
76	30	3593	Carburetors, Pistons, Piston Rings & Valves
77	31	3594	Fluid Power Pumps & Motors
78	32	3596	Scales & Balances, Except Laboratory
79	33	3599	Machinery, Except Electrical NEC
80	34	3612	Transformers
81	35	3613	Switchgear and Switchboard Apparatus
82	36	3621	Motors and Generators
83	37	3625	Relays and Industrial Controls
84	38	3629	Electric Industrial Apparatus NEC
85	39	3641	Electric Lamp Bulbs and Tubes

Table 3-1: MP&M Phase I Sectors and SIC Codes			
Number of SIC Groups			
Total	By Sector	4-Digit Standard Industrial Classification Groups	
Sector 5, Ordnance			
86	1	3482	Small Arms Ammunition
87	2	3483	Ammunition, Except for Small Arms
88	3	3484	Small Arms
89	4	3489	Ordnance and Accessories NEC
Sector 6, Space			
90	1	3761	Guided Missiles and Space Vehicles
91	2	3764	Guided Missile and Space Vehicle Propulsion
92	3	3769	Other Space Vehicle and Missile Parts
Sector 7, Mobile Industrial Equipment			
93	1	3523	Farm Machinery and Equipment
94	2	3524	Garden Tractors & Lawn & Garden Equipment
95	3	3531	Construction Machinery & Equipment
96	4	3532	Mining Machinery & Equipment, Except Oil Field
97	5	3536	Hoists, Industrial Cranes & Monorails
98	6	3537	Industrial Trucks, Tractors, Trailers
99	7	3795	Tanks and Tank Components
Source: Environmental Protection Agency			NEC = Not Elsewhere Classified

output from 1982 to 1991. *Value of shipments* is the sum of the receipts a manufacturer earns from sales of all its outputs. Similar to revenues, value of shipments is a useful indicator of the overall size of a market or the size of a firm in relation to its market or competitors. To measure the amount of production activity in a firm or market, though, economists often use *value added,* which is the difference between the value of shipments and the value of inputs used to make the products that it sells. This difference is the value of the production activity that occurred in that firm or market. Over the entire period, Phase I value added nearly kept pace with GDP, in real terms, growing 27.6 percent, compared to real GDP growth of 29.0 percent.

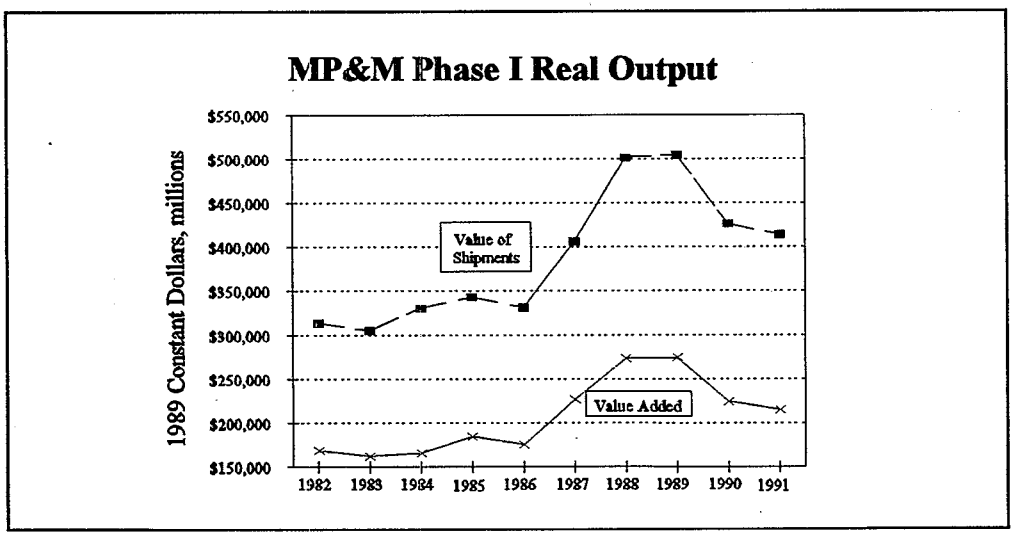
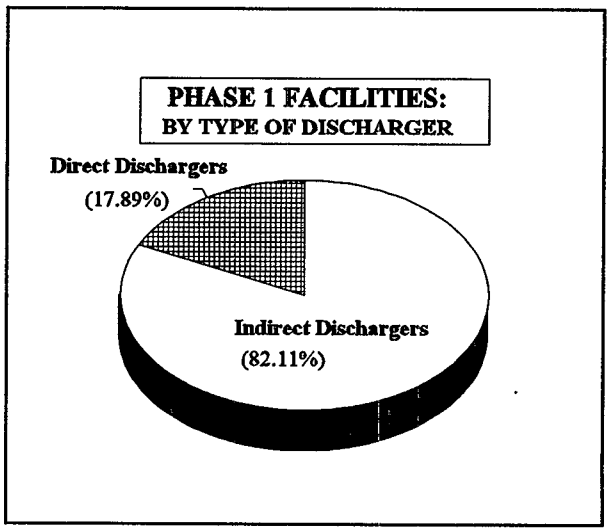


Table 3-2: MP&M Phase I Real Output					
	$ millions, current		$ millions, 1989 constant		$ millions, 1989 constant
Year	Value of Shipments	Value Added	Value of Shipments	Value Added	US Gross Domestic Product (GDP)
1982	270,914.8	145,778.8	314,027.4	168,958.8	3,758,400.0
1983	269,015.0	142,605.5	305,887.8	162,180.0	3,904,800.0
1984	296,340.5	148,365.0	330,669.0	165,873.7	4,150,700.0
1985	311,552.8	167,748.6	343,310.6	184,849.4	4,278,200.0
1986	302,099.1	160,092.1	331,861.7	175,768.8	4,405,100.0
1987	376,170.3	210,233.6	406,325.6	226,950.5	4,539,900.0
1988	481,491.2	262,966.0	501,844.6	274,066.8	4,716,400.0
1989	504,878.3	275,041.5	504,878.3	275,041.5	4,837,600.0
1990	521,673.6	275,959.7	426,359.1	224,871.8	4,883,700.0
1991	521,253.4	271,570.3	414,325.2	215,515.6	4,847,600.0
Total Growth Over Period:					
1982-91	92.4%	86.3%	31.9%	27.6%	29.0%
Source: Department of Commerce / Office of Management and Budget					

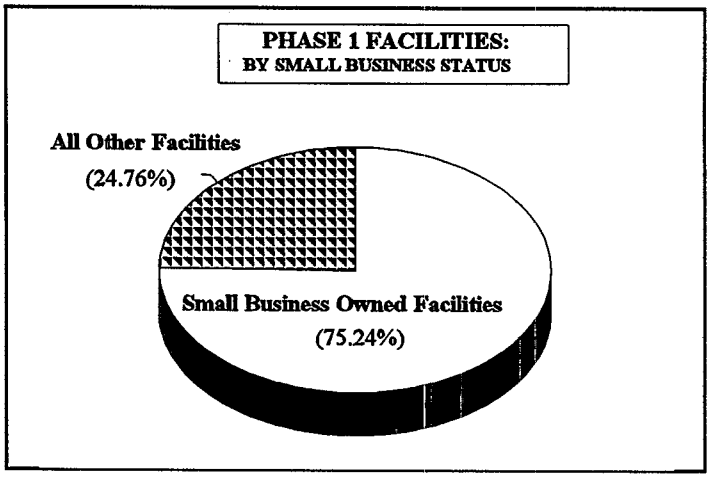


The apparently large increase in output in 1987 partly reflects a change in SIC industry definitions in that year. The profile document discusses this in more detail; however, the effect of this change is to exaggerate growth in output from 1986 to 1987 and to reduce the comparability of data before and after the SIC redefinition. Abstracting from this anomaly, output generally grew in the first part of the decade, before declining in recent years. Real value added fell by almost 22 percent between 1989 and 1991. During the same period, though, nominal value of shipments grew by slightly over 3 percent, which is consistent with the recent experience of manufacturing industries in general.

Out of a total population of 90,901 MP&M Phase I facilities, effluent dischargers number an estimated 10,601.[2] Of the effluent dischargers, 8,705 (82 percent) are indirect dischargers, while the remaining 1,896 facilities (18 percent) are direct dischargers.

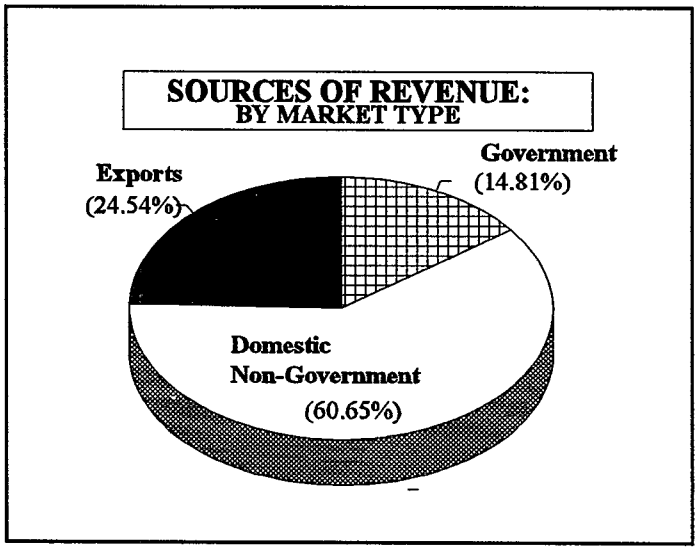
[2]The total Phase I population is based on the 1987 Census of Manufacturers, while the population of effluent dischargers is based on the Survey.

MP&M Phase I sectors typically have a disproportionately large number of small facilities, though output is typically concentrated among larger facilities. Sectors vary widely in how their output is distributed among facilities of various sizes, though, and will be examined individually later in this chapter. Using facility and firm revenue data to impute firm-level employment, Small Business Administration small business thresholds were also applied to each facility to estimate the number of facilities that were likely to be owned by small businesses, as defined by the Small Business Administration. By using this methodology, detailed in the regulatory flexibility analysis (see Chapter 10), EPA determined that 7,976 facilities (75 percent) are small business owned.



The Survey asked effluent dischargers to indicate how much of their revenues came from each of three major MP&M activities: manufacturing, repairing and maintenance. Manufacturing dominated, yielding 93.4 percent of all revenues earned by Phase I effluent dischargers.

Facilities were also asked to indicate their level of dependence on each of three types of customers: government, domestic non-government and export. Each of these customer types exerts different levels of market power. Market power among producers is defined as the ability to influence prices. Large, concentrated producers exert market power because they can choose to supply or withhold enough output to change the market price. Market power among customers is the ability to influence prices by buying more or less. If purchases are highly concentrated in a few buyers, these buyers may be able to exert downward pressure on prices by withholding purchases. For example, the government often exerts more market power than individual households. When an individual household varies the amount it buys



of a product, that choice typically does not influence the product's price. However, in some markets, a decrease in government purchases may significantly affect market demand and cause a decrease in prices.[3]

The various customer types also affect MP&M producers in other ways. Heavy dependence on export sales, for instance, would indicate that an industry may face relatively elastic markets. In such a market. if one firm tries to raise prices unilaterally, a large share of its customers will be able to turn to other suppliers of the same product at the previous price. Survey responses indicated that Phase I sectors derive almost 25 percent of their revenues from export sales, though sector level analyses in this chapter will show wide variation in export dependence. Industries that depend heavily on government purchases may be less pro-cyclical than others.

3.3 Comparative Characteristics of Phase I Sectors

This section compares the seven sectors that comprise the MP&M Phase I industry by examining economic structural characteristics that influence a firm's ability to pass through cost increases by raising prices. These structural characteristics are discussed in detail in the profile document, *Industry Profile for the Metal Products and Machinery Industry (Phase I)* and Appendix B to that document, *Partial-Cost-Pass-Through Methodology.* The characteristics discussed below are: the long-term growth rate, market concentration, the strength of foreign trade competition and the risk-adjusted level of profits in each sector.

While individual economic structural characteristics differ between sectors, the overall measures of financial condition and performance that indicate the impacts of effluent guidelines do not differ in a statistically significant way between sectors or between other potential subcategorizations of the MP&M Phase I industry. Appendix D, *Statistical Analysis of Financial Measures for MP&M Industry Facilities* of the accompanying profile document presents the subcategory analysis.

3.3.1 Growth Rate of Output

Table 3-3 compares the sizes of the seven Phase I sectors, measured by value of shipments, value added and employment. It also gives the average growth rates of the Phase I sectors over the period 1982 to 1991 for each sector, measured by the average growth rate in inflation-adjusted value added between 1982 and 1991.

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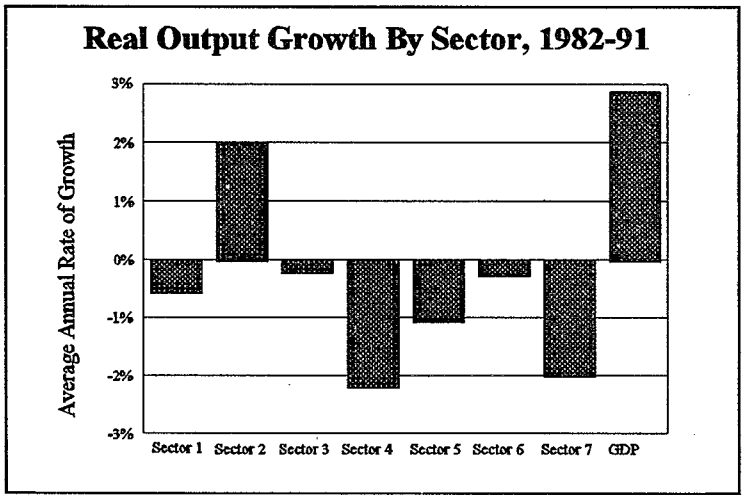
[3]In certain types of markets, such as armaments, the government may also gain market power from legal and contractual limitations on producers. This is different from the market power discussed above, which comes from concentration.

Table 3-3: 1989 Phase I Output and Employment, by Sector				
Sector	Value of Shipments, *millions*	Value Added, *millions*	Avg. Growth Rate of Real Value Added	Employment, *thousands*
1. Hardware	$132,152.7	$70,827.5	-0.57%	1,329.1
2. Aircraft	$83,979.6	$44,889.4	2.01%	602.4
3. Electronic Eq.	$66,745.1	$37,961.3	-0.20%	584.5
4. Stationary Ind. Eq.	$147,309.1	$79,984.3	-2.18%	1,288.8
5. Ordnance	$7,341.6	$5,117.7	-1.04%	77.0
6. Space	$29,497.7	$19,142.6	-0.26%	221.0
7. Mobile Ind. Eq.	$37,852.5	$17,118.7	-1.98%	236.9
Gross Domestic Product (GDP)		*$4,837,600.0*	*2.87%*	
Source: Department of Commerce				

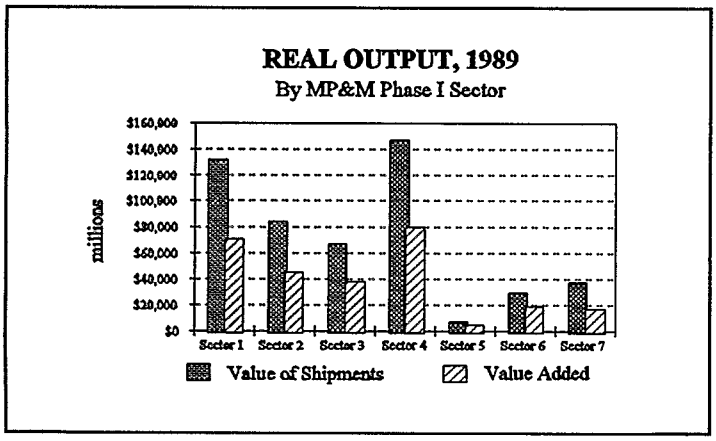
Declining industries may have very different options from growing industries, in the face of similar market stresses. While aggregate real output for the entire MP&M category increased over the relevant period, the *median* rate of growth, calculated individually for each sector,[4] was less than zero, at -0.6 percent per year. Against this standard, Table 3-3 shows that the Hardware, Aircraft and Electronic Equipment sectors experienced average annual growth rates above the MP&M median. The Aircraft sector showed the only positive average growth rate, at just over 2 percent per year.



To different degrees, three important factors explain Phase I growth and the wide variation in these growth rates: 1) the level of business activity overall or in closely related markets, 2) government spending, regulation and standard-setting, and 3) technological advances.

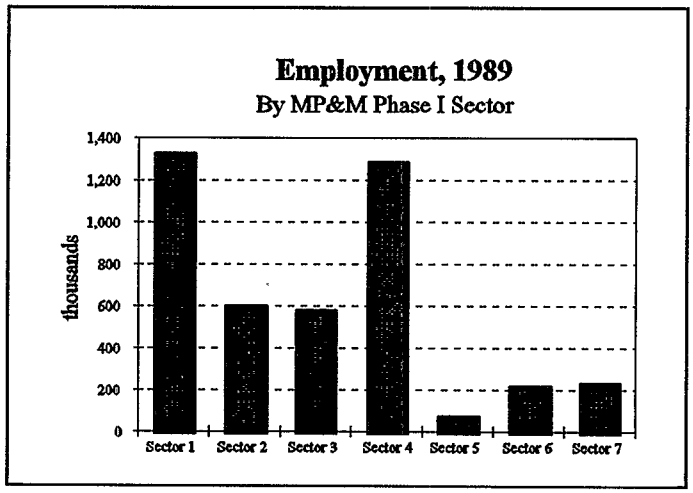
The Hardware sector, for instance, consists mostly of small facilities whose performance depends closely upon the demand for their products from construction and manufacturing industries. Cost-cutting in those industries has contributed to an overall decline in real output from the Hardware sector over the period of the analysis. At the same time, economic recession abroad has also reduced demand, although favorable exchange rates have mitigated this effect recently. Two major governmental initiatives have significant implications for

[4]Medians are measured across all 15 MP&M Phase I and II sectors.



the Hardware sector. Industry observers expect the North American Free Trade Agreement (NAFTA) to give a strong boost to the sector.[5] In Europe, though, the prospect of heightened European Community (EC) trade barriers after unification has caused some manufacturers to relocate from the U.S. to within the EC. Structurally, the Hardware sector faces oligopsonistic markets in some areas, such as specialty fasteners. The valve and pipe fitting manufacturers, for another example, sell to highly concentrated oil and gas producers. In 1989, the Hardware sector reported $132 billion in shipments and employment of 1.33 million full-time equivalent production and non-production employees.

The Aircraft sector has proven the most resistant to the recession of 1990 - 1991, among Phase I sectors. It is a highly concentrated group of industries that faces relatively little import penetration and ranks third in value of shipments among the Phase I sectors, with $84 billion in shipments and employment of 602 thousand employees.

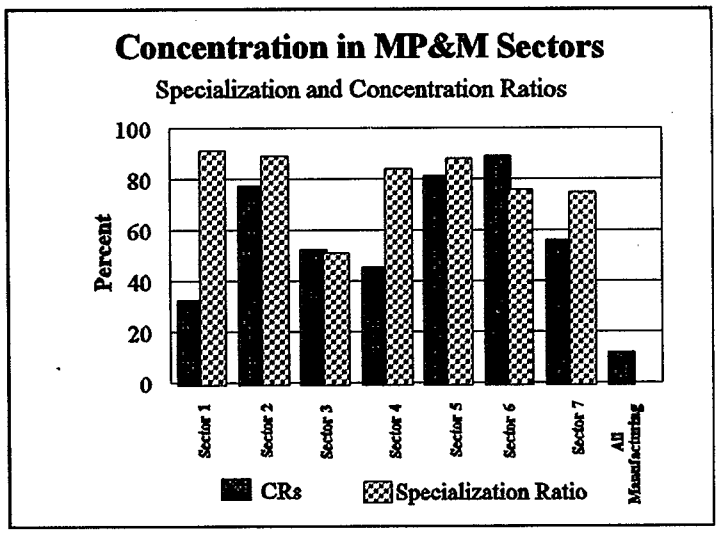


Regulatory policy and technological advances will shape much of the future of the Electronic Equipment sector, particular in the areas of high-technology communications equipment in which the U.S. has a strong presence. Inroads by foreign manufacturers have been offset by emerging markets, deregulation and the growth in the total size of the electronic equipment market. The Electronic Equipment sector ranks fourth in output and employment, among MP&M Phase I sectors.

[5] *U.S. Industrial Outlook*

3.3.2 Measures of Market Concentration

MP&M firms compete in relatively concentrated markets, compared to manufacturing industries in general. Concentration of production among a small group of producers gives those producers increased market power and therefore an enhanced ability to increase prices in response to input cost increases. Once the market price has been set, smaller producers may be able to share in the price increase.



Horizontal concentration is a measure of the proportion of production within an industry that comes from a small group of firms. The **eight-firm concentration ratio** used in this analysis (**CR_8**) is the percentage of shipments of an industry's products that comes from the eight largest firms in that industry. In spite of numerous small firms and establishments, the eight largest firms in each 4-digit industry in each MP&M sector produce, on average, between 32.6 percent and 80.0 percent of their industry's value of shipments (see Table 3-4). The Aerospace, Ordnance and Aircraft sectors — sectors 6, 5 and 2, respectively — exhibit the highest concentration ratios, but even the least concentrated sector, Hardware, has a sizable CR_8 of 32.6 percent, compared to an aggregate of 12.0 percent for all manufacturing industries.

Table 3-4: Concentration in MP&M Sectors

Sector	Concentration Ratio, 8-firm (CR_8)	Specialization Ratio
1. Hardware	32.6%	91.0%
2. Aircraft	77.3%	89.0%
3. Electronic Eq.	52.2%	51.0%
4. Stationary Ind. Eq.	45.5%	84.0%
5. Ordnance	81.2%	88.0%
6. Space	89.0%	76.0%
7. Mobile Ind. Eq.	55.9%	75.0%
MP&M Median	*57.7%*	*77.3%*
Manufacturing	*12.0%*	*NA*

Source: Department of Commerce

Three Phase I sectors have CR_8 values less than the MP&M median of 55.7 percent across all fifteen sectors. These are the Hardware, Electronic Equipment and Mobile Industrial Equipment sectors.

If, instead of producing a higher percentage of the output from a particular industry, the largest firms expand their production into other industries, especially related industries that sell to or buy from their own, then the industry is said to be **vertically concentrated.** In lieu of a more direct measure of vertical concentration, the current analysis uses the **specialization ratio,** which is the percentage of the average firm's revenues that is derived from shipments of products classified within the firm's own industry classification. A lower specialization ratio indicates that firms in the industry tend to produce a wider range of products and are more likely to be vertically concentrated. Industries with very high specialization ratios cannot be vertically concentrated, because, by definition, most of their production falls into a narrow range of products within the industry.

Table 3-4 shows that the Electronic Equipment, Space and Mobile Industrial Equipment sectors have lower specialization ratios than the MP&M median value of 77.3 percent and are therefore more likely to be vertically concentrated.

The Mobile Industrial Equipment sector serves many small customers, such as homeowners, farmers and construction firms. These customers face significant foreign trade pressure from Europe, Canada and Japan, and their level of activity is sensitive to weather fluctuations. The agricultural equipment industry, which is a component of this sector, also suffers from overcapacity.

The Ordnance and Space sectors exhibit the highest horizontal concentration among Phase I sectors, but they are also somewhat highly specialized and therefore they do not stand out as candidates for high vertical integration. These two sectors are also the most highly dependent on sales to the government; each sector earns more than half of its revenues from the government.

3.3.3 Foreign Competition

To the extent that foreign competitors do not incur the same compliance costs as domestic producers, dependence on foreign markets can reduce an industry's ability to increase prices in response to cost increases. Industries that compete heavily against imports in the United States or foreign producers in export markets have to price their products competitively with products from foreign producers that may not have incurred compliance costs.

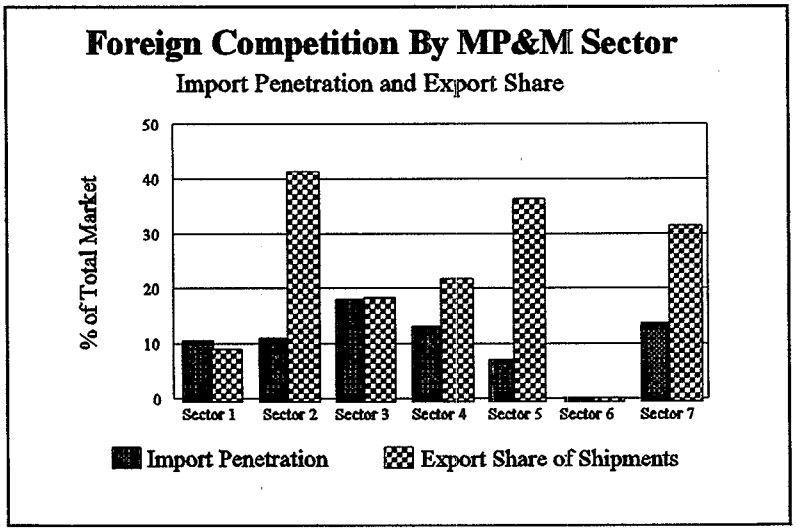
Table 3-5 presents measures of foreign competition in import and export markets. The import penetration ratio is the ratio of imports to the sum of domestic shipments and imports. Against an MP&M median value of 11.7 percent, only two sectors, Ordnance and Space, experience low import competition.

Table 3-5: Foreign Competition *percent*

Sector	Import Penetration	Export Share
1. Hardware	10.6	8.9
2. Aircraft	11.0	41.4
3. Electronic Eq.	18.0	18.3
4. Stationary Ind. Eq.	13.2	21.7
5. Ordnance	7.0	36.3
6. Space	0.0	0.1
7. Mobile Ind. Eq.	13.7	31.5
MP&M Median	*13.2*	*18.3*
All Manufacturing	*11.7*	*9.5*

Source: Department of Commerce

The Aerospace sector has negligible imports and exports; it is relatively isolated from foreign markets. While foreign markets affect the other sectors significantly, none exhibit both relatively high import penetration and relatively high dependence on export markets. Only Sector 3, Electronic Equipment, faces more import penetration, at 18 percent, than the national average of 11.7 percent,[6] while it depends on export customers for about 18.3 percent of its shipments, compared to a national manufacturing average of 9.5 percent. Only Sectors 2 Aircraft and 5 Ordnance have higher export dependence than the national average, and both of these face low import penetration. The foregoing notwithstanding, the Electronic Equipment, Aircraft and Ordnance sectors are relatively sensitive to foreign competition. Only Sector 6, Aerospace, is substantially independent of foreign competition. Foreign competition



[6] National average across all manufacturing industries.

significantly affects the other MP&M sectors. For instance, changes in the foreign trade environment will figure prominently in determining the future of the Stationary Industrial Equipment sector. The key to growth in the well-developed foreign trade in stationary industrial equipment is the adoption of international standards under the ISO 9000 initiative[7] and NAFTA.

3.3.4 Barriers to Entry

The presence of positive economic profits is one of the surest indicators of imperfect competition and market power on the part of producers. Positive profits can exist only in the presence of both entry and exit barriers. Entry barriers are fixed costs that a new firm must incur before it produces any goods. Exit barriers are fixed costs that a firm cannot recover in liquidation.[8] These barriers not only allow firms to raise prices with diminished fear of new entrants underpricing them, but they are also evidence, in and of themselves, of the exercise of market power, as firms erect entry and exit barriers to protect and enhance market power.

The usefulness of economic profit as an indicator of market power is matched, unfortunately, by the difficulty in measuring it. However, the cost pass-through analysis requires only an accurate rank ordering of the economic profitability of the seven sectors, which is a much easier task than identifying precise point values for each sector. It is useful to note, at this point, that all profits can be completely described by two parameters: the rate of return and the magnitude of risk.

The **pre-tax return on assets (PTRA)** is a good measure of the rate of return. It is well-defined, commonly used and calculated from data reported in the Survey. Furthermore, the PTRA is commonly used by firms to gauge their own profitability. This implies that if firms were to exercise market power, they would seek to influence PTRA. This is another reason that PTRA would be a good indicator of market power.

Profits, though compensate investors not only for the use of their capital, but also for the riskiness of their use. Therefore, one firm might have a higher PTRA than another not because it is more economically profitable, but because it is riskier. To compensate for differences in riskiness, EPA gathered or estimated beta-coefficients (βs) for each facility from published sources by assigning the β associated with its parent firm. The

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[7]ISO 9000 is an international standardization initiative that seeks to increase the compatibility and uniformity of products among nations.

[8]Entry barriers cannot exist without exit barriers, in the neoclassical theory of firm behavior. In the absence of exit barriers, the cost of entry is fully negated by the liquidation value of the firm. Therefore, subject to liquidity constraints, the firm would be able to afford any magnitude of entry cost, and such costs would not be an entry barrier.

firm β is a standard measure of risk defined as the covariance of the firm's profitability with respect to the market. Table 3-6 presents risk-adjusted PTRA values for each Phase I sector; all PTRA values in the profile are risk-adjusted. The median of 22.0 percent is a median across Phase I sectors only, because the Survey did not target Phase II facilities.

Table 3-6: Financial Performance by Phase I Sector

Sector	Pre-Tax Return on Assets	Debt-to-Asset Ratio
1. Hardware	6%	0.90
2. Aircraft	15%	0.98
3. Electronic Eq.	22%	0.33
4. Stationary Ind. Eq.	22%	0.71
5. Ordnance	31%	0.73
6. Space	22%	0.51
7. Mobile Ind. Eq.	29%	0.42
Phase I Median	22%	0.71

Source: Environmental Protection Agency Data Collection Portfolio

In addition to having the two lowest returns on assets, Sectors 1 Hardware and 2 Aircraft also have the two highest long-term debt burdens, when measured as the ratio of debt to long-term assets. Their debt-to-asset ratios are 0.90 and 0.98, respectively. However, it should be noted that the Survey responses with regard to balance sheet items were subject to wide, though manageable, ranges of variation and error. With this caveat about the statistical significance of measured differences in these values in mind, Sectors 4 Stationary Industrial Equipment and 5 Ordnance also have moderately high debt-to-asset ratios. Sector 3 Electronic Equipment has the lowest debt-to-asset ratio of the Phase I sectors, at 0.33.

3.4 Sector Cost Pass-Through Capabilities

Appendix B in the accompanying profile document[9] details the methodology by which cost pass-through coefficients were assigned to each sector. This section summarizes the methodology and findings of the cost pass-through analysis.

Cost pass-through coefficients were assigned in a two-part process. The first part examined the six "structural" determinants of cost pass-through ability previously discussed in this chapter. These six determinants measured market concentration, foreign competition, overall growth and entry barriers. The second

[9] *Industry Profile for the Metal Products and Machinery Industry (Phase I), Appendix B: Partial-Cost-Pass-Through Methodology*

part assessed the historical ability that each sector demonstrated to pass on input cost increases as output price increases. Each part of the process yielded a point score, which, when summed, determined the range of cost pass-through coefficients assigned to each corresponding sector. Finally, the assigned range of cost pass-through coefficients was adjusted for each sector to account for the percentage of the domestic industry expected to incur compliance costs from effluent guidelines.

Table 3-7 summarizes the results from the first part of the cost pass-through analysis. Each of the six structural measures is given a value of "High," "Neutral" or "Low," depending on whether the measure is above, equal to or below the MP&M median, respectively, for each sector. The medians are calculated on all 15 MP&M sectors, including the 8 Phase II sectors.

Table 3-7: Summary of Structural Analysis of Cost Pass-Through Potential

Sector	Concentration Ratio	Specialization Ratio	Import Penetration	Export Dependence	Growth	Profit
1. Hardware	Low	Low	High	High	Neutral	Low
2. Aircraft	Low	Low	High	Low	High	Low
3. Electronic Eq.	Low	High	Low	Neutral	High	Neutral
4. Stationary Ind. Eq.	Low	Neutral	Neutral	Low	Low	Neutral
5. Ordnance	High	Low	High	Low	Low	High
6. Aerospace	Neutral	High	High	High	High	Neutral
7. Mobile Ind. Eq.	Low	High	Low	Low	Low	High

Source: Abt Associates Inc.

Table 3-8 presents the results from the second part of the cost pass-through analysis. While the structural measures in Table 3-7 indicate what range of cost pass-through ability each sector *ought* to have, based on theory, Table 3-8 indicates what range of cost pass-through ability each sector has actually experienced historically. The estimated historical elasticities are the percentage change in output price per percentage change in input prices, estimated over the period 1982 to 1991 by linear regression. Higher values correspond to higher average abilities to pass-through cost increases. The range of estimated elasticities is divided into three equal parts. In Table 3-8 each sector is categorized as "High" if its estimated historical elasticity falls into the top third of the range, "Neutral" if it falls into the middle third, and "Low" if it falls into the lower third of the range of estimated historical elasticities.

Table 3-8: Estimated Historical Elasticity Values and Assigned Elasticity Score for MP&M Phase I and Phase II Sectors				
Sector		Estimated Historical Elasticity	Rank	Historical Elasticity Score
Phase I Sectors				
1.	Hardware	0.889	14	Low
2.	Aircraft	0.924	4	High
3.	Electronic Equipment	0.899	12	Low
4.	Stationary Industrial Equipment	0.909	9	Neutral
5.	Ordnance	0.907	10	Neutral
6.	Aerospace	0.773	15	Low
7.	Mobile Industrial Equipment	0.901	11	Low
Phase II Sectors				
8.	Instruments	0.923	5	High
9.	Precious and Non precious Metals	0.938	2	High
10.	Shipbuilding	0.970	1	High
11.	Household Equipment	0.921	6	Neutral
12.	Railroad	0.911	8	Neutral
13.	Motor Vehicle	0.898	13	Low
14.	Bus and Truck	0.930	3	High
15.	Office Machine	0.920	7	Neutral
Source: Abt Associates Inc.				

The results of the structural and historical analyses are combined using a numerical algorithm detailed in Appendix B of the profile document The algorithm assigns to each sector an elasticity value that gives the expected percent change in output price associated with a one percent change in input costs. Using financial data from the Survey, these elasticities are expressed as the cost pass-through coefficients shown in Table 3-9, which are then multiplied by the share of output in each sector that is expected to be subject to effluent guidelines. This takes into account the fact that if a sector has few dischargers, then discharging facilities would have more difficulty changing prices in the face of competition from many facilities that are not affected by the effluent guidelines.

Table 3-9: Assignment of Cost Pass-Through Coefficients to MP&M Phase I Sectors		
Sector		Cost Pass-Through Coefficient
1.	Hardware	0.321
2.	Aircraft	0.964
3.	Electronic Equipment	0.958
4.	Stationary Industrial Equipment	0.366
5.	Ordnance	0.956
6.	Aerospace	0.962
7.	Mobile Industrial Equipment	0.886
Source: Abt Associates Inc.		

The estimated cost pass-through coefficients translate the compliance costs estimated by the engineering analysis into dollar values of the impact of proposed effluent guidelines on each facility analyzed under the assumption that facilities will be able to increase prices. For example, if the engineering analysis indicates that a particular facility subject to a particular effluent guideline will incur annual costs of $1,000 to meet those guidelines, the cost pass-through coefficient multiplied by $1,000 will be the estimated increase in annual revenue from price increases. The difference between the annualized costs incurred and the revenue from price increases is the actual cost burden to the facility.

Chapter 4
Facility Impact Analysis

4.1 Introduction

The facility-level economic impact analysis assesses how MP&M Phase I effluent guidelines would affect facilities and how facilities would most likely respond. The facility-level analysis provides the basis for estimating the number of facility closures and associated production and employment losses that may result from an effluent guideline for the MP&M industry.

The facility-level economic analysis draws largely from sample facility data obtained from the Survey. Facility-level data were also used in the engineering analysis to assess the costs or savings that would likely accompany facility compliance with different effluent guideline compliance options. Although these analyses are based on facility specific-data, the facilities that were analyzed represent only a small sample of the population of facilities likely to be covered by an MP&M guideline. Accordingly, these facilities are considered as model, representative facilities in the context of the overall industry impact analysis.[1] To develop analytic results that are meaningful for the overall economic impact analysis, the results from the facility analyses are extrapolated to the MP&M population based on sampling weights applied to each observation in the sample.

Based on these analyses, EPA expects that the proposed MP&M Phase I effluent guidelines are economically achievable and will not subject affected facilities to unmanageable or unreasonable financial or economic burdens.

The major sections of this chapter explain the methodology behind each component of the facility impact analyses and present the results. The first section presents an overview of the facility impact analysis

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[1]EPA examined the Metal Finishing industry, which overlaps the MP&M Phase I industry, for its Sustainable Industry Project (SIP) and found four major categories of facilities with very different propensities to close in the face of declines in financial performance and very different environmental strategies. In particular, the SIP defined a particularly problematic group of facilities ("tier 3") that accounted for a disproportionately large quantity of pollutant discharges and could not afford to invest in pollution prevention and control technologies but were deterred from closing, in spite of low or non-existent profits, by the threat of post-closure liabilities. The facility impact methodology described in his chapter includes the effect of such liabilities on closure decisions by using data from the Survey regarding such liabilities to compare with facility going-concern values in modeling the closure decision. Facility heterogeneity in pollutant discharges is incorporated by the cost-effectiveness analysis, presented in an accompanying report.

methodology. The following sections then examine in detail the methodologies for each of the component analyses that comprise the facility impact analysis: the *Baseline Closure Analysis,* the *Post-Compliance Closure Analysis* and the *Analysis of Financial Stress Short of Closure.* The chapter concludes by presenting national estimates of the facility-level impacts of various effluent guidelines alternatives.

4.2 Overview of the Facility Impact Analysis Methodology

The facility level analysis estimates financial impacts of proposed MP&M effluent guidelines on facilities. Since this analysis involves a series of component analyses (see Table 4-1), this section identifies those components and explains how they relate to one another.

Table 4-1: Summary of Facility Impact Methodology

Impact Category	Description	Analysis	Significance of Negative Finding
1. Baseline Closure	Identifies facilities that are in jeopardy of financial failure regardless of the promulgation of effluent guidelines	Two tests: 1. After-tax cash flow negative? *and* 2. Liquidation value exceed going concern value?	Facilities failing *both* tests are considered a baseline closure and excluded from subsequent analyses
2. Post-Compliance Closure	Identifies facilities that are likely to close instead of implementing the pollution prevention and treatment systems needed for effluent guidelines compliance	Two tests: 1. *Post-compliance* after-tax cash flow negative? *and* 2. Liquidation value exceed post-compliance going concern value?	Facilities failing *both* tests are projected to close as the result of regulation, a severe economic impact.
3. Financial Stress Short of Closure	Identifies facilities with limited ability to finance the pollution prevention and treatment systems needed for effluent guidelines compliance	Two tests: 1. Decline in pre-tax ROA to a level that jeopardizes access to financing? *or* 2. Decline in ICR to a level that jeopardizes access to financing?	Facilities failing *either* test are likely to experience financial weakness as the result of regulation, a moderate economic impact.

Source: Environmental Protection Agency

Three Financial Analyses

The following three sections address three groups of financial tests. Each group of tests predicts a particular facility decision.

Section 4.3, the Baseline Closure Analysis, identifies facilities that would likely choose to terminate operations in the pre-compliance environment. These are facilities that are having or will likely have serious

financial difficulties regardless of the promulgation of effluent guidelines. Attributing these financial difficulties to the guidelines rather than to these pre-existing financial problems would over-estimate the burden of those guidelines. Accordingly, facilities that failed the Baseline Closure Analysis were excluded from subsequent analyses that measure the impact of meeting effluent guidelines.

The Baseline Closure Analysis subjects facilities to two financial tests, which are detailed in Section 4.3. One examines current cash flow. The second compares the benefits of closing and liquidating the facility to the value of expected future earnings from operating the facility. Facilities that failed both tests were projected baseline closures.

Next, the Post-Compliance Closure Analysis (Section 4.4) determines if facilities that would likely choose to remain open in the baseline in the absence of effluent guidelines would likely choose to terminate operations in the face of those guidelines. The Post-Compliance Closure Analysis subjects facilities to the same two tests as in the baseline case, except that the revenues and costs now reflect changes due to compliance with effluent guidelines. Facilities that fail both tests are projected post-compliance closures.

Additionally, some facilities might choose not to close, post-compliance, but might nevertheless experience intermediate levels of financial stress. Therefore, the Analysis of Financial Stress Short of Closure described in Section 4.5 identifies those facilities whose profitability is low *or* whose interests costs are relatively high, when compared to industry norms.

Two Cost Pass-Through Assumptions

The Post-Compliance Closure Analysis and Analysis of Financial Stress Short of Closure were performed under assumptions of both zero-cost-pass-through and partial-cost-pass-through of compliance costs to customers. The zero-cost-pass-through case presents an extremely conservative assessment of regulatory impacts in that facilities are assumed to pass none of the costs of compliance through to customers. That is, both quantities and prices — and therefore revenues — for each facility's production were assumed to remain constant after compliance *even though costs increased after compliance*. Because it is likely that companies would be able to recover some of the compliance costs by increasing prices, the no-cost-pass-through case represents a conservative, worst case result of compliance.

For a more realistic assessment of impacts, EPA also analyzed the impact of regulatory options under an assumption of partial-cost-pass-through. For the partial-cost-pass-through analysis, EPA estimated the ability

of each firm to recover compliance costs from customers. The assessment of cost pass-through potential was based on an econometric analysis of historical pricing and cost trends in the MP&M industries coupled with an analysis of market structure factors that provide additional insight into the likely ability of firms to pass on higher costs to customers. Market structure factors considered in the analysis included: market power based on horizontal and vertical integration; extent of competition from foreign suppliers (both in domestic and export markets); barriers to competition as indicated by supra-normal, risk-adjusted profitability; and the long term growth trend in the industry. The analysis of pass-through potential yielded pass-through measures indicating the fraction of compliance costs that firms subject to regulation are expected to recover from customers through increased revenues. The partial-cost-pass-through analysis yielded modestly lower impacts in terms of expected facility closures and losses in employment and production.

Facility Discharge Status

Whether facilities discharge effluent streams to a publicly owned treatment works (POTW) (i.e., indirect dischargers) or directly to a waterway (i.e., direct dischargers) is relevant to the structure of the economic impact analysis because these facilities and their effluent streams are regulated under different authorities of the CWA. Indirect dischargers are subject to Pretreatment Standards for Existing Sources (PSES) while direct dischargers are subject to Best Available Technology Economically Achievable (BAT) and Best Practicable Control Technology Currently Available (BPT) requirements. For this regulation, different sets of regulatory options were considered for indirect and direct dischargers. The four PSES regulatory options were considered for indirect dischargers, and three BAT/BPT options were considered for direct dischargers. EPA performed the facility impact analyses separately for these two classes of facilities and the regulatory options that were considered for them.

Since the analytical methodology for estimating impacts on indirect dischargers is the same as for estimating impacts on direct dischargers, the following three sections will explain the methodologies without distinguishing between discharger types. Each section will describe one of the three financial analysis: the Baseline Closure Analysis, the Post-Compliance Closure Analysis and the Analysis of Financial Stress Short of Closure.

The discussions of the Post-Compliance Closure Analysis and the Analysis of Financial Stress Short of Closure will each have separate discussions of the two alternative cost pass-through assumptions. Section 4.4, for instance, will first present the methodology for estimating post-compliance closures under a zero-cost-pass-through assumption, and then separately under a partial-cost-pass-through assumption. The Analysis of Financial

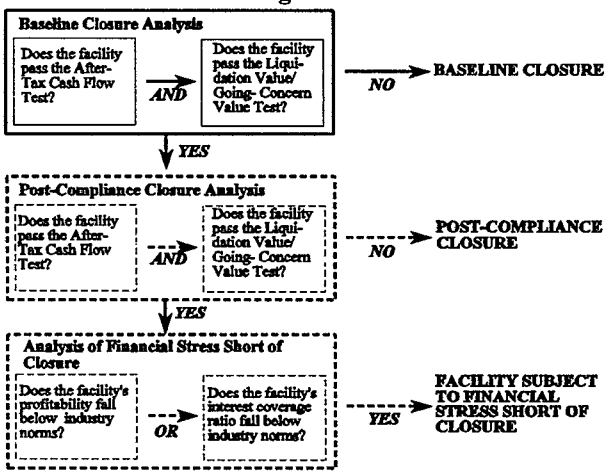
Stress Short of Closure will be divided similarly.

Finally, Section 4.7 presents the analytical findings, separately for direct and indirect dischargers. Within each discharge category, this last section presents results under each cost pass-through assumption and for each regulatory option.

4.3 Baseline Closure Analysis

In Figure 4-1, the solid lines designate the part of the facility impact analysis described in this section. The purpose of the Baseline Closure Analysis is to identify facilities that are in jeopardy of financial failure independent of the compliance costs that may be imposed by pollution prevention and control under an MP&M effluent guideline. Because these facilities were financially weak before promulgation of effluent guidelines, attributing closures or financial stress among these facilities to the guidelines would overestimate the financial impact of the guideline. Accordingly, facilities that failed this analysis were excluded from the subsequent analyses that measure the impact of compliance costs on financial performance and condition. This analysis involved two financial tests:

Figure 4-1



1. *After-Tax Cash Flow Test:* Is average after-tax cash flow negative? That is, is the sample facility losing money on a cash basis?

2. *Liquidation Value/Going-Concern Value Comparison Test:* Does the baseline liquidation value of facility assets exceed the going-concern value of the facility?[2] That is, is the facility worth more liquidated than the facility's future earnings are worth today?

[2]Based on a discounted value analysis of the facility's total cash flow, after-tax, available for capital.

The After-Tax Cash Flow Test examines whether a facility has lost money on a cash basis during the three years covered by the Survey. If the facility, on average, incurred a cash loss, then the facility's management is presumed to be under pressure to change operations or business practices to eliminate future losses. One possible change is to terminate operations at the facility. The second test examines whether that option might be financially advantageous to the facility's ownership.

The Liquidation Value/Going-Concern Value Comparison Test examines whether the liquidation value of facility assets exceeds the going concern value of the facility based on a discounted value analysis of the facility's after-tax cash flow. This test determines whether the facility is worth more in liquidation or in its current operation (i.e. as a going concern). If the liquidation value exceeded the going-concern value, then the facility is presumed to see a reward for terminating the facility's business and liquidating its assets.

If a facility failed *both* tests, then it was judged to be at risk of financial failure independent of compliance costs, and it was removed from the subsequent financial impact analysis. The requirement that the facility fail both tests means that a facility must be under pressure to consider termination of business — that is, after-tax cash flow is negative — and must also see a reward for doing so — that is, liquidation value is estimated to exceed going-concern value based on a discounted cash flow analysis. The analytic steps and interpretation for both tests are discussed below.

After-Tax Cash Flow Test

The After-Tax Cash Flow Test involves calculating, for each sample facility, the average after-tax cash flow (AATCF) over the years for which income statement data were obtained in the Survey. The calculations are as follows:

1. Express all income statement values for a sample facility in 1989 constant dollars, based on the Consumer Price Index for urban consumers (CPI-U). The Financial Accounting Standards Board recommends that public-reporting firms use the CPI-U to prepare supplemental reports that disclose the effects of changing prices on financial performance and condition[3]. The Survey requested financial data for the three years 1987-1989, and most facilities reported values for each of these years. However, a few facilities were not

[3]See *Statement of Financial Accounting Standards No. 89, Financial Reporting and Changing Prices*, December 1986, Financial Accounting Standards Board, Stamford, Connecticut.

in operation in one or more of the earlier years or accounting procedures for those years differed from those in later years. As a result, a few facilities did not report values for all three years or may have reported values for one or more later years, 1990 or 1991. Data for any of the years reported is deflated[4] to 1989.

2. Compute after-tax cash flow in 1989 dollars for each year of data. *After-Tax Cash Flow* (ATCF) was computed as follows:

$$ATCF = E + D$$

or,

$$ATCF = [REV - (TC + I + D + T)] + D = REV - TC - I - T$$

where:

E = Earnings or after-tax income;

D = Depreciation;

REV = Revenue;

TC = Total Costs, including Operating Costs and Fixed Costs

I = Interest

T = All Income Taxes.

3. Compute *Average After-Tax Cash Flow* (AATCF) over the number of years of data that are available for a facility. The average value of ATCF was computed as a simple arithmetic average. For example, if a facility reported data for 1987, 1988 and 1989, the three values for ATCF indexed to 1989 were arithmetically averaged to yield AATCF at 1989.

If the facility, on average, incurred a cash loss over the number of years of reported data (i.e., AATCF < 0), then the facility's management and ownership is presumed to be under pressure to change operations or business practices to eliminate future losses. One possible change is to terminate operations at the facility. Whether it may be financially advantageous to the facility's ownership to terminate facility operations is the subject of the next financial test.

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[4]Deflation is the term for expressing nominal values in constant dollar equivalent values, regardless of whether the deflator is less than or greater than 1. In most cases, deflators for years earlier than 1989 are greater than 1.

Liquidation Value/Going-Concern Value Comparison Test

The second part of the test compares two facility-level values calculated from Survey data: (1) a liquidation value and (2) the discounted value of total cash flow, after-tax, available for capital. The financial issue underlying these calculations and comparison is whether the facility is worth more in liquidation or in its current operation (i.e., as a going concern).

Calculation of Liquidation Value

Question 6 of the economic Survey requested data needed to calculate liquidation value. Specifically, assuming a three-year liquidation process, facilities were asked to estimate market values for the following asset categories: buildings and land, other fixed assets, inventories, and other working capital (net of inventories). The Survey also asked for estimates of two types of liquidation costs. These liabilities include closure costs — costs that occur because of closure and that are incurred during closure — and *post-closure costs* — costs that occur because of closure but that are incurred after closure. Thus, the concept of liquidation value requested in the Survey is that of the gross market value of facility assets less extraordinary liabilities that occur because of liquidation. Three adjustments were required to use the liquidation value in the economic impact analysis, as follows:

1. Deflate liquidation value estimates to 1989. To put the comparison of liquidation value and cash flow-based values on a consistent, constant dollar basis, the liquidation value estimates were deflated from 1991, the time at which Survey data were requested, to 1989 using CPI-U.

2. Adjust for tax losses or gains on liquidation of facility assets. Because the liquidation value of the facility is compared with a going-concern value based on *after-tax* cash flow, the calculated liquidation value is netted for the tax cost (or benefit) resulting from capital gains (or losses). This adjustment was made by first subtracting the book values of assets as reported in the facility's *1989* balance sheet from the facility's reported asset liquidation values (in 1989 dollars), which yields a net gain (or loss, if negative) on the liquidation of facility assets. The extraordinary liability items accompanying liquidation were also subtracted from this value to yield a net gain (or loss) for tax purposes at facility liquidation. This value was multiplied by 0.34, the federal corporate income tax rate after $335,000 of income, to give a net tax liability (or benefit, if the value was negative) upon

liquidation. This value was subtracted from the liquidation value calculated in step 1 to give an after-tax liquidation value.

3. Adjust for a three-year distribution of receipts in liquidation. In providing estimates of liquidation value, facilities were asked to assume a three-year liquidation period to anticipate the usual lag of several years between promulgation of a rule and the deadline for full compliance. To adjust for the passage of time in liquidation, it was assumed that the net receipts from sale of facility assets would accrue in three equal installments uniformly spread over the three-year liquidation period. The first payment was assumed to occur at the middle of the first year, the second at the middle of the second year, and the third at the middle of the third year.[5] These values were discounted to the beginning of the liquidation period using the facility's estimated weighted average, after-tax cost of capital (see Appendix A of this report, titled *Calculation of Real, Weighted Average, After-Tax Cost of Capital*). The resulting value is used as the *after-tax liquidation value* in both the Baseline Closure Analysis and later in the Post-Compliance Closure Analysis.

Calculation of Going-Concern Value

The after-tax liquidation value was compared with the estimated value of the facility as a going concern to determine whether facility owners could be expected to benefit financially by terminating production and liquidating facility assets. To make the going-concern value and liquidation value comparable, they are both calculated in similar ways: both are calculated on an after-tax, total capital basis, in which going-concern liabilities are not subtracted from the liquidation value. The measure of cash flow discounted in this analysis is after-tax and includes payments available to total capital — that is, debt and equity. Correspondingly, the discounting factor — the Weighted Average Cost of Capital — also reflects the after-tax cost of all capital.

The income statement portion of each facility's Survey contains data for calculating total after-tax cash flow. *Total After-Tax Cash Flow Available for All Capital* (TATCF) is defined as follows:

$$TATCF = REV - (TC + T) = ATCF + I \qquad (1)$$

[5]Other receipt schedules are possible. However, this multi-year schedule recognizes the fact that, historically, effluent guideline are implemented so that facilities come into compliance over a period of years.

or

$$TATCF = (1-\tau) \times (REV - TC) + \tau \times (I + D) \qquad (2)$$

where:

REV	=	Revenue;
TC	=	Total Costs, including Operating Costs and Fixed Costs
T	=	All Income Taxes ($T = \tau \times [REV - TC - I - D]$);
ATCF	=	After-Tax Cash Flow (as defined above)
I	=	Interest;
τ	=	Corporate Income Tax Rate; and
D	=	Depreciation.

In expression (1), TATCF differs from ATCF only by the amount of interest payments: ATCF is after-tax cash flow *available to equity*, while TATCF is after-tax cash flow *available to all capital*. Interest expense is not adjusted for taxes when it is added back to the ATCF expression because the cash flow available for all capital includes the total amount of interest payments *without any adjustment for taxes*. When the equation is solved as in expression (2), the benefit of the tax shield for both depreciation and interest is explicitly apparent.[6] Computation of TATCF involves comparable steps to those outlined above for ATCF, namely:

1. Deflate income statement values to 1989.

2. Compute TATCF in 1989 dollars for each year of data.

3. Compute average total after-tax cash flow (ATATCF) over the number of years of data which are available for a facility.

The going-concern value for the facility was calculated by discounting TATCF over a fifteen-year period using the facility's estimated real (i.e., excluding the effects of inflation), weighted average, after-tax cost of capital (RWACC). Fifteen years was used as the length of the discounting period because compliance-related

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[6]For a theoretical exposition of this method of cash flow analysis and valuation, see Haley, Charles W. and Schall, Lawrence D., *The Theory of Financial Decisions*, McGraw-Hill, 1979, pp. 208-217, 323-332, and 344-352.

investments are expected to have a useful life of at least 15 years. At the same time, extending the discounting period beyond 15 years would have had little effect on the estimated going-concern values as discounting progressively reduces the contribution of out-year values to the calculated present value. The cost of capital is the expected total payment required by providers of the firm's capital for financing the firm's assets and is calculated from a combination of Survey data, firm-level data obtained from public financial statements, and financial and economic data obtained from federal government publications and other secondary sources (see Appendix A, titled *Calculation of Real, Weighted Average, After-Tax Cost of Capital*).

The going-concern value of the facility is calculated as follows:

$$PV(TATCF) = \sum_{t=0}^{N-1} \frac{TATCF_t}{(1 + RWACC)^t}$$

where:

PV(TATCF) = The *Present Value of After-Tax Cash Flows Available for All Capital*, or the estimated value of the facility as a going concern; and

N = The number of years of cash flows analyzed.

RWACC = Real Weighted Average Cost of Capital

Comparing Liquidation and Going-Concern Values

To complete the second test of baseline facility viability, the estimated after-tax liquidation value for the facility was compared with the going-concern value. If the liquidation value exceeded the going-concern value, then facility ownership is presumed to see a reward for terminating the facility's business and liquidating its assets.

Combining the Tests to Determine Baseline Closures

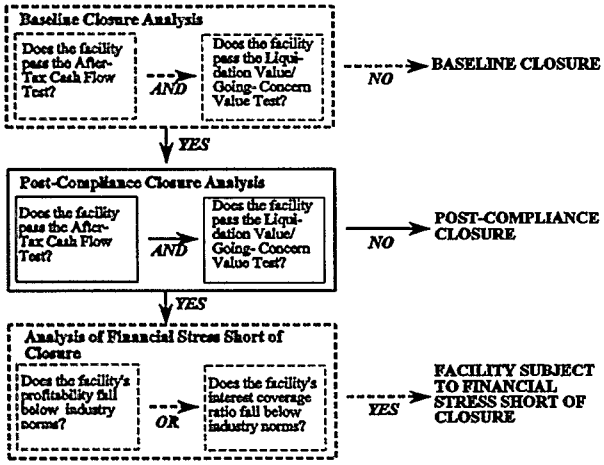
If a facility failed both tests, then it was presumably in jeopardy of financial failure independent of the promulgation of MP&M effluent guidelines and was excluded from further consideration. Failure of the after-tax cash flow tests means that the facility is incurring a cash loss and is thus under financial pressure to alter its business to prevent future losses. Failure of the liquidation value/going-concern value test means that facility ownership would benefit financially by terminating operations and liquidating facility assets. The combination

of these two circumstances leads to the expectation that facility management and ownership may decide to cease business at the facility independent of the application of an MP&M guideline.

4.4 Post-Compliance Closure Analysis

The previous Baseline Closure Analysis evaluates each facility's financial and operating condition prior to incurring costs for meeting effluent proposed guidelines and identifies those facilities that are projected to close even in the absence of such guidelines. The post-compliance financial viability analysis, described in this section, identifies facilities that are likely to terminate MP&M operations and liquidate assets after effluent guideline promulgation rather than invest in compliance with the regulation. In Figure 2, solid lines denote the Post-Compliance Closure Analysis, while broken lines denote the other parts of the facility impact analysis. Facilities that pass the baseline test but fail the post-compliance test are projected closures *due to the effluent guidelines.*

Figure 4-2



The Post-Compliance Closure Analysis is *identical* to the Baseline Closure Analysis, *except* that the after-tax cash flow amounts used in the After-Tax Cash Flow test and the Liquidation-Value/Going-Concern Comparison Test are adjusted to reflect the annual cash outlays for financing and operating the pollution prevention and treatment systems needed to comply with an MP&M guideline.

The adjustments to cash flow reflect the annualized costs of purchasing and financing equipment to comply with the alternative regulatory options and include allowances for the cost of debt and equity financing. In addition, the cash flow adjustments reflect the annual costs incurred by facilities for operating and maintaining the pollution prevention and treatment systems needed for compliance. The capital cost and operating and maintenance costs that underlie these cash flow adjustments were estimated by EPA on the basis of engineering studies at sample MP&M facilities.

As in the Baseline Closure Analysis, the post-compliance analysis requires two tests:

1. As the result of the financial effects of compliance, would after-tax cash flow to equity become negative?

2. As the result of the financial effects of compliance, would the baseline liquidation value of facility assets exceed the discounted value of the facility's total cash flow, after-tax, available for capital? That is, will the facility be worth more in liquidation than as a going concern?

Again, the facility must fail both tests to be judged as likely to terminate MP&M operations rather than undertake the investments needed for pollution prevention and control. The logic underlying the two tests is the same as that outlined above. Failure of the cash flow test means the facility would lose money on its operations after compliance and thus be under pressure to consider termination of business. Failure of the liquidation/going-concern value analysis means that management would perceive a financial benefit from terminating operations instead of undertaking compliance-related investments. Taken together, these analyses are meant to simulate the compliance decision-making process of a facility's management.

Both of the *post-compliance* tests were considered under two assumptions. The first, and extremely conservative assumption, is that the facility could pass none of the cost increases resulting from compliance activities onto its customers. While firms are historically able to pass on at least some cost increases to customers, this zero-cost-pass-through assumption is well-defined, easy to measure precisely and methodologically robust.

If a facility did *not* fail the analysis under this *zero-cost-pass-through* assumption, then the facility was presumed to not be a candidate for closure as the result of an MP&M guideline. If the facility failed the analysis under the zero-cost-pass-through assumption, then the analysis was performed under the second, more realistic assumption that the facility could be expected to pass on some of its compliance costs to customers. If the facility failed this less stringent, *partial-cost-pass-through* assumptions, then the facility was judged as a candidate for closure as the result of an MP&M guideline (see *Appendix B, Analysis of Cost Pass-Through Potential for MP&M Industry Sectors*, of the companion document, *Industry Profile for the MP&M Industry (Phase I),* for a detailed explanation of the concepts and methodology underlying the partial cost pass-through analysis case).

This chapter presents results under both the partial-cost-pass-through and zero-cost-pass-through scenarios. However, to present worst-case results, analyses in the following chapters, which address other types of impacts, are based on the extremely conservative zero-cost-pass-through assumption.

After-Tax Cash Flow Test

Post-compliance cash flow was calculated using the same basic formulation as for pre-compliance cash flow but with the addition of costs resulting from compliance. Specifically, the relevant formulation for pre-compliance cash flow is as follows:

$$ATCF = REV - (TC + I + T)$$

$$\text{with } T = \tau \times (REV - TC - I - D)$$

and, therefore,

$$ATCF = (1 - \tau) \times (REV - TC - I) + (\tau \times D)$$

where:

REV = Revenue;

TC = Total Costs, including Operating Costs and Fixed Costs

I = Interest;

T = All Income Taxes;

τ = Corporate Income Tax Rate; and

D = Depreciation.

Adding the post-compliance adjustments, the post-compliance formulation is as follows:

$$ATCF_{pc} = (1 - \tau) \times [(REV + \underline{\Delta REV}) - (TC + \underline{\Delta C}) - (I + \underline{\Delta I})] - \underline{P} - \underline{E} + [\tau \times (D + \underline{\Delta D})]$$

where:

$ATCF_{pc}$ = Post-compliance cash flow (in the calculation, the *average of cash flow values, AATCF,* is used as the basis for adjustment);

ΔC = Operating (and Monitoring) Costs of Compliance

P = Annual principal payment on the debt used to finance compliance capital outlays;

E = Annual allowance for cost of equity capital used to finance compliance capital outlays;

Δ signifies the change in the value for a variable due to compliance;
All other variables are defined as before.

The changes in the expression, relative to the pre-compliance case, are indicated by ***underlined, bold-faced italics.***

In this formulation, the change in revenue (ΔREV) is zero except in the partial-cost-pass-through analysis. As noted above, the analysis was first conducted for each facility using the zero-cost-pass-through assumption. That is, both quantities and prices — and therefore revenues — for each facility's production were assumed to remain constant after compliance *even though costs were increased on the basis of the estimated equipment and operating costs for effluent guidelines compliance*. Because it is likely that companies would both attempt and be able to recover some of the compliance costs by increasing prices, the zero-cost-pass-through case represents a conservative, worst case result of compliance. It was necessary to relax this assumption only if a facility failed the zero-cost-pass-through analysis. In this case, the facility was analyzed under a less stringent partial-cost-pass-through assumption. The partial-cost-pass-through analysis is based on an econometric analysis of historical pricing and cost trends in the MP&M industries coupled with an analysis of market structure factors that provide additional insight into the likely ability of firms to pass on higher costs to customers. This analysis, which is documented in *Appendix B, Analysis of Cost Pass-Through Potential for MP&M Industry Sectors* in the companion document, *Industry Profile for the MP&M Industry (Phase I),* provided estimates of the fraction of compliance costs that firms subject to regulation are expected to recover from customers through increased revenues. Specifically, a cost pass-through coefficient, $\boldsymbol{\alpha}$, was developed for each facility in the analysis. When multiplied by the annual compliance cost, the cost pass-through coefficient provides an estimate of the expected change in facility revenues associated with the increased costs resulting from effluent guideline compliance costs. The partial-cost-pass-through analysis does not decompose the change in revenues into separately estimated changes in prices and output quantities.

The Operating Cost of Compliance (ΔC) is the change in costs estimated to result from operating and monitoring pollution controls adopted to comply with effluent guidelines.

The change in interest expense (ΔI) and the principal payment for debt used to finance compliance capital outlays (P) were calculated as follows:

1. Calculate the amount of the pollution control investment to be financed by debt. The investment due to the effluent guidelines — that is, equipment and, if relevant, land and buildings — was assumed to be financed by debt and equity in the same proportions as each facility's overall proportion of debt to equity. This proportion is the same as the debt

and equity weightings in the computation of the weighted average cost of capital (see Appendix A). The debt fraction of total capitalization was multiplied by the total compliance investment (TCI) outlay (capital costs of compliance, as estimated by the engineering analyses) to calculate the debt required for the compliance investment.

2. Calculate the annual interest expense resulting from the TCI-related financing. The facility was assumed to finance the TCI debt at a rate equal to the interest rate developed for the weighted average cost of capital analysis. To calculate an annual interest payment, this rate was multiplied by the debt component of the TCI financing.

3. Calculate the annual principal payment resulting from the TCI-related financing. The facility was assumed to finance the TCI debt over a 15-year period with fixed annual principal payments equal to 1/15th of the initial debt amount. The assumption of a fixed annual principal payment means that the sum of the principal payment and interest would decline successively with each principal payment (because of the decline of the outstanding principal balance on which interest is paid). Accordingly, the post-compliance cash flow equation is a *first-year* calculation when the sum of principal and interest on compliance-related financing are at their peak and thus provides a conservative treatment of the cash flow burdens resulting from the compliance-related debt financing.[7]

The preceding calculations of payments to principal and interest payments are expenditures associated with pollution control investments financed by borrowing money (financing by using debt). A business may also choose to finance some of its investments with its own money (equity financing). While the business does not pay interest on its own equity, there is still an economic cost associated with equity financing.

By using equity to finance part of an investment, a business forgoes income it could have earned by using the equity in some other way, such as by investing it in other activities. This foregone earning is the cost of equity. To recognize this cost in the financial decision analysis, an allowance for the recovery and cost of equity capital is included in the after-tax cash flow analysis.

The equity allowance is calculated as follows:

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[7]This methodology conforms with conventional business practices.

1. Calculate the amount of the compliance investment to be financed by equity. The proportion of debt to equity associated with each facility was previously used to estimate the amount of debt that the facility would choose to use to finance its pollution control investments. The remaining amount of TCI, not financed by debt, is the amount financed by equity.

2. Calculate the level annual payment required to recover the equity capital and the associated cost of equity over a 15-year period. A 15-year time horizon, the same period for depreciating the TCI and for financing the compliance capital debt, is used as the period over which the equity capital and its equity cost are to be recovered. The equity capital is charged at the nominal cost of equity developed for the weighted average cost of capital analysis (see appendix). The annual charge is based on the standard level payment amortization formula, as summarized below. Note that no adjustment for taxes appears in the calculation for, or use of, the allowance for cost of equity capital; all payments to equity are made from after-tax cash flow.

$$E = \frac{eq \times TI}{\left[\frac{1-(1+e)^{-N}}{e}\right]}$$

E	=	Annual allowance for cost of equity capital
eq	=	Equity fraction of compliance investment;
TI	=	Treatment investment
e	=	Nominal cost of equity capital;
N	=	Number of years of capital recovery (15 in current analysis)

The change in depreciation (ΔD) was calculated as the straight-line depreciation of TCI outlays over a 15-year recovery period.[8] For this analysis, all capital outlays except for land are assumed to be depreciable for tax purposes.

The changes in variable values were used to compute an $AATCF_{pc}$ (average $ATCF_{pc}$) using the arithmetic average of pre-compliance, constant dollar after-tax cash flows for each facility. The after-tax cash flow test is as before. If $AATCF_{pc}$ was found negative, the facility was assumed to seek to avoid the cash losses that will prospectively accompany compliance. If, at the same time, it is financially advantageous for the facility to terminate its operations (i.e., liquidation value exceeds going-concern value) then the facility was assumed to do so. Note that this latter condition could be met without recalculating the liquidation value/going-concern value analysis on a post-compliance basis *if liquidation value exceeded going-concern value in the baseline analysis.*

Liquidation Value/Going-Concern Value Comparison Test

This test was also based on the same formulations as outlined for the Baseline Closure Analysis with the difference that the incremental effects of compliance were included in the analysis. The After-Tax Liquidation Value, as discussed in the Baseline Analysis, was calculated independently of compliance considerations and is thus the same value used for the post-compliance analysis. Therefore, the following discussion describes only the incremental changes in the calculation of going-concern value for the facility.

As discussed previously, the going-concern value for the facility was calculated by a discounting analysis based on Total After-Tax Cash Flow Available for All Capital (TATCF). The formulation of TATCF on a pre-compliance basis was as follows:

$$TATCF = (1-\tau) \times (REV - TC) + \tau \times (I + D)$$

where:

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[8]It would have been possible to calculate depreciation using the Modified Accelerated Cost Recovery System (MACRS) schedules specified in the current U.S. Tax Code. The MACRS schedules provide an accelerated write-off of capital outlays in which the fraction of a depreciable outlay that may be charged against taxes in early years generally exceeds the fraction chargeable in later years. In addition, the recovery periods under the MACRS schedules are generally less than the class lives and expected useful lives of the depreciable property. Thus, the MACRS schedule would generally provide a greater present value of the write-off of depreciable property against taxes than indicated by the straight-line method. However, the 15-year straight-line method used here was considerably simpler to implement for the single-year formulation and moreover it provides a more conservative treatment of the tax benefit provided by depreciation. It is highly doubtful that the difference in depreciation accounting would have made any difference in the findings from this analysis.

τ	=	Corporate Income Tax Rate;
REV	=	Revenue;
TC	=	Total Costs, including Operating Costs and Fixed Costs
I	=	Interest
D	=	Depreciation.

In adjusting this expression for the post-compliance analysis of total after-tax cash flow, two kinds of cash flow were accounted for:

1. At the time the facility implements the pollution controls required to comply with an MP&M guideline, the facility makes an outlay in the amount of the treatment investment (TCI, Total Compliance Investment). For the discounting analysis, this outlay is assumed to occur at time zero.

2. After installing the pollution controls, the facility's operating cash flows change because the facility operating expenses change and, in the case of the partial cost pass-through analysis, facility revenues may also change. In addition, to the extent that the facility's financing of the treatment investment involves debt, the facility will incur additional interest expense. Finally, because of the acquisition of new, probably depreciable assets, the facility may have a change in the amount of depreciation. Note that because the going-concern value analysis is based on after-tax cash flow available for *total capital* — that is equity and debt capital, interest expense is not part of the cash outlays that would be subtracted from revenues in arriving at the residual of cash flows available for payments to capital. Similarly, because depreciation is a non-cash item, depreciation would also not be subtracted from cash revenues in calculating residual cash flow. Finally, since interest expenses and depreciation are tax deductible, cash flow is increased by the sum of interest expenses and deprecation multiplied by τ, the corporate tax rate.

Accounting for these adjustments, the post-compliance total cash flow expression takes on two values as follows:

At time t = 0,

$$TATCF_{pc} = -\mathbf{TI} + (1-\tau) \times [(REV + \Delta REV) - (TC + \Delta TC)] + \tau \times [(I + \Delta I) + (D + \Delta D)]$$

and for all other periods, t = 1 ... N,

$$TATCF_{pc} = (1-\tau) \times [(REV + \Delta REV) - (TC + \Delta TC)] + \tau \times [(I + \Delta I) + (D + \Delta D)]$$

where:

$TATCF_{pc}$ = Post-compliance values for TATCF;

TI = Treatment Investment;

Δ signifies the change in a variable's value resulting from compliance with MP&M effluent guidelines. All other variables are defined as in the baseline analysis.

All variable values were calculated in the same way as outlined above in the discussion regarding analysis of post-compliance after-tax cash flow. $TATCF_{pc}$, exclusive of the compliance capital outlay, was calculated by first computing the adjusted TATCF values for each year for which facility data are available. These yearly post-compliance TATCF values were then averaged to generate the $TATCF_{pc}$ value used in the discounted cash flow valuation of the facility as a going concern. Except in a partial cost pass-through analysis, ΔREV, the change in facility revenues, post-compliance, would be zero.

The discounting procedure is as discussed previously with the specific formulation as follows:

$$PV(TATCF_{pc}) = \sum_{t=0}^{N} \frac{TATCF_{t,pc}}{(1 + RWACC)^t}$$

where:

$PV(TATCF_{pc})$=The present value of after-tax cash flows available for capital, or the estimated value of the facility as a going concern;

N = The number of years for which cash flows are analyzed, *minus one*;

$TATCF_{pc}$ is a constant value for all periods except t = 0, when the value is reduced by the amount of the compliance capital outlay, TI, as discussed above.

As for the baseline feasibility analysis, the liquidation value and going-concern values were compared. If the liquidation value exceeds the going-concern value, then the facility presumably gains financially by terminating operations instead of undertaking the facility improvement program required for compliance. As with the After-Tax Cash Flow test, the analysis was first conducted under the zero-cost-pass-through assumption. If a facility's liquidation value exceeded its going-concern value under this worst case assumption, then the analysis for that facility was performed under the less stringent, partial-cost-pass-through assumption. Only if the facility failed this less stringent test would it be deemed to have failed the Liquidation Value/Going-Concern Value Comparison Test and be a possible candidate for closure as a result of effluent guideline compliance costs.

Combining the Tests

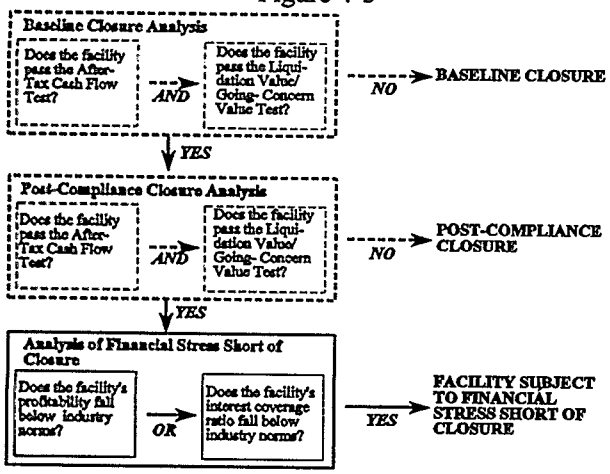
If a facility fails both the After-Tax Cash Flow and Liquidation Value/Going-Concern Value Comparison tests, then the facility was judged to be a candidate for closure and liquidation of assets as the result of the costs of an MP&M guideline. The facility's ownership is financially better off by avoiding future losses in operating cash flow and taking the financial gain expected in liquidation. A facility need only fail one test incrementally as the result of MP&M compliance to be judged a candidate for closure *if the facility had already failed the other test in the baseline analysis*. This is likely to occur when the facility has a liquidation value that exceeds going-concern value in the baseline analysis but still has positive cash flow. If, as the result of compliance, after-tax cash flow was expected to become negative, the facility would meet the second condition for failure.

4.5 Analysis of Financial Stress Short of Closure

The third financial impact test, the Financial Stress Analysis, identifies facilities might have difficulty financing the investments associated with an MP&M guideline. Figure 4-3 places this portion of the facility impact analysis in context by denoting it with solid lines. This analysis was undertaken only for those facilities that remain open. Facilities that fail the Moderate Impacts Analysis may experience a financial impact that is less severe than closure as the result of efforts to comply with an MP&M guideline. However, they may incur significant financial stress from undertaking compliance-related investments and/or incurring the operating cost burdens of compliance. Financing assistance might be required from the parent firm or through an equity infusion or other financial restructuring. These facilities or firms are projected to become among the poorer, but still viable, financial performers in an industry. Although they are not projected to fail or otherwise terminate operations directly due to the MP&M effluent guidelines, the deterioration in their financial performance could leave them more vulnerable to other factors in their business environment.

The Financial Stress Analysis examines whether the facility can afford the investments associated with effluent guideline compliance. It is based on two measures of financial performance: pre-tax return on assets (PTRA) and the interest coverage ratio (ICR). These rank among the more important criteria that creditors and equity investors review to determine whether and under what terms to provide financing to a firm. The PTRA and ICR also provide insight into the ability of firms to generate funds for compliance investments from internally generated equity — that is, from after-tax cash flow. In this analysis, the two measures are evaluated against industry norms obtained from secondary sources. These measures were defined as follows:

Figure 4-3



- Pre-Tax Return on Assets (PTRA) (net operating income divided by total assets): a measure of the profit performance of a firm's capital assets, independent of the effects of tax and financial structure. PTRA is perhaps the single most comprehensive measure of a firm's economic and financial performance (for credit analysis in particular). Interest payments are made from pre-tax income. PTRA provides information about the quality of management, the competitive position of a firm within its industry, and the economic condition of the industry in which the firm competes. If a firm cannot sustain a competitive PTRA on a post-compliance basis, it will probably have difficulty financing the treatment investment, whether financing is to be obtained as debt or equity, or, more likely, a blend of the two.

PTRA = COI / TA

with

COI = REV - TC

and, therefore

PTRA = (REV - TC) / TA

where:

PTRA = Pre-tax return on assets;

COI = Cash income from operations;

REV = Revenue;

TC = Total Costs

TA = Total assets.

- Interest Coverage Ratio (ICR) [*pre-tax and pre-interest* income (cash operating income) divided by interest expense]: a measure of a firm's ability to service its contractual financial obligations on the basis of current, ongoing financial performance. If a firm's operating cash-flow does not comfortably exceed its contractual payment obligations, then investors and creditors will be concerned that any decline in sales or increase in costs may: (1) sharply reduce or eliminate returns to the equity owners of the firm, and/or (2) prevent the firm from meeting its contractual payment obligations. In the first case, earnings might fall or become negative, with a consequent reduction or elimination of dividends and/or reinvested earnings. The market value of the firm's equity could also fall, causing a capital loss to investors. In sum, the greater the ICR, the greater will be the firm's ability to meet interest payments and, generally speaking, the greater the firm's credit-carrying ability. ICR also provides a measure of the amount of cash flow available for equity after interest payments.

ICR = COI / I

with

COI = REV - TC

and, therefore

ICR = (REV - TC) / I

where:

ICR = Interest coverage ratio;

COI = Cash income from operations;

I = Interest expense.

When these measures are calculated taking account the cash effects of compliance with MP&M effluent guidelines, they indicate a facility's ability to obtain the financing. Facilities whose values for these measures fall below accepted industry norms may have difficulty in obtaining financing from *external* providers of capital. In addition, low PTRA and low ICR indicate a decreased ability to generate cash internally (after meeting current obligations) for equity financing.

Adjusting for the effects of MP&M compliance costs, the two measures are as follows:

$$PTRA_{pc} = \frac{[(REV + \Delta R) - (TC + \Delta TC)]}{(TA + TI)}$$

and

$$ICR_{pc} = \frac{[(REV + \Delta R) - (OC + \Delta FC)]}{(I + \Delta I)}$$

where:

$PTRA_{pc}$ = Pre-tax return on assets, post-compliance;

ICR_{pc} = Interest coverage ratio, post-compliance;

TI = Treatment investment (assuming all of the front-end outlay would be capitalized and reported as an addition to assets on the balance sheet);

Δ signifies the change in the value for a variable due to compliance.

All other variables are defined as before.

The incremental values for revenues, expenses, and interest were calculated in the same way as described for the previous analyses of the Facility Financial Decision. As before, the incremental revenue effect (ΔR) was assumed to be zero for the more conservative zero-cost-pass-through analysis. If a facility met the tests under this assumption, then analysis was not required under the partial cost pass-through case. However, if a facility failed one or both of the tests in the zero-cost-pass-through case, then the measures were recalculated under the less stringent partial-cost-pass-through assumption.

To determine whether a facility's values for PTRA and ICR were so low as to indicate difficulty in financing treatment equipment outlays, the values were compared with industry norms derived from data reported in Robert Morris Associates *Annual Statement Summaries* (RMA).[9] Specifically, facility PTRA and ICR values were compared with the lowest quartile (i.e., 25th percentile) value for the respective financial measures as calculated from RMA data for the relevant industries. The RMA-based threshold values shown in Table 4-2 were calculated from data over the period 1985-1992 (see *Appendix B, Summary of Threshold Values for Evaluating Facility Financing Feasibility*). Facilities with a post-compliance PTRA *or* ICR less than the 25th percentile value were judged likely to experience difficulty in financing treatment system investments. Because both measures are judged to be critically important to financial success and ability to attract capital, failure with regard to either measure alone was deemed adequate for the impact determination.

Table 4-2: Thresholds for Financial Stress Short of Closure

Sector	Pre-Tax Return on Assets	Interest Coverage Ratio
1. Hardware	2.82%	2.10
2. Aircraft	2.86%	2.11
3. Electronic Equipment	1.51%	1.89
4. Stationary Industrial Equipment	3.09%	2.15
5. Ordnance	2.86%	2.11
6. Space	2.86%	2.11
7. Mobile Industrial Equipment	1.86%	1.76

Source: Environmental Protection Agency

4.6 Aggregating and Extrapolating Facility-Level Results to the Population of Facilities Expected To Be Subject to Regulation

The financial analyses discussed in the preceding sections are based on the sample of MP&M industry facilities on which financial and technical data were obtained through the Survey. Using results from these analyses to assess the aggregate impacts of effluent guideline for the MP&M Phase I industry group requires extrapolating these sample facility results to the industry population. The extrapolation is done with sample weights that were developed on the basis of the sample design.

The Surveys were sent to a stratified random sample of facilities in the industry groups that will be subject to the MP&M effluent guideline. The sample was designed to cover all industry groups subject to

[9]RMA provides financial statistics based on bank credit reports from public-reporting and non-public-reporting firms in a variety of industries.

regulation while taking account of the expected variance in facility characteristics within the separate industry groups or sampling strata. To gain a relatively similar level of statistical precision in the descriptive information obtained about each of the separate 4-digit SIC industry groups[10], the sample design specified a varying number of observations over the sampling strata. In general, the higher the expected variance within a sampling stratum, the greater the number of observations needed to achieve a similar level of statistical precision across sampling strata of unequal variances.

Because of these sample design considerations, the sampling weights that are used to extrapolate results from the facility to the industry population vary among the industry groups that were the basis for the sampling strata. In essence, the sampling weight indicates the number of facilities in the underlying population that a sample facility represents. Therefore, to extrapolate and aggregate the facility-level results to the level of the MP&M industry groups required treating each facility as a model unit that represents the number of facility units in the 4-digit industry group indicated by its sampling weight (*Appendix __, Sample Design and Resulting Facility Sample Weights* explains the sample design and resulting sampling weights used for the aggregate impact analysis).

Sample weights were used to extrapolate and aggregate facility-level results to the level of the seven Phase I MP&M sectors and to the MP&M Phase I industry group in aggregate. In addition, the weighted results were used to aggregate and analyze results according to other facility characteristics. For example, for the small business impact analysis, facilities and their associated impact findings were scrted according to facility size criteria to permit analysis of whether small businesses would be expected to incur a disproportionate share of the impact burden resulting from the MP&M effluent guideline.

Key analytic results that were extrapolated and aggregated to the MP&M Phase I sector and total industry group level include:

- <u>Fraction and aggregate number of facilities that were identified as failing the Baseline Closure Analysis.</u> These facilities were assessed as being in such poor financial condition *before compliance with the MP&M guideline* as to be in significant jeopardy of closure independent of effluent guidelines.

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[10]While the sample was designed around 4-digit SIC industries, this analysis aggregates the results to the seven MP&M Phase I sectors for reasons described in the statistical appendix.

- Fraction and aggregate number of facilities that were identified as failing the Post-Compliance Facility Financial Viability Analysis. These facilities were assessed as being likely to close or otherwise terminate MP&M operations instead of comply with the costs of the MP&M guideline.

- Fraction and aggregate number of facilities that were identified as failing the Financial Stress Analysis. These facilities were assessed as being likely to encounter significant financial difficulties short of closure in their efforts to finance the treatment system costs of the MP&M guideline.

In addition, for each of these categories of analytic findings, the facility weights and other relevant data from the Surveys were used to project:

- Total revenues or value of shipments affected. That is, what are the gross values of shipments or revenues, and fractions within the MP&M industry sector and total industry group, that fell in the different impact categories? In particular, the value of shipments associated with the failures of the Post-Compliance Closure Analysis is the estimated total loss in domestic shipments resulting from compliance with the MP&M guideline. This makes the extremely conservative assumption that other facilities would not increase production.

- Total employment affected. The estimated numbers of employees affected is based on the employment intensity of production (i.e., number of employees and labor-hours per dollar of revenue) in the model facilities falling in the different impact categories.

- Total annualized cost of compliance. The annual cost of compliance experienced by MP&M facilities is measured by the impact of capital and operating compliance costs on an annualized, after-tax measure of cash flow that reflects private costs of capital and the expected tax treatment of capital outlays and annual expenses.

- Total capital and operating cost burden to the economy from effluent guideline compliance. Total capital cost and operating costs for compliance were aggregated to the MP&M total industry and sector levels *for those facilities that are expected to achieve compliance and*

remain in business — that is, the segment of the industry that fails neither the Baseline Closure Analysis nor the Post-Compliance Closure Analysis. The total estimated capital costs were annualized over a 15-year recovery period at the real private opportunity cost of capital of seven percent as specified by the Office of Management and Budget. The sum of the total annual operating costs and the annualized capital costs represents the total annual cost burden to the economy of the MP&M guideline.

These results were extrapolated and aggregated to the MP&M total industry and sector levels for both the *zero-cost-pass-through* and *partial-cost-pass-through* economic impact assumptions.

The zero-cost-pass-through analysis assumes that facilities and firms affected by the MP&M guideline must absorb all of the increased capital and operating costs resulting from effluent guideline compliance *with no change in product prices*. In addition, no attempt was made in the analysis to redistribute any of the lost production to the facilities that remain in operation in the industry. Accordingly, the *zero-cost-pass-through* analysis provides a highly restrictive, worst-case estimate of the possible economic impact of the MP&M effluent guideline. This is a methodology that yields robust numerical results that are protective of the regulated industry.

The less restrictive *partial-cost-pass-through* analysis provides a more realistic assessment of how producers and consumers may be expected to respond to the promulgation of MP&M effluent guidelines. Producers are expected to attempt recovery of compliance costs by increasing the prices they charge consumers. As the result of such price increases, the affected industry will move to a new supply and demand equilibrium in which unit prices are likely to be higher and the total quantity of production lower relative to the equilibrium conditions without implementation of the effluent guideline.[11] In contrast to the relatively pessimistic *zero-cost-pass-through* case, the *partial-cost-pass-through* case probably represents a more realistic approximation of the *longer-term* market equilibrium solution that would result in the MP&M subject industries. This conclusion

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[11]This discussion speaks of the market adjustment process as though all changes occur against a static backdrop for other supply and demand considerations. In fact, other market conditions are constantly changing and the pre-regulation equilibrium is itself a dynamic event with each industry's output and prices in an essentially perpetual state of equilibrium-seeking adjustment. Accordingly, the changes in prices and quantities *resulting from regulation* should be thought of as the changes relative to the future path of *equilibriums* that would otherwise have prevailed in the marketplaces for the goods and services of the MP&M industries. In this light, the observation that an industry may produce less of a given good or service does not mean necessarily that the industry will produce absolutely less than it did before regulation. Rather, with continued growth in the domestic and international economies, the affected industries are more likely to continue growth but, perhaps at a lower rate, during the period of regulatory adjustment.

is based in large part on the way in which the cost pass-through elasticities were estimated — that is, the elasticity values that are the basis of the *partial-cost-pass-through* coefficients were estimated from relatively long-term cost and price series for the subject industries.

In this analysis, the market adjustment to the costs of regulation is analyzed by using *partial-cost-pass-through* coefficients that indicate the fraction of compliance costs that affected producers are expected to recover from customers through higher *prices*. The analysis for each sample facility assumes that the pre-compliance quantity of production remains unchanged and that prices increase by the amount indicated by the estimated *partial-cost-pass-through* coefficients. Accordingly, the change in *revenue* for each sample facility is proportional to the indicated change in price. However, in the aggregate analysis that is based on extrapolation of sample results to the total MP&M population and various sub-aggregations, the total quantity of production in the affected industries is allowed to vary. Specifically, the estimated closure of facilities and the associated losses in shipments, employment, and value of production activity provide an estimate of the impact of compliance costs on the aggregate production equilibrium for the affected industries. To summarize, the new industry equilibrium of production quantities and pricing is assumed to be accomplished by the joint effects of (1) the changes in pricing as estimated from the partial-cost-pass-through analysis, (2) the exit of facilities from the industry because of adverse financial results, and (3) the associated loss in production, as estimated from the results of the Post-Compliance Closure Analysis. Note that production quantities at those facilities remaining in the industry are assumed to not change — neither from the effect of "own" consumer response to their increased prices *nor* from the possible reallocation of some demand that previously was served by those facilities that are assumed to exit the industry.

4.7 Estimated Facility Economic Impacts

The findings from the facility impact analysis are summarized below.

Baseline Closure Analysis

The estimated baseline closures for both indirect and direct discharge facilities are summarized in Table 4-3. Of the estimated 10,601 discharging facilities, 13.9 percent or 1,471 facilities were assessed as baseline closures from the financial analyses outlined above. The 1,471 baseline closures include 1,413 indirect dischargers, or 16.2 percent of indirect dischargers, and 58 direct dischargers, or 3.1 percent of direct dischargers.

Table 4-3: Summary of Baseline Closure Analysis	Total	Indirect Dischargers	Direct Dischargers
Facilities in Analysis	10,601	8,706	1,895
(dischargers only)	100.0%	82.1%	17.9%
Baseline Failures	1,471	1,413	58
(percent failing in class)	13.9%	16.2%	3.1%
Facilities in Analysis	9,130	7,293	1,837
(percent in class)	86.1%	83.8%	96.9%
Source: Environmental Protection Agency			

Post-Compliance Closure Analysis

Findings from the Post-Compliance Impact Analyses are summarized below. Findings are presented first for the PSES options considered for indirect discharging facilities, and then for the BAT/BPT options considered for direct discharging facilities. A third section presents aggregate findings for the proposed PSES and BAT/BPT options for both discharger classes. The expected impacts of compliance in terms of estimated total capital cost and total annual costs are also summarized. In addition, the numbers of facilities expected to incur financial stress short of closure (moderate impacts) are also presented.

The analyses of Post-Compliance Closure and Financial Stress Short of Closure were performed under assumptions of both zero-cost-pass-through and partial-cost-pass-through of compliance costs to customers. That is, both quantities and prices for each facility's production were assumed to remain constant after compliance, even though costs increased on the basis of estimated equipment and operating requirements for effluent guideline compliance. Because companies would likely recover some of the compliance costs by increasing prices, the zero-cost-pass-through case represents an extremely conservative, worst case assessment of the effect of proposed regulations.

4.7.1 Indirect Dischargers

For indirect discharging facilities, EPA analyzed the impacts of five possible PSES regulatory options — Options 1, 2, 3, 1A and 2A. The estimated facility-level impacts associated with each regulatory option are discussed below and presented in Table 4-4.

Table 4-4. Estimated Impacts of Regulatory Compliance, Indirect Dischargers (dollar values in $000, 1989)					
	Options Originally Considered for Proposal			Subsequent Options	
	Option 1	Option 2	Option 3	Option 1A	Option 2A*
Facilities in Analysis	7,293	7,293	7,293	7,293	1,792
Zero-Cost-Pass-Through Analysis					
Severe Impacts (closing facilities)					
Number of Facilities	161	151	227	151	7
Percent of Class	2.20%	2.07%	3.11%	2.07%	0.39%
Employment (FTEs)	3,001	2,354	18,215	2,354	540
Value of Shipments	$316,939	$202,031	$2,013,307	$202,031	$114,509
Moderate Impacts (financial stress short of closure)					
Number of Facilities	42	124	184	54	12
Financial Impacts in Complying Facilities					
Capital Cost	$235,374	$372,345	$1,002,541	$373,127	$299,428
Total Annual Compliance Cost					
Tax-adjusted†	$172,491	$182,232	$525,311	$178,059	$121,585
No adjustments‡	$231,296	$228,330	$668,824	$221,887	$146,050
Partial-Cost-Pass-Through Analysis					
Severe Impacts (closing facilities)					
Number of Facilities	91	52	160	82	7
Percent of Class	1.25%	0.72%	2.20%	1.12%	0.39%
Employment (FTEs)	1,714	892	7,710	1,068	540
Value of Shipments	$279,162	$151,711	$735,140	$164,254	$114,509
Moderate Impacts (financial stress short of closure)					
Number of Facilities	0	41	66	12	12
Financial Impacts in Complying Facilities					
Capital Cost	$238,132	$375,372	$1,020,259	$375,885	$299,428
Total Annual Compliance Cost					
Tax-adjusted†	$173,798	$183,721	$537,334	$179,366	$121,585
No adjustments‡	$232,913	$230,184	$684,583	$223,503	$146,050

* EPA estimates that Option 2a will exempt 5,501 indirect discharging facilities from regulation.
† "Tax-adjusted" compliance costs are an estimate of the annual cash compliance cost to industry and reflect private costs of capital and expected tax treatment of capital outlays and annual expenses.
‡ Compliance costs with "No adjustments" are an estimate of the total annual cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate.

Source: Environmental Protection Agency

Impacts of Option 1, Indirect Dischargers

Zero-Cost-Pass-Through Analysis

Of the 7,293 indirect discharging facilities subject to regulation, EPA estimates that 161 facilities or 2.2 percent could be expected to close as the result of regulation. The employment and shipments losses associated with these facility closures are estimated at 3,001 full-time equivalent (FTE) positions and $317 million, respectively (all amounts in 1989 dollars). The estimates of possible facility closures and associated losses in employment and shipments are highly conservative because of the assumption of zero-cost-pass-through and because the analysis does not account for the likelihood that non-closing facilities will absorb some of the lost production and employment from closing facilities. As a result of compliance, an additional 42 facilities are expected to incur financial stress short of closure, a moderate impact. EPA estimates that MP&M Phase I industries will incur capital costs of $235 million for complying with Option 1. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $231 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $172 million.

Partial-Cost-Pass-Through Analysis

The more realistic, partial-cost-pass-through analysis shows fewer impacts. Among indirect dischargers, 91 facilities or 1.3 percent are expected to close as a result of regulation and no facilities are expected to incur moderate economic impacts. Employment and shipments losses associated with closing facilities are estimated at 1,714 FTEs and $279 million respectively. Because additional facilities are expected to come into compliance under the partial-cost-pass-through analysis, costs of compliance are estimated to be modestly higher. Total capital costs of compliance are estimated at $238 million and total annualized compliance costs are estimated at $174 million, tax-adjusted, and $233 million, without adjustments.

Impacts of Option 2, Indirect Dischargers

Zero-Cost-Pass-Through Analysis

Under Option 2, EPA estimates that 151 facilities or 2.1 percent could be expected to close as the result of regulation. The employment and shipments losses associated with these facility closures are conservatively estimated at 2,354 FTEs and $202 million, respectively. An additional 124 facilities are expected to incur financial stress short of closure because of regulation. EPA estimates that MP&M Phase I industries will incur capital costs of $372 million for complying with Option 2. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $228 million.

The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $182 million.

Partial-Cost-Pass-Through Analysis

Under the more realistic, partial-cost-pass-through analysis, 52 facilities or less than 1 percent of indirect dischargers passing the baseline analysis are expected to close as a result of regulation and another 41 facilities are expected to incur moderate economic impacts. Employment and shipments losses associated with closing facilities are estimated at 892 FTEs and $152 million respectively. Total capital costs of compliance are estimated at $375 million and total annualized compliance costs are estimated at $184 million, tax-adjusted, and $230 million, without adjustments.

Impacts of Option 3, Indirect Dischargers

Zero-Cost-Pass-Through Analysis

Impacts under Option 3 are estimated to be markedly higher than those for the other options. Under Option 3, EPA estimates that 227 facilities or 3.1 percent could be expected to close as the result of regulation. The employment and shipments losses associated with these facility closures are conservatively estimated at 18,215 FTEs and $2,013 million, respectively. Also, an additional 184 facilities are expected to incur financial stress short of closure because of regulation, again considerably higher than for the other options considered. Compliance costs are also considerably higher for Option 3. EPA estimates that MP&M Phase I industries will incur capital costs of $1,003 million for complying with Option 3. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a 7% social discount rate amounts to $669 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $525 million.

Partial-Cost-Pass-Through Analysis

Although impacts are moderated under the partial-cost-pass-through analysis (in relation to the zero-cost-pass-through analysis), they still remain considerably higher than the impacts estimated for the other options. Among indirect dischargers, 160 facilities or 2.2 percent of facilities passing the baseline analysis are expected to close as a result of regulation and another 66 facilities are expected to incur moderate economic impacts. Employment and shipments losses associated with closing facilities are estimated at 7,710 FTEs and $735 million respectively. Total capital costs of compliance are estimated at $1,020 million and total annualized compliance costs are estimated at $537 million, tax-adjusted, and $694 million, without adjustments.

Impacts of Option 1A, Indirect Dischargers

Zero-Cost-Pass-Through Analysis

Under Option 1A, EPA estimates that 151 facilities or 2.1 percent could be expected to close as the result of regulation. This equals the number of facilities expected to close under Option 2. The employment and shipments losses associated with these facility closures are conservatively estimated at 2,354 FTEs and $202 million, respectively. An additional 54 facilities are expected to incur financial stress short of closure because of regulation, a moderate economic impact. This is less than half the number of facilities incurring moderate impacts as under Option 2. EPA estimates that MP&M Phase I industries will incur capital costs of $373 million for complying with Option 1A. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $222 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $178 million.

Partial-Cost-Pass-Through Analysis

The more realistic, partial-cost-pass-through analysis again shows fewer impacts than under Option 2. Among indirect dischargers, 82 facilities or 1.1 percent are expected to close as a result of regulation and another 12 facilities are expected to incur moderate economic impacts. Employment and shipments losses associated with closing facilities are estimated at 1,068 FTEs and $164 million respectively. Total capital costs of compliance are estimated at $376 million and total annualized compliance costs are estimated at $179 million, tax-adjusted, and $224 million, without adjustments.

Impacts of Option 2A, Indirect Dischargers

Impacts under Option 2A, the proposed option, are generally lower than any of the other options considered. Capital costs under this option, though, constitute a larger share of compliance costs than under the other options considered.

Zero-Cost-Pass-Through Analysis

Among the five PSES options that EPA analyzed, the proposed Option 2a, which applies the limitations of Option 2 to large flow facilities and exempts low flow facilities from regulation, achieves the lowest impacts in terms of facility closures, employment losses, and financial burdens. Under Option 2a, EPA estimates that a minimal number of facilities — 7 — would be expected to close as the result of regulation. These 7 facilities represent 0.1 percent of the 7,293 indirect discharge facilities found to pass the baseline closure analysis and 0.4 percent of the 1,792 indirect discharge facilities that both have a discharge volume of at least 1,000,000 gallons

per year and pass the baseline closure analysis. The employment and shipments losses associated with these facility closures are conservatively estimated at 540 FTEs (0.03 percent of total) and $134 million (0.03 percent of total), respectively. An additional 12 facilities are expected to incur financial stress short of closure because of regulation, a moderate economic impact. EPA estimates that MP&M Phase I industries will incur capital costs of $299 million for complying with Option 2A. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $146 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $122 million.

Partial-Cost-Pass-Through Analysis

The more realistic, partial-cost-pass-through analysis yields the same results as the zero-cost-pass-through analysis, in terms of compliance costs, facility closures and other facility impacts. The estimated impacts of Option 2a under the partial-cost-pass-through case are the same as the already modest values estimated for the zero-cost-pass-through case. The estimated closure and financial impact values remain the lowest among the five PSES options analyzed for indirect discharging facilities.

4.7.2 Direct Dischargers

For direct discharging facilities, EPA analyzed the impacts of three possible BAT/BPT regulatory options — Options 1, 2, and 3 — as previously described in Section 4. Of these options, EPA is proposing Option 2 because, as discussed in Chapter 1, it represents the performance achievable with the best available technology and, in view of its comparatively modest economic impacts, is economically achievable. The estimated facility-level impacts associated with each of the regulatory options are discussed below and presented in Table 4-5. For direct dischargers, EPA estimated the same number of facility closures under both the zero-cost-pass-through and partial-cost-pass-through analyses. Thus, results for these two cases are not presented separately. However, the cost pass-through assumptions do affect the number of facilities estimated to incur moderate financial impacts short of closure. These results are presented in separate rows in Table 4-5.

Table 4-5: Estimated Impacts of Regulatory Compliance, Direct Dischargers (dollar values in $000, 1989)			
	Option 1	Option 2	Option 3
Facilities in Analysis	1,837	1,837	1,837
Severe Impacts (closing facilities)			
Zero-Cost-Pass-Through Analysis and Partial-Cost-Pass-Through Analysis (same results)			
Number of Facilities	18	18	90
Percent of Class	0.96%	0.96%	4.92%
Employment (FTEs)	158	158	7,339
Value of Shipments	$5,277	$5,277	$756,873
Moderate Impacts (financial stress short of closure)			
Zero-Cost-Pass-Through Analysis			
Number of Facilities	6	0	0
Partial-Cost-Pass-Through Analysis			
Number of Facilities	0	0	0
Financial Impacts in Complying Facilities			
Zero-Cost-Pass-Through Analysis and Partial-Cost-Pass-Through Analysis (same results)			
Capital Cost	$40,421	$53,995	$108,700
Total Annual Compliance Cost			
Tax-adjusted*	$13,908	$15,477	$54,602
No adjustments†	$15,516	$16,332	$68,720

* "Tax-adjusted" compliance costs are an estimate of the annual cash compliance cost to industry and reflect private costs of capital and expected tax treatment of capital outlays and annual expenses.
† Compliance costs with "No adjustments" are an estimate of the total annual cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate.

Source: Environmental Protection Agency

Impacts of Option 1, Direct Dischargers

Of the 1,837 direct discharging facilities subject to regulation, EPA estimates that 18 facilities or 1.0 percent could be expected to close as the result of regulation. The employment and shipments losses associated with these facility closures are estimated at 158 FTEs and $5 million, respectively. The estimates of possible facility closures and associated losses in employment and shipments are conservative because the analysis does not account for the likelihood that non-closing facilities will absorb some of the lost production and employment from closing facilities. An additional 6 facilities are expected to incur financial stress short of closure because of regulation, a moderate economic impact. EPA estimates that MP&M Phase I industries will incur capital costs of $40 million for complying with Option 1. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $16 million. The estimated

total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $14 million.

Impacts of Option 2, Direct Dischargers

Under Option 2, EPA estimated the same magnitude of facility closures and associated impacts as for Option 1; however, moderate facility impacts are slightly lower and compliance costs incurred by industry are slightly higher. Closing facilities are estimated at 18 facilities or 1.0 percent of direct dischargers passing the baseline analysis. Associated employment and shipments losses are again estimated at 158 FTEs and $5 million, respectively. No facilities were assessed as likely to incur financial stress short of closure. EPA estimates that MP&M Phase I industries will incur capital costs of $54 million for complying with Option 2. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $16 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $15 million.

Impacts of Option 3, Direct Dischargers

In a similar way as for indirect dischargers, impacts under Option 3 for direct dischargers are estimated to be markedly higher than those for Options 1 and 2. Under Option 3, EPA estimates that 90 facilities or 4.9 percent could be expected to close as the result of regulation. The employment and shipments losses associated with these facility closures are conservatively estimated at 7,339 FTEs and $757 million, respectively. However, no facilities are expected to incur financial stress short of closure either under the zero-cost-pass-through assumption or under the more realistic partial-cost-pass-through assumption. Compliance costs are also considerably higher for Option 3 than for Options 1 and 2. EPA estimates that MP&M Phase I industries will incur capital costs of $109 million for complying with Option 3. The total annualized cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate amounts to $69 million. The estimated total annualized, after-tax cash cost to industry, which reflects private costs of capital and expected tax treatment of capital outlays and annual expenses, amounts to $55 million.

Aggregate Impacts for the Proposed Options

Table 4-6 summarizes aggregate impacts for both indirect and direct discharging facilities for the proposed regulatory options applicable to existing facilities: Option 2A for indirect dischargers (PSES) and Option 2 for direct dischargers (BAT/BPT). Overall, 3,629 facilities passed the Baseline Closure analysis (1,837 direct discharging facilities and 1,792 "large flow" indirect discharging facilities) and thus are expected to be

subject to regulation. Of this population, 25 facilities or 0.7 percent are expected to close as a result of regulation in both the zero-cost-pass-through and partial-cost-pass-through analyses. The total associated employment impact amounts to 698 FTEs (0.03 percent of the total employment in facilities passing the baseline analysis and thus potentially subject to regulation) and the associated value of lost shipments amounts to $140 million (0.03 percent of the total shipments in facilities passing the baseline analysis and thus potentially subject to regulation). An additional 12 facilities are expected to encounter financial stress short of closure as a result of regulation. Summed over both indirect and direct discharging facilities, the total capital costs of compliance amount to $353 million. Total annualized costs of compliance are estimated at $162 million, without tax adjustments and with capital costs annualized on the basis of a real social discount rate, and at $137 million, when calculated on an after-tax basis using private costs of capital. These results are identical in both the zero-cost-pass-through and partial-cost-pass-through analyses.

Table 4-6: Estimated Aggregate Impacts of Regulatory Compliance Proposed Regulatory Options 2a and 2 for Indirect and Direct Dischargers (dollar values in $000, 1989)

	Option 2a (Indirect Dischargers)	Option 2 (Direct Dischargers)	Sum for Both Classes of Facilities
Facilities in Analysis	1,792	1,837	3,629
Zero-Cost-Pass-Through and Partial-Cost-Pass-Through Analyses (same results)			
Severe Impacts (closing facilities)			
Number of Facilities	7	18	25
Percent of Class	0.39%	0.96%	0.69%
Employment (FTEs)	540	158	698
Value of Shipments	$114,509	$5,277	$119,786
Moderate Impacts (financial stress short of closure)			
Number of Facilities	12	0	12
Financial Impacts in Complying Facilities			
Capital Cost	$299,428	$53,995	$353,424
Total Annual Compliance Cost			
Tax-adjusted*	$121,585	$15,477	$137,063
No adjustments†	$146,050	$16,332	$162,382

* "Tax-adjusted" compliance costs are an estimate of the annual cash compliance cost to industry and reflect private costs of capital and expected tax treatment of capital outlays and annual expenses.
† Compliance costs with "No adjustments" are an estimate of the total annual cost of compliance without tax adjustments and with capital costs annualized on the basis of a real social discount rate.

Source: Environmental Protection Agency

Chapter 5

Labor Requirements of the Proposed Regulation

5.1 Introduction

Firms will need to install and operate wastewater treatment systems to comply with an effluent limitations guideline for the Metal Products and Machinery (MP&M) Industry, Phase I. The manufacture, installation, and operation of these systems will require use of labor resources. To the extent that these labor needs translate into employment increases in affected firms, the MP&M rule has the potential to generate employment benefits. If realized, these employment benefits may partially offset the employment losses that are expected to occur among facilities adversely affected by the rule. The employment effects that would occur in the manufacture, installation, and operation of treatment systems are termed the "direct" employment benefits of the rule. The employment effects associated with the operation of the treatment systems will occur in the MP&M facilities that install treatment systems for compliance with the MP&M regulation. The employment effects associated with manufacture and installation of the treatment systems will occur in firms that supply the treatment system components to the MP&M facilities or provide installation services. Because these employment effects are directly attributable to the MP&M rule, they are conceptually parallel to the employment losses that were estimated for the facilities that are expected to incur significant impacts as a result of the MP&M rule.

In addition to direct employment benefits, the MP&M rule may generate other employment benefits through two mechanisms. First, employment effects may occur in the industries that are linked to the industries that manufacture and install wastewater treatment systems; these effects are termed "indirect" employment benefits. For example, a firm that manufactures the pumps, piping and other hardware that comprise a treatment system will purchase intermediate goods and services from other firms and sectors of the economy. Thus, increased economic activity in the firm that manufactures the treatment system components has the potential to increase activity and employment in these linked firms and sectors. Second, the increased payments to labor in the directly and indirectly affected industries will lead to increased purchases from consumer-oriented service and retail businesses, which in turn lead to additional labor demand and employment benefits in those businesses. These effects are termed "induced" employment benefits.

In view of these possible employment benefits, EPA estimated the labor requirements associated with compliance with the proposed MP&M regulation, as represented by Option 2a for indirect dischargers and Option 2 for direct dischargers (Option 2a/2). The following discussion summarizes the findings from this effort. Labor requirements — and thus the possible employment benefits — were estimated in two steps. EPA first estimated the direct employment effects associated with the manufacture, installation, and operation of the MP&M wastewater treatment systems. These effects are discussed in Section 5.1. Second, EPA considered the additional employment effects that might occur through the indirect and induced effect mechanisms outlined above; these effects are discussed in Section 5.2.

On the basis of these analyses, EPA found that the MP&M regulation may yield direct employment requirements of 1,594 full-time equivalent positions on a 15-year annualized basis. When the indirect and induced employment effects are included, this value increases to 3,900 to 6,400 full-time equivalent positions.

5.2 Estimating the Direct Labor Requirements of the MP&M Rule

As discussed above, an effluent guideline for the MP&M industry will create demand for labor services for manufacturing, installing, and operating wastewater treatment systems. EPA analyzed each of these components of direct labor requirements separately. The sum of the estimated requirements for the three labor categories represents the estimated total direct labor requirement, and thus the potential direct employment benefit, from compliance with the MP&M effluent guideline.

Direct Labor Requirements for Manufacturing Wastewater Treatment Systems

EPA estimated the direct labor requirements for manufacturing wastewater treatment systems based on the cost of the treatment system equipment and labor's expected contribution to the equipment's value in its manufacture. Labor's contribution was estimated in dollars and was converted to a full-time employment equivalent based on a yearly labor cost. Each component of the calculation is discussed below.

Cost of Treatment System Equipment

The cost of treatment system equipment was estimated as part of the facility-level impact analysis for the regulatory options. Treatment system equipment requirements and associated costs were estimated for each facility in the Survey that was assessed as incurring costs. For the labor requirements analysis, compliance costs and their associated labor requirements were considered only for those facilities that were assessed as likely to comply with the rule and continue MP&M production activities. *The labor*

requirement effects of compliance were not estimated for facilities assessed as closures in either the baseline or post-compliance analysis. These compliance costs were weighted according to the number of facilities each sample facility represents in the underlying MP&M industry population and summed to give an aggregate treatment system equipment cost for the MP&M industry. The total estimated capital *equipment* cost in 1989 dollars for complying with Option 2a/2 is $263.7 million.[1] This value is less than the total capital cost of regulatory compliance reported in Chapter 4; the difference is the estimated allowance for installation of the treatment system equipment.

Labor's Expected Contribution to the Equipment's Value

Input-output tables assembled by the Bureau of Economic Analysis in the Department of Commerce provide information on the composition of inputs used to produce the outputs of industries in the U.S. economy.[2] The inputs tallied in the input-output tables include the purchase of intermediate goods, materials and services from other industries as well as the use of labor by the subject industry. In particular, the *direct requirements* matrix identifies the value of each input, including labor, that is required to produce a one dollar value of output for a subject industry. From discussions with MP&M project engineers, the "Heating, Plumbing, and Fabricated Structural Metal Products Industry" (Bureau of Economic Analysis industry classification 40) was identified as the industry with output that most nearly matches the kinds of equipment needed for compliance with the MP&M effluent guideline. From the direct requirements matrix, the labor input, titled *compensation of employees*, accounts for $0.31016 of each dollar of output value from the Heating, Plumbing, and Fabricated Structural Metal Products Industry. Multiplying labor's share of output value (32.02 percent) times the value of equipment purchases for complying with the MP&M rule ($263.7 million) yields labor's contribution to manufacturing the treatment system equipment, measured in terms of gross compensation, $81.8 million (see Table 5-1).

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[1] The $320.4 million is the one-time outlay for purchasing the capital equipment estimated to be needed for compliance with the MP&M regulation and is not the *annual* cost of the capital equipment. In the economic impact analysis, the capital outlay is annualized over a 15-year period and the resulting value, which is part of the total annual cost of compliance, is much less than the $320.4 million value.

[2] See *The 1982 Benchmark Input-Output Accounts of the United States*, U.S. Department of Commerce, Bureau of Economic Analysis, December 1991 and "Benchmark Input-Output Accounts for the U.S. Economy, 1982," in *Survey of Current Business*, July 1991, U.S. Department of Commerce, Bureau of Economic Analysis. The 1982 tables are the most current information on the inter-industry input-output structure of the U.S. economy.

Table 5-1: Analysis of Possible Employment Generation Effects of the Proposed Regulatory Option 2a/2 for the MP&M Industry (all dollar amounts in thousands of 1989 dollars)						
	Total Weighted Expenditures	Labor Cost Share of Production Value[1]	Labor Cost Component one-time basis	Labor Cost Component annual basis[2]	Direct Labor Requirements[3] one-time basis	Direct Labor Requirements[3] annual basis
Direct Labor Effects From Treatment System Equipment:						
Manufacturing	$263,693	31.02%	$81,787	$8,980	1,704	187
Installation	$87,898	42.23%	$37,122	$4,076	773	85
Operation				$63,467		1,322
Total Direct Labor Effects				$76,522		1,594

Notes:
[1] Source: U.S. Department of Commerce, *The 1982 Benchmark Input-Output Accounts of the United States*, December 1991.
[2] Annualized over 15 years at the social discount rate of 7 percent.
[3] Number of jobs calculated on the basis of an average hourly labor cost of $24.00 and 2,000 hours per labor-year.
Source: U.S. Environmental Protection Agency

In the economic impact analysis of the MP&M rule, the manufacture of treatment system equipment is considered a one-time event that occurs at the beginning of industry's compliance activities. Accordingly, the labor requirements for manufacturing treatment system equipment should be viewed as a one-time requirement. Elsewhere in the MP&M economic impact analysis, the labor effects associated with facility impacts are presented on an annual basis, with the expectation that these job effects would persist over the period of analysis. Accordingly, to assess consistently the possible labor requirement effects from manufacturing treatment system equipment, it was necessary to annualize the one-time labor effect. Consistent with the annualization procedures elsewhere in the economic impact analysis, the one-time labor compensation value was annualized over a fifteen-year period at the social discount rate of 7 percent. The resulting annual value of gross labor compensation in manufacturing treatment system equipment is $9.0 million.

Conversion to Full-Time Employment Equivalent Basis

To convert the gross payment to labor to a full-time employment equivalent basis, the payment to labor was divided by an estimated yearly labor cost. The yearly labor cost is based on the same labor cost, $24.00 per hour, used in the engineering cost analysis to estimate the cost of operating treatment system equipment. The $24.00 per hour rate is a comprehensive labor cost including an allowance for fringe benefits (e.g., holidays, vacation, and various insurances) and payroll taxes, and was calculated in 1989 dollars. Assuming a 2,000 hour work-year, the gross annual labor cost per full-time employment position is

$48,000. On a one-time, one-year basis (i.e., not annualized), the outlay for manufacturing treatment system equipment is estimated to require 1,704 person-years of full-time employment. On a 15-year annualized basis, the $9.0 million of gross labor cost for manufacturing treatment system equipment is estimated to require 187 full-time employment positions.

Direct Labor Requirements for Installing Treatment System Equipment

EPA estimated the direct labor requirements for installing treatment system equipment in a parallel manner to that used for analyzing the labor requirements for manufacturing treatment system equipment. Each component of the calculation is discussed below.

Cost of Installing Treatment System Equipment

The cost of installing treatment system equipment was estimated as part of the engineering analysis for estimating the purchase cost of treatment system equipment and is expected to average about 25 percent of the total capital outlay for regulatory compliance. On this basis, the cost of installing treatment system equipment was estimated at $87.9 million.

Labor's Expected Contribution to the Equipment's Value

The Bureau of Economic Analysis industry group that EPA used as the basis for estimating labor's share of cost in installing treatment system equipment is the "Repair and Maintenance Construction Industry" (Bureau of Economic Analysis industry classification 12). In this industry group, gross payments to labor account for $0.42233 of each dollar of output value, as recorded in the direct requirements matrix for the national input-output tables. Multiplying labor's share of value (42.23 percent) by the estimated total installation cost ($87.9 million) yields a gross labor cost for treatment system equipment installation of $37.1 million. Like the purchase cost of treatment system equipment, the installation cost is a one-time outlay and, accordingly, an annualized value was calculated using the 15-year amortization period and the 7 percent social discount rate. The resulting annual value for the labor cost of installing treatment system equipment is $4.1 million.

Conversion to Full-Time Employment Equivalent Basis

Conversion to a full-time employment equivalent basis is based on the same yearly labor cost, $48,000, as used in estimating the labor requirements for the manufacturing of treatment system equipment. On a one-time, one-year basis, EPA estimates that 773 person-years of full-time employment would be required for installing the equipment needed to comply with the proposed Option 2a/2 MP&M

effluent guideline. Annualized over 15 years, the corresponding labor requirement for installing treatment system equipment is 85 full-time equivalent positions.

Direct Labor Requirements for Operating Treatment Systems

MP&M project engineers estimated the annual labor hours required to operate wastewater treatment systems as part of the estimation of the annual operating and maintenance costs for each MP&M regulatory option. On a full-time equivalent basis, the estimated annual labor requirement for operating treatment systems is 1,322 person-years. This value is assumed to recur annually over the period of analysis. The corresponding total annual estimated payments to labor is $63.5 million (1989 dollars).

Total Direct Labor Requirements for Complying with the MP&M Effluent Guideline

Summing the three components yields the total direct labor requirements for complying with the proposed MP&M effluent guideline as represented by Option 2a/2. On a full-time equivalent basis, the estimated total annual labor requirement for complying with Option 2a/2 is 1,594 person-years. The corresponding total annual estimated payments to labor is $76.5 million (1989 dollars). To the extent that these labor requirements manifest as net new labor needs in the U.S. economy, the 1,594 full-time employment equivalents have the potential to offset employment losses that may otherwise occur because of the rule. Specifically, on the basis of the facility impact analysis presented in Chapter 4, EPA estimated that total employment losses in facilities expected to close as a result of regulation would amount to 698 FTE positions. From the analysis presented in this chapter, the estimated direct labor demands resulting from the manufacturing, installation and operation of treatment system equipment in complying facilities may exceed the employment losses associated with estimated facility closures. As a result, the combined net employment effect of the regulation may be positive.

5.3 Estimating the Indirect and Induced Labor Requirement Effects of the MP&M Rule

In addition to its direct labor effects, the MP&M effluent guideline may also generate labor requirements through the indirect and induced effect mechanisms described in the introduction to this chapter. The indirect and induced effects associated with an economic activity are analyzed by use of multipliers. Multiplier estimates generally vary with the industry in which the direct economic activities are expected to occur and with the economic characteristics of the location of the direct activities.

A range of multipliers was used in this analysis to illustrate the possible aggregate employment effects of a MP&M effluent guideline. A recent EPA study used multipliers ranging from 3.5 to 3.9 to

calculate the possible indirect and induced employment effects of direct activity investments in general water treatment and pollution control.[3] A study of "clean water investments" commissioned by the National Utility Contractors Association (NUCA) documented total employment effect multipliers ranging from 2.8 to 4.0.[4] Using the high and low values for these multipliers, the indicated aggregate employment effects associated with the direct labor requirement of 1,888 full-time positions would range from 5,285 to 7,550.

A more conservative assessment of these possible employment effects would recognize that the three categories of labor requirements analyzed above are likely to have different indirect labor demand effects. In particular, the direct labor demands for manufacturing and installing treatment system equipment result from additional economic activity in those industries. Accordingly, it is reasonable to expect that the additional economic activity in manufacturing and installing equipment will translate into increased activity in the industries that are linked to the direct effect industries and, hence, lead to additional labor demand in those industries through the indirect effect mechanism. In contrast, the increased labor demand in the MP&M industry for operating treatment systems does not result from increased economic activity in that industry. As a result, increased labor demand *in the MP&M industry* resulting from the MP&M effluent guideline may not translate into increased labor requirements in the industries that are linked to the MP&M industry. In this case, the appropriate employment multiplier for the *equipment-operations component* of direct labor requirements would exclude the indirect effect mechanism and include only the induced effect mechanism. Multipliers cited in the NUCA study referenced above suggest that a multiplier *based only on the induced effect mechanism* might fall in the range of 2.4 to 2.9. Using this lower multiplier range for the equipment-operations component of direct labor requirements and the higher, 2.8 to 4.0 range for the manufacturing and installation components, the estimated aggregate employment effects of the MP&M effluent guideline would range from 4,662 to 5,837 full-time equivalent positions.

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[3] U.S. Environmental Protection Agency, Office of Water (February 1993). *Job Creation Fact Sheet*, internal document.

[4] Apogee Research, Inc., *A Report on Clean Water Investment and Job Creation*, prepared for National Utility Contractors Association, March 1992.

Chapter 6
Community Impact Analysis

6.1 Introduction

This chapter examines community level employment impacts that may result from proposed effluent limitations guidelines and standards for the Metal Products and Machinery (MP&M) Industry. Community impacts are assessed by estimating the expected change in employment in communities with MP&M facilities that are affected by regulation. Possible community employment effects include the lost employment in facilities that are expected to close because of regulation, and related employment losses in other businesses in the affected community. These employment losses are considered significant if they are expected to exceed one percent of the pre-regulation level of employment in the affected communities. For such comparisons, a community is defined as the area in which employees may reasonably commute to work — typically a Metropolitan Statistical Area (MSA), or county if the affected community is not contained within a MSA.

In addition to these expected employment losses, as discussed in the preceding chapter, EPA anticipates that employment may increase as a result of facilities' expenditures for purchase and operation of treatment systems for regulatory compliance. On a national and state level, such employment gains, if they occur, may partially offset the employment losses that are expected to result from facility closures. However, these gains will mitigate *community* employment losses only if they occur in the same communities in which facility closures occur.

To understand the significance of community employment impacts from the proposed regulatory option (Option 2a for Indirect Dischargers and Option 2 for Direct Dischargers), EPA performed two analyses of expected community employment impacts. *First*, EPA examined the community employment impacts based on the known location of the *sample facility* closures estimated to result from regulation. Because the location of these sample facilities is known, it is possible to compare the expected employment loss from closure, including losses in related businesses, with the pre-regulation employment in the affected community, defined as either the MSA or the county in which the sample facility closure is located. This analysis directly tests the significance of employment losses in the communities in which the estimated *closing* sample facilities are located. However, this analysis does not address the impact of closures in the underlying facility population that are represented by the sample facility closures. That is, each of the 396

sample facilities on which this impact analysis was based represents an additional set of facilities in the underlying population of 10,601 water-discharging MP&M facilities. Thus, each sample facility closure represents additional facility closures whose location is not known. Thus, in the *second* analysis, EPA examined the significance of expected facility closures taking into account the employment losses from the closing facilities in the underlying facility population that are represented by the sample facility closures. Because the locations of these *non-sample* closing facilities are not known, it is not possible to measure the significance of the associated employment losses in specific communities. However, it is possible to allocate the estimated employment losses among states and assess the significance of these losses at the state level. In addition, at the state level, it is also possible to consider the effect of employment gains that may occur as a result of compliance-related outlays.

Both of these analyses indicated that employment impacts at the community level are likely to be comparatively minor. At the level of both MSAs and states, EPA expects that employment losses — including losses in closing facilities and in related businesses — will be well less than one percent of pre-regulation employment levels. When possible employment gains are included, the already slight community employment impacts are further diminished.

The remainder of this chapter is organized as follows. Section 6.1 presents the methodology and findings for the analysis of community employment impacts for estimated sample facility closures. Section 6.2 reviews the methodology and findings from the analysis of employment impacts at the state level; this analysis takes into account the non-sample, represented facilities. Section 6.3 adds the effect of possible employment gains to the estimated employment losses by state.

6.2 Assessment of Community Impacts for Estimated Sample Facility Closures

To assess the significance of facility closures and associated employment losses in specific communities, EPA compared the employment loss from estimated sample facility closures, including losses in related businesses, to the pre-regulation level of employment in the communities in which the sample facilities are located. As described in the introduction, this analysis considers only the employment impacts associated with estimated *sample* facility closures and does not account for the employment effects of closures in the underlying population of facilities that are *represented* by the estimated sample facility closures. The employment losses in *represented* facilities are not considered in this analysis because the location of these facilities in terms of a specific MSA or county is not known. The methodology and results for this assessment are discussed below.

Methodology

The analysis of community employment impacts involves estimating the total employment loss in an affected community and comparing that loss with the pre-regulation level of employment in the community. For this analysis, the relevant community is the MSA or county (if the facility is not located within a MSA) in which the estimated closing facility is located. These jurisdictions are assumed to represent the labor market area within which residents could reasonably commute to work.

In estimating the employment impact in an affected community, EPA accounts for both the primary and secondary impacts of facility closures. Primary impacts consist of the employment losses that are expected to occur as a direct result of the regulation, namely the loss of full employment in the estimated closing facility. Secondary economic impacts and associated employment losses occur in other businesses than those directly affected by regulation and result from two mechanisms. First, reductions in output at closing facilities influence activity and employment levels in linked industries (indirect effects). Second, the losses in employment and employee earnings in both the directly and indirectly affected businesses result in reduced personal consumption expenditures, which may further affect employment levels in the community (induced effects). If the total employment loss, including primary and secondary impact, is expected to exceed one percent of the pre-regulation level of employment in the community, then EPA considers the employment loss to be a significant economic impact.

Estimating Primary Employment Impacts

The primary employment impact of an MP&M regulation is the employment loss in estimated closing facilities — that is, in those facilities estimated to incur Severe Impacts as the result of regulation. For this analysis, all employment at a sample facility as reported in the §308 Survey response is assumed to be lost. Employment at sample facilities was calculated on the basis of Full-Time Equivalent positions (FTEs), which assume a 2,000 hour work year. No employment loss is assumed for facilities estimated to incur Moderate Impacts (Financial Stress Short of Closure).

Estimating Secondary and Total Employment Impacts

Secondary employment impacts are estimated based on multipliers that relate a change in employment in a directly affected industry to aggregate employment change including the employment affects in: (1) linked industries (indirect effects) and (2) consumer businesses whose employment is affected by changes in the earnings and expenditures of the employees in the directly and indirectly affected industries (induced effects). For this analysis, EPA calculated state-specific, composite MP&M

employment multipliers that are based on the estimated relationship of employment in MP&M industry sectors to total state employment, and the composition of employment within a state among the seven MP&M Phase I sectors.

These state-specific composite employment multipliers were calculated from Regional Input-Output Modeling System (RIMS) multipliers developed by the Bureau of Economic Analysis (BEA) within the Department of Commerce. BEA publishes state-level employment multipliers by BEA industry classifications, which are conceptually similar to but structurally different from SIC code classifications. For this analysis, EPA used the state-level employment multipliers for the 2-digit BEA industries that "best" match the seven MP&M industry sectors, as summarized in Table 6-1. The "best" BEA sector match was determined as the BEA sector containing the greatest share of MP&M sector revenues, based on Census of Manufacturers (COM) data from the Department of Commerce.

Table 6-1: Phase I MP&M Sectors and BEA Sectors Used To Construct State-Level Employment Multipliers

Phase I MP&M Sector	"Best" BEA Sector Match
1: Hardware	18: Fabricated Metal Products
2: Aircraft	22: Transportation Equipment, except Motor Vehicles
3: Electronic Equipment	20: Electric and Electronic Equipment
4: Stationary Industrial Equipment	19: Machinery, except Electrical
5: Ordnance	18: Fabricated Metal Products
6: Aerospace	22: Transportation Equipment, except Motor Vehicles
7: Mobile Industrial Equipment	19: Machinery, except Electrical

Source: U.S. Environmental Protection Agency

The BEA state- and sector-specific multipliers were weighted on the basis of MP&M employment by sector for each state to construct each state's composite multiplier. MP&M employment data by sector were calculated by aggregating employment data by the 4-digit SIC code sectors that define each of the seven MP&M Phase I sectors. Each state's composite multiplier was calculated as follows:

$$M_i = \sum_{j=1}^{7} \left[\left(\frac{Emp_{i,j}}{Emp_{i,MP\&M}} \right) \times M_{i,j} \right]$$

where:

M_i = Composite Employment Multiplier for the *i*th state

$Emp_{i,j}$ = Employment for the *i*th State, *j*th MP&M sector

$Emp_{i,MP\&M}$ = Employment for the *i*th State over all Phase I MP&M sectors

$M_{i,j}$ = BEA Employment Multiplier for the *i*th state for the BEA sector matching the *j*th MP&M sector

The composite multipliers, listed in Table 6-2, were used in the community impact analyses for both the sample facility closure analysis, which was performed for the specific communities in which the estimated sample facility closures are located, and the state-level analysis, which accounts for closures in the non-sample, *represented* facilities. Each multiplier indicates the expected change in total state employment resulting from a change in MP&M industry employment, taking into account the structure of inter-industry linkages in the state and the composition of MP&M employment in the state.

Table 6-2: Composite Employment Multipliers by State

State	Composite Multiplier	State	Composite Multiplier
Alabama	2.5155	Montana	1.6122
Alaska	1.4943	Nebraska	2.3709
Arizona	2.6651	Nevada	1.6439
Arkansas	2.2802	New Hampshire	2.5176
California	2.7202	New Jersey	2.4625
Colorado	2.8000	New Mexico	2.1481
Connecticut	2.3424	New York	2.1233
Delaware	1.9012	North Carolina	2.5079
District of Columbia	1.2715	North Dakota	2.2031
Florida	2.1904	Ohio	3.0269
Georgia	2.3517	Oklahoma	2.3088
Hawaii	1.8275	Oregon	2.4743
Idaho	2.1952	Pennsylvania	2.8821
Illinois	3.0812	Rhode Island	1.9809
Indiana	3.0417	South Carolina	2.2823
Iowa	2.7162	South Dakota	2.0144
Kansas	2.3542	Tennessee	2.6036
Kentucky	2.7583	Texas	2.7606
Louisiana	2.0767	Utah	2.6434
Maine	2.0442	Vermont	2.1326
Maryland	2.3199	Virginia	2.2651
Massachusetts	2.5502	Washington	2.3778
Michigan	2.7169	West Virginia	2.1381
Minnesota	2.7329	Wisconsin	2.6641
Mississippi	2.2981	Wyoming	1.7647
Missouri	2.5785		

Source: U.S. Department of Commerce and Environmental Protection Agency

The expected total employment loss — that is, considering both primary and secondary employment impacts — in a community was calculated by multiplying the employment loss in the estimated sample facility closure by the composite multiplier for the particular state. Note that the use of a

state-level multiplier for a MSA- or county-level analysis is likely to overstate the employment impact in the MSA or county. The state-level multipliers register the expected effect throughout a state resulting from changes in activity levels in the subject industry within the state. To the extent that some of these effects occur in locations beyond the MSA or county in which the primary impacts occur, the state-level multiplier will exaggerate the employment impacts in the MSA or county.

Assessing the Significance of the Estimated Total Employment Loss

To assess whether the community employment loss from an estimated sample facility closure is significant, EPA compared the estimated total employment loss with the pre-regulation employment in the community, based on 1990 Census data. For facilities that are located in an MSA, the pre-regulation employment is the 1990 employment for the MSA. For facilities not located within a MSA, the pre-regulation employment is the 1990 employment for the county in which the facility is located. If the total employment loss exceeded one percent of the pre-regulation level of employment, the community employment impact was deemed significant.

Findings

The facility closure analysis of the proposed regulatory option — Option 2a for indirect dischargers and Option 2 for direct dischargers — indicated that 3 sample facilities would be expected to close as a result of regulation. Two of the three sample facilities are located in California: one in Merced county, and one in the Los Angeles-Long Beach MSA. The third facility is located in Virginia, in the Norfolk-Virginia Beach-Newport News MSA. The total of employment losses in these *sample* facilities amounts to 168 FTEs, or an average of 56 FTEs per closing sample facility (see Table 6-3). The facility employment losses in each MSA or county were multiplied by the relevant state multiplier to estimate the total employment losses, including primary and secondary effects. The total losses by MSA ranged from 20 to 264 FTEs (see Table 6-3). Table 6-3 also lists the pre-regulation employment for the relevant communities. Comparison of the estimated total employment loss with these pre-regulation employment values indicated that none of the estimated sample facility closures would be expected to have a significant effect on total community employment. The largest of the percentage impacts is estimated for Merced County, California and amounts to 0.26 percent. The estimated impact in the Los Angeles-Long Beach MSA amounts to only 0.01 percent, while the impact in the Norfolk-Virginia Beach-Newport News MSA rounds to zero when calculated to the nearest hundredth of a percent.

6.3 Assessment of State-Level Employment Impacts

To capture the effect of employment losses in the non-sample facilities that are *represented* by the estimated sample facility closures, EPA performed an analysis in which the employment loss in these non-sample facilities was distributed among states in proportion to pre-regulation levels of MP&M industry employment. Because the community locations of these non-sample, *represented* facilities is not known, it is not possible to analyze the impact of these employment losses in specific communities as defined by MSAs or counties. However, the analysis at the state level provides additional insight into the likely employment impacts at a local level. As part of this analysis, EPA also distributed the possible employment gains (estimated in the preceding chapter) among states and calculated a net potential employment impact by state taking into account the expected effect of both facility closures and labor demands from compliance-related outlays. The methodology and findings from this analysis are discussed below.

Table 6-3: Community Employment Impacts in Estimated Sample Closing Facilities

MSA or County	Total Pre-Regulation Employment	Facilities Affected		MP&M State Multiplier	Total Employment Loss in MSA	
		Number	Empl. (FTEs)		FTEs	as % of Pre-Regulation Employment
Los Angeles-Long Beach	4,173,000	1	97	2.72	264	0.01%
Merced County	64,617	1	62	2.72	169	0.26%
Norfolk-Virginia Beach-Newport News	594,463	1	9	2.27	20	0.00%

Source: U.S. Environmental Protection Agency

Methodology

The methodology for this part of the community impact analysis builds from the previous analysis by using the same state-specific, composite employment multipliers for estimating total employment impacts at the state level. In addition, this analysis begins with the same allocation of primary employment impacts among states for the estimated sample facility closures as reported in the previous section. The steps in the analysis are summarized below.

Calculate Primary Employment Impacts from Estimated Non-Sample Facility Closures

This analysis differs from the preceding analysis by accounting for employment impacts in non-sample facility closures. Therefore, the first step was to identify the employment impacts in non-sample facility closures that were to be distributed among states. As discussed in Chapter 4, on a sample-weighted basis, the proposed regulation — Option 2a, Indirect Dischargers and Option 2, Direct Dischargers — is expected to cause a total of 698 primary employment losses in 25 facility closures. The estimated 3 sample

facility closures account for 168 of these primary employment losses. Accordingly, the primary impacts in estimated non-sample facility closures amount to 22 facility closures and 530 FTE losses (see Table 6-4).

Table 6-4: Summary of Primary Employment Impacts in Estimated Facility Closures (Proposed Option: Option 2a, Indirect Dischargers and Option 2, Direct Dischargers)		
	Number Facilities	Number Employees
Sample-Weighted Closures (from Chapter 4)	25	698
Estimated Sample Closures	3	168
Residual Impacts in Non-Sample, *Represented* Facilities	22	530
Source: U.S. Environmental Protection Agency		

Distribute Impacts in Estimated Non-Sample Facility Closures among States

The primary employment impacts in non-sample facilities were distributed among states in proportion to each state's estimated MP&M Phase I sector employment as calculated from Department of Commerce employment data. The employment distribution percentages are summarized in Table 6-5.

Calculate Total Primary Employment Loss by State

The total primary employment loss in each state was the sum of the primary employment loss in estimated *sample* facility closures by state (as described in the preceding section) and the primary employment loss in the estimated *non-sample, represented* facility closures as distributed among states based on the distribution of MP&M employment by state. Table 6-6 summarizes the estimated primary employment loss by state in estimated *sample* and *non-sample* facility closures and as the sum over both groups of estimated facility closures. These estimated values range from a low of zero (when rounded to the nearest integer) to a high of 228 for California. Only California is estimated to have a total primary employment loss in closing facilities that may exceed 50 FTEs.

Calculate Expected Aggregate Employment Loss by State

As in the preceding analysis, the expected aggregate employment loss by state was calculated by multiplying each state's composite employment impact multiplier by the state's estimated total primary employment impact. The composite employment impact multipliers used for this calculation are the same as those used in the preceding analysis and summarized in Table 6-2.

Compare Expected Aggregate Economic Loss by State with Pre-Regulation Employment

To evaluate the significance of the estimated total employment loss by state, EPA compared the employment loss values with estimated total civilian employment for each state, as reported by the

Department of Commerce for 1991. Table 6-7 summarizes the calculation of expected aggregate employment loss by state and the comparison of the estimated loss values with total state employment.

Table 6-5: Distribution of MP&M Phase I Sector Employment by State			
State	MP&M Employment Percentage	State	MP&M Employment Percentage
Alabama	1.3%	Montana	0.0%
Alaska	0.2%	Nebraska	0.5%
Arizona	1.0%	Nevada	0.1%
Arkansas	1.1%	New Hampshire	0.6%
California	13.1%	New Jersey	3.3%
Colorado	0.9%	New Mexico	0.2%
Connecticut	2.8%	New York	5.7%
Delaware	0.1%	North Carolina	2.3%
District of Columbia	0.0%	North Dakota	0.1%
Florida	3.1%	Ohio	7.2%
Georgia	1.8%	Oklahoma	1.2%
Hawaii	0.2%	Oregon	0.8%
Idaho	0.1%	Pennsylvania	5.9%
Illinois	7.1%	Rhode Island	0.4%
Indiana	3.2%	South Carolina	1.4%
Iowa	1.1%	South Dakota	0.1%
Kansas	1.0%	Tennessee	2.2%
Kentucky	1.2%	Texas	6.1%
Louisiana	0.6%	Utah	0.4%
Maine	0.3%	Vermont	0.2%
Maryland	1.0%	Virginia	1.4%
Massachusetts	3.3%	Washington	1.1%
Michigan	5.2%	West Virginia	0.3%
Minnesota	2.2%	Wisconsin	3.7%
Mississippi	0.8%	Wyoming	0.0%
Missouri	2.0%		
Source: U.S. Department of Commerce and Environmental Protection Agency			

Findings

Table 6-7 summarizes the findings from the analysis of estimated total employment loss by state expected to result from the proposed regulatory option. As shown in the table, the estimated aggregate loss by state averaged 36 FTEs and ranged from a low of zero to a high of 621; 33 states (including the District of Columbia) had a total estimated loss of less than 25 FTEs. In only 9 states is the the total employment loss estimated to exceed 50 FTEs. The maximum estimated employment loss in any state as a percentage total state employment amounts to only one-half of one-hundredth of one percent of total state employment. In eight states, the indicated loss as a percent of total state employment amounts to two one-thousandths of

Table 6-6: Estimated Employment Loss in Facility Closures By State
(Proposed Options: Option 2a, Indirect Dischargers and Option 2, Direct Dischargers)

State	Estimated Facility Closure Impacts						State	Estimated Facility Closure Impacts					
	Sample		Non-Sample		Total			Sample		Non-Sample		Total	
	Fac.	FTEs	Fac.	FTEs	Fac.	FTEs		Fac.	FTEs	Fac.	FTEs	Fac.	FTEs
Alabama	0	0	0.3	7	0.3	7	Montana	0	0	0.0	0	0.0	0
Alaska	0	0	0.0	1	0.0	1	Nebraska	0	0	0.1	3	0.1	3
Arizona	0	0	0.2	5	0.2	5	Nevada	0	0	0.0	0	0.0	0
Arkansas	0	0	0.2	6	0.2	6	New Hampshire	0	0	0.1	3	0.1	3
California	2	159	2.9	69	4.9	228	New Jersey	0	0	0.7	18	0.7	18
Colorado	0	0	0.2	5	0.2	5	New Mexico	0	0	0.0	1	0.0	1
Connecticut	0	0	0.6	15	0.6	15	New York	0	0	1.2	30	1.2	30
Delaware	0	0	0.0	0	0.0	0	North Carolina	0	0	0.5	12	0.5	12
District of Columbia	0	0	0.0	0	0.0	0	North Dakota	0	0	0.0	1	0.0	1
Florida	0	0	0.7	16	0.7	16	Ohio	0	0	1.6	38	1.6	38
Georgia	0	0	0.4	9	0.4	9	Oklahoma	0	0	0.3	6	0.3	6
Hawaii	0	0	0.0	1	0.0	1	Oregon	0	0	0.2	4	0.2	4
Idaho	0	0	0.0	0	0.0	0	Pennsylvania	0	0	1.3	31	1.3	31
Illinois	0	0	1.6	38	1.6	38	Rhode Island	0	0	0.1	2	0.1	2
Indiana	0	0	0.7	17	0.7	17	South Carolina	0	0	0.3	7	0.3	7
Iowa	0	0	0.2	6	0.2	6	South Dakota	0	0	0.0	1	0.0	1
Kansas	0	0	0.2	5	0.2	5	Tennessee	0	0	0.5	12	0.5	12
Kentucky	0	0	0.3	6	0.3	6	Texas	0	0	1.3	32	1.3	32
Louisiana	0	0	0.1	3	0.1	3	Utah	0	0	0.1	2	0.1	2
Maine	0	0	0.1	2	0.1	2	Vermont	0	0	0.0	1	0.0	1
Maryland	0	0	0.2	6	0.2	6	Virginia	1	9	0.3	7	1.3	16
Massachusetts	0	0	0.7	17	0.7	17	Washington	0	0	0.2	6	0.2	6
Michigan	0	0	1.1	27	1.1	27	West Virginia	0	0	0.1	1	0.1	1
Minnesota	0	0	0.5	12	0.5	12	Wisconsin	0	0	0.8	20	0.8	20
Mississippi	0	0	0.2	5	0.2	5	Wyoming	0	0	0.0	0	0.0	0
Missouri	0	0	0.4	11	0.4	11	Total	3	168	21.9	530	24.9	698

Source: U.S. Environmental Protection Agency

Table 6-7: Analysis of Expected Total Employment Loss by State from Estimated Facility Closures (Proposed Option: Option 2a, Indirect Dischargers and Option 2, Direct Dischargers)											
State	FTE Loss in Closures	State Multiplier	Total State Impact	Total State Employment	Impact, Percent of Total	State	FTE Loss in Closures	State Multiplier	Total State Impact	Total State Employment	Impact, Percent of Total
Alabama	7	2.52	18	1,758,000	0.001%	Montana	0	1.61	0	375,000	0.000%
Alaska	1	1.49	1	236,000	0.001%	Nebraska	3	2.37	6	834,000	0.001%
Arizona	5	2.67	14	1,608,000	0.001%	Nevada	0	1.64	1	614,000	0.000%
Arkansas	6	2.28	13	1,036,000	0.001%	New Hampshire	3	2.52	9	589,000	0.001%
California	228	2.72	621	13,714,000	0.005%	New Jersey	18	2.46	44	3,752,000	0.001%
Colorado	5	2.80	13	1,667,000	0.001%	New Mexico	1	2.15	2	665,000	0.000%
Connecticut	15	2.34	35	1,679,000	0.002%	New York	30	2.12	64	7,967,000	0.001%
Delaware	0	1.90	1	342,000	0.000%	North Carolina	12	2.51	31	3,246,000	0.001%
District of Columbia	0	1.27	0	260,000	0.000%	North Dakota	1	2.20	1	304,000	0.000%
Florida	16	2.19	36	5,961,000	0.001%	Ohio	38	3.03	116	5,094,000	0.002%
Georgia	9	2.35	22	3,008,000	0.001%	Oklahoma	6	2.31	15	1,416,000	0.001%
Hawaii	1	1.83	2	546,000	0.000%	Oregon	4	2.47	10	1,418,000	0.001%
Idaho	0	2.20	1	473,000	0.000%	Pennsylvania	31	2.88	89	5,524,000	0.002%
Illinois	38	3.08	116	5,598,000	0.002%	Rhode Island	2	1.98	4	469,000	0.001%
Indiana	17	3.04	52	2,632,000	0.002%	South Carolina	7	2.28	17	1,635,000	0.001%
Iowa	6	2.72	16	1,447,000	0.001%	South Dakota	1	2.01	2	349,000	0.000%
Kansas	5	2.35	13	1,238,000	0.001%	Tennessee	12	2.60	30	2,256,000	0.001%
Kentucky	6	2.76	18	1,615,000	0.001%	Texas	32	2.76	89	7,991,000	0.001%
Louisiana	3	2.08	7	1,796,000	0.000%	Utah	2	2.64	6	765,000	0.001%
Maine	2	2.04	3	598,000	0.001%	Vermont	1	2.13	3	291,000	0.001%
Maryland	6	2.32	13	2,403,000	0.001%	Virginia	16	2.27	37	3,113,000	0.001%
Massachusetts	17	2.55	45	2,847,000	0.002%	Washington	6	2.38	14	2,340,000	0.001%
Michigan	27	2.72	74	4,125,000	0.002%	West Virginia	1	2.14	3	701,000	0.000%
Minnesota	12	2.73	32	2,307,000	0.001%	Wisconsin	20	2.66	53	2,453,000	0.002%
Mississippi	5	2.30	10	1,081,000	0.001%	Wyoming	0	1.76	0	228,000	0.000%
Missouri	11	2.58	28	2,511,000	0.001%	Total	698		1,848		

Source: Department of Commerce and Environmental Protection Agency

a percent. For most states (30), the estimated loss as a percent of total state employment amounts to one one-thousandth of a percent. Finally, for the remaining 12 states, the estimated loss rounds to zero when calculated to the nearest thousandth of a percent. Thus, on the basis of the findings from this and the preceding analysis, EPA expects that the proposed regulation for the MP&M industry will not cause significant employment impacts at the state level.

6.4 Assessment of State-Level Employment Impacts Including Possible Employment Gains

As a final part of the analysis of community level employment impacts, EPA considered the effect of total state-level employment impacts including the effect of possible employment gains as analyzed in the preceding chapter. Possible labor gains, as estimated in Chapter 5, were distributed by state, and state-level employment multipliers were applied to these gains to estimate the total potential state-level employment gain. These values were subtracted from the total employment loss values calculated in the preceding section to calculate a net employment loss by state, which takes account of possible gains from compliance-related activities.

For this analysis, EPA first distributed the estimated additional labor demand from manufacture, installation, and operation of compliance equipment according to the distribution of MP&M employment by state. These values represent the possible *primary impact* labor gains that may offset the employment losses from estimated facility closures.

In recognition that these employment gains, if realized, would also generate employment gains in linked industries, EPA again applied state-level employment multipliers to these gains to estimate a total possible employment gain by state. In using the BEA state-level employment multipliers to calculate total possible employment gains, EPA further recognized that the industry definitions on which the multipliers would be based should differ depending on whether the primary labor effect occurred from the manufacture and installation of the compliance equipment or from its operation. Specifically, the primary employment gains stemming from operation of compliance equipment would occur in the MP&M industry and the employment multiplier effect should reflect the composite multiplier applicable to the MP&M industry as a whole within a state. However, employment gains stemming from manufacture and installation of compliance equipment would involve different industries and the multiplier effects should be based on the state-level multipliers applicable to those specific industries. For estimating the total employment effect stemming from manufacture of compliance equipment, EPA used the state-level multipliers for BEA industry sector 18, Fabricated Metal Products (which is also one of the sectors used to calculate composite

MP&M industry multipliers). For installation of compliance equipment, EPA used the state-level multipliers for BEA industry sector 7, Repair and Maintenance Construction.

Accordingly, to calculate a total potential employment gain from compliance-related activities, EPA multiplied and summed the labor requirement values for the different activity categories as follows:

Component of Primary Employment Gain	Industry on Which Multiplier Is Based
Manufacture of Compliance Equipment	Fabricated Metal Products Manufacturing
Installation of Compliance Equipment	Repair and Maintenance Construction
Operation of Compliance Equipment	Composite MP&M Industry in a state

The resulting estimates of total potential employment gain by state are summarized in Table 6-8. These values range from a low of zero for the District of Columbia, which has a very low estimated employment in MP&M industry activity, to a high of 552 for California, the state with the largest estimated MP&M industry employment. The average possible gain by state amounted to 81 FTEs. These values were subtracted from the estimated total loss values calculated in the preceding section to yield an estimated net employment loss from the regulatory option. As shown in Table 6-8, for all states but California, which has an estimated net employment loss of 69 FTEs, the estimated potential gain exceeds the estimated loss from facility closures. Thus, the potential employment gains associated with compliance activities, *if realized*, could substantially offset the local employment losses expected to result from facility closures.

These potential offsets to the employment losses from estimated facility closures further strengthen EPA's conclusion that the proposed MP&M industry regulation should not have a significant employment impact on affected communities.

Table 6-8: Estimated Employment Impacts Including Losses from Facility Closures and Gains from Manufacture, Installation and Operation of Compliance Equipment (Proposed Option: Option 2a, Indirect Dischargers and Option 2, Direct Dischargers)

State	Total Loss from Facility Closures with Multiplier	Potential Gain, Primary Impact Only	Gain with State Multiplier	Net Employment Loss/(Gain)	State	Total Loss from Facility Closures with Multiplier	Potential Gain, Primary Impact Only	Gain with State Multiplier	Net Employment Loss/(Gain)
Alabama	18	21	52	(34)	Montana	0	0	1	(0)
Alaska	1	3	4	(3)	Nebraska	6	8	19	(13)
Arizona	14	16	41	(27)	Nevada	1	1	2	(1)
Arkansas	13	18	40	(26)	New Hampshire	9	10	25	(16)
California	621	209	552	69	New Jersey	44	53	130	(87)
Colorado	13	14	38	(25)	New Mexico	2	2	5	(3)
Connecticut	35	45	104	(69)	New York	64	90	187	(124)
Delaware	1	1	2	(2)	North Carolina	31	37	90	(59)
District of Columbia	0	0	0	(0)	North Dakota	1	2	4	(3)
Florida	36	49	105	(69)	Ohio	116	115	345	(229)
Georgia	22	28	65	(43)	Oklahoma	15	19	43	(29)
Hawaii	2	3	6	(4)	Oregon	10	12	29	(19)
Idaho	1	2	3	(2)	Pennsylvania	89	93	265	(176)
Illinois	116	113	344	(228)	Rhode Island	4	7	13	(9)
Indiana	52	51	153	(101)	South Carolina	17	22	49	(33)
Iowa	16	18	46	(30)	South Dakota	2	2	5	(3)
Kansas	13	16	38	(25)	Tennessee	30	35	90	(60)
Kentucky	18	19	52	(34)	Texas	89	97	261	(171)
Louisiana	7	10	20	(13)	Utah	6	7	18	(12)
Maine	3	5	10	(6)	Vermont	3	4	8	(5)
Maryland	13	17	38	(26)	Virginia	37	22	49	(12)
Massachusetts	45	52	130	(86)	Washington	14	17	40	(27)
Michigan	74	82	222	(148)	West Virginia	3	4	9	(6)
Minnesota	32	35	94	(62)	Wisconsin	53	59	155	(102)
Mississippi	10	14	31	(20)	Wyoming	0	0	0	(0)
Missouri	28	33	84	(56)					

Apparent errors result from rounding.
Source: U.S. Environmental Protection Agency

Chapter 7
Foreign Trade Impacts

7.1 Introduction

To the extent that effluent guidelines change the total production costs of domestic producers in the MP&M industries without similarly affecting production costs for foreign producers, they are likely to affect the balance of trade for the goods and services produced by the MP&M Phase I industries. If cost changes cause facility closures, domestic and foreign facilities would compete to replace, in whole or in part, the sales associated with the closing facility. The possible consequence of reduced exports and higher imports would be detrimental to the U.S. trade balance both in aggregate and for the MP&M industry products in particular. The purpose of the foreign trade analysis is to gauge the likely extent of trade impacts that could result from the MP&M effluent guideline.

This analysis examines the effects of Option 2A under the zero-cost-pass-through assumption, which is the most conservative assumption in that it leads to the largest number of estimated closures[1]. Even under this assumption, the MP&M Phase I industry is estimated to experience approximately 0.01 percent change in its trade balance for affected industries. Therefore, EPA finds that the proposed effluent guidelines will not significantly reduce the trade balance of the United States or of the MP&M Phase I industry.

The following sections describe the data sources, methodology and findings associated with the foreign trade analysis.

7.2 Data Sources

The foreign trade impact analysis begins with the revenue losses associated with facility closures projected to follow the proposed regulation as discussed in Chapter 4. These estimated revenue losses are based on the zero-cost-pass-through analysis case. The zero-cost-pass-through was selected because it yields the largest estimated losses in revenues and is therefore the most conservative assumption. The revenue losses are allocated between domestic and foreign producers based on data from the Survey and secondary sources characterizing the state of U.S. competition with foreign producers.

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[1] However, it is not conservative with respect to the projected responses from facilities that do not close. These facilities are allowed to compete for sales associated with closing facilities. This relaxes the assumption, implicit in the facility impact analysis, of no change in facility-level output., but it retains the assumption of no price increase.

This analysis uses responses from Question 5 of the Survey[2], which asked respondents to identify their "major source of competition" in each of three markets:

1. Local / Regional
2. National
3. International

Respondents were asked to select one and only one of the following possible responses for each of the above categories:

1. Domestic producers of the same or similar products
2. Foreign producers of the same or similar products
3. No competition in this market
4. Do not operate in this market

Question 2 asked for the percentage of revenues earned from exports from each responding facility, and therefore the percentage of revenues earned from domestic sales.

Secondary sources supplemented Survey data. Import and export data for MP&M Phase I sectors were taken from Department of Commerce publications for the year 1991, the most recent year available at the time of this economic impact analysis, and therefore the best predictor of foreign competitiveness at the time of effluent guideline promulgation. The trade data were aggregated at the 4-digit SIC level and included both dischargers and non-dischargers.

7.3 Methodology

In conventional economic theory, the effect of an increase in domestic production costs on the foreign trade balance depends on several complex considerations: the likely pricing behavior of domestic producers in response to the cost increase; the price elasticity of demand in both domestic and export markets; the likely pricing and supply response of foreign producers; and the likely change in currency exchange rates. In practice, these analytic factors are very difficult to estimate with any useful accuracy. For a more practical analytic approach, this chapter assesses the likely international trade effects of the proposed regulation, Option 2A/2, by allocating the revenue losses in closing facilities between domestic and foreign producers based on an assessment of the character of international competition faced by the facility and its MP&M sector. Each closing facility's

[2] The §308 Survey is attached as Appendix A to the companion Profile document.

revenue loss is assigned to one of three trade impact scenarios that span the range of likely trade effects that would occur because of the facility closure.

7.3.A Defining the Trade Impact Scenarios

When a facility closes, other domestic producers and foreign producers of the same goods and services produced by the closing facility will compete to replace the facility's former export and domestic sales. The outcome of this competition between domestic and foreign producers will determine the impact of a facility closure on the MP&M industry trade balance.

In the competition for the facility's former export markets, domestic exports will fall and that component of the trade balance will deteriorate unless domestic producers are competitive enough to increase their exports to equal the amount previously exported by the closing facility. If domestic producers so dominate a world market that all of a closing facility's exports are retained by other domestic producers, then the nation will experience no loss of exports due to that facility's closure. Alternatively, if foreign producers are successful in winning some or all of the foreign markets previously served by the closing facility, then domestic exports will fall because of the facility closure and the trade balance will deteriorate accordingly.

Similarly, the closing facility's domestic sales are also subject to competition between domestic and foreign producers. Whether imports will increase depends on the success of foreign producers in competing away some or all of the domestic market share previously served by the closing facility. For example, if U.S. firms fare poorly against foreign producers, all of the closing facility's previous domestic sales might be replaced by imports. In that case, imports would increase by an amount equal to the closing facility's domestic sales and the trade balance for MP&M products would deteriorate by a like amount. Alternatively, if U.S. producers retain all of the former domestic sales of a closing facility, then imports will not increase and the import component of the trade balance will be unaffected by the prospective facility closure.

The combination of the results from the competition for the former domestic and export sales of closing facilities yields the change in the net trade balance for the MP&M industry. The amount by which the net trade balance declines is determined as the increase in imports plus the decrease in exports.

The foreign trade impact analysis identifies three scenarios that span the likely range of foreign trade impacts of post-compliance closures[3]. In the analysis, each closing facility is assigned to one of the three impact scenarios based on the assessment of the character of international competition faced by the facility (from Question 5 on the Survey) and its MP&M sector (from secondary census data). Each scenario describes a possible outcome of the competition between domestic and foreign producers to replace the production loss in facilities estimated to close as a result of the MP&M regulation:

1. *Worst case*. In the worst case scenario, all production for domestic consumption and for export by domestic facilities projected to close post-compliance is captured by foreign sources. Exports are assumed to decrease by the amount previously exported by closing facilities. In addition, imports are assumed to increase to replace the entire non-export portion of these facilities' production. Therefore, the net trade balance deteriorates by the total amount of production lost due to the post-compliance closures.

2. *Best case*. In the best case scenario, all production for domestic consumption and for export by facilities projected to close is replaced in full by production and exports from other domestic facilities. Both exports and imports remain unchanged because foreign producers do not replace any of the domestic production lost by facility closures. The net trade balance remains constant.

3. *Proportional case*. In the proportional case, the production of facilities projected to close is replaced both by remaining domestic facilities and by foreign imports in the same proportions as the baseline ratio of imports and exports to the total domestic market. As explained further below, this scenario attempts to reflect the approximate historical competitiveness of MP&M industry sectors in competing with foreign producers in domestic and foreign markets. As an example, in this scenario, if imports account for half of the domestic market of an MP&M sector's products, then a closing facility's production for domestic sales would be replaced half by imports and half by other domestic producers.

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[3] It is possible, but highly unlikely, for the trade balance to deteriorate or improve by more than the total value of production lost by closing facilities. Even keeping prices constant, under the zero-cost-pass-through assumption, changes in output can affect relative prices between countries by influencing currency exchange rates. Currently, the impact of exchange rates on the MP&M trade balance cannot be modeled with useful accuracy and is not included in this analysis.

In the analysis, each sample facility that is projected to close — and its associated revenue— is assigned to one of the three scenarios, depending on the facility's own characterization of foreign competition in the Survey and on secondary source data on foreign trade at the sector level.

7.3.B Assigning the Production from Closed Facilities to One of the Three Scenarios

Each facility projected to close was assigned to a foreign trade impact scenario in two steps. The first step assigns a point value to the facility's self-assessment of foreign competition as indicated in its responses to the Survey. The second step assigns point values to the facility based on MP&M sector-specific secondary source information compiled in the preceding industry profile (Chapter 3). The sum of these scores indicates the trade impact scenario to which the facility is assigned for the trade impact analysis.

The first step examines the sample facility's own assessment of its competition against imports and exports, as indicated by its response to the Survey question (Question 5) that asked the facility to identify its "major source of competition" in each of three markets. The respondent facility's export market is the "international market" as referenced in the Survey. If the sample facility indicated that it has no competition in the export market, it is assigned an export competition point value of +1. Alternatively, if it indicated that foreign producers are its main source of competition, then it is assigned a point value of -1. The other possible responses were that the facility competes primarily against other domestic producers or that the facility does not operate in the export market. Either of these responses corresponds to 0 points.

The facility's domestic market includes both local and national markets, as referenced in the Survey. If the facility indicated that its primary source of competition in *either* of these domestic markets comes from foreign producers, the facility is assigned a point value of -1 in the area of import competition. If, however, it indicated that it has no competition in either of these markets, it is assigned a point value of +1. The exception is that, if a facility indicated strong foreign competition in one domestic market and no competition in the other, it was given a score of 0. Responses indicating that the facility does not operate in domestic markets or that it competes primarily against domestic producers in those markets correspond to 0 points.

The analysis then sums each facility's import and export competitiveness scores. The possible score values from the facility's self assessment of foreign competition range from +2, corresponding to no significant foreign competition, to -2, indicating significant foreign competition.

The second step of the analysis uses measures of foreign competition developed for the MP&M industry sector profiles and in the analysis of facility cost-pass-through potential. To measure the degree of *import* competition, each sector was given a score of -1, +1, or 0, depending on whether its import penetration ratio was, respectively, higher than, lower than, or equal to the median import penetration ratio among the MP&M sectors. Sectors with high import penetration ratios exhibit relatively less success in competing against foreign competition. *Export* competition was scored in the opposite way: each sector was assigned a score of +1, -1 or 0, depending on whether exports as a share of domestic production were, respectively, higher than, lower than, or equal to the median export share among the MP&M sectors. A high export share indicates relative success in competing against foreign producers. The foreign trade analysis uses the *sum* of the import and export scores as an indicator of the performance of each MP&M sector in competing with foreign producers for domestic and export markets. These possible score values range from +2, indicating strong competitive performance against foreign producers in domestic and export markets, to -2, indicating weak competitive performance against foreign producers in domestic and export markets. Each sample facility closure takes on the point score of the sector to which it belongs.

Adding the score based on respondents' self-assessments of the character of competition from foreign producers to the score based on overall international market considerations for the sector yields a combined international trade impact score for each projected sample facility closure ranging from -4 to +4. On the basis of that score, each sample facility closure and its sample-weighted production was assigned to one of the three foreign trade impact scenarios according to Table 7-1 below:

Table 7-1: Assignment of Facilities to Trade Impact Scenarios

Score	Assigned Scenario
-4 to -2	*Worst Case:* Total replacement of lost output by foreign production.
-1 to +1	*Proportional Case:* Proportional replacement of lost output by foreign production.
+2 to +4	*Best Case:* Zero replacement of lost output by foreign production.

Source: Environmental Protection Agency

7.3.C Calculating Changes in Imports and Exports

Once each sample facility closure was assigned to a trade impact scenario, it is then possible to allocate the sales that had been earned by projected closures between foreign and domestic producers in export and import markets.

First, the pre-compliance sales from failing facilities were divided between domestic and export sales using their facility-specific Survey responses indicating the share of revenues earned from exports. Exports are the product of each facility's export revenue share and its total revenues. Domestic sales include the remainder. Depending on the foreign trade impact case to which each estimated facility closure was assigned, the disposition of export and domestic sales was calculated as follows.

Best Case Scenario

For sample facility closures assigned to the best case scenario, all of their domestic sales are estimated to be replaced by other domestic producers, while all of their export sales are also replaced by domestic producers. Because the production and sales of the failing facility have been replaced by other domestic facilities, neither exports, imports nor the trade balance change.

ΔX	=	0	=	*change in exports*
ΔM	=	0	=	*change in imports*
$\Delta X - \Delta M$	=	0	=	*change in trade balance*

Worst Case Scenario

In the worst case scenario, all former exports from closing facilities are assumed to be captured by foreign producers, as are all former domestic sales. Therefore, exports fall by the full amount of the closing facility's baseline exports and imports increase by the full amount of the facility's baseline domestic sales. The U.S. trade balance declines by the amount of revenue the closing facility earned under baseline conditions.

$$\Delta X = R \times SHARE_X$$

$$\Delta M = R \times (1 - SHARE_X)$$

$$\Delta X - \Delta M = R$$

where

R	=	*Facility average total revenue over period of analysis*
$SHARE_X$	=	*Share of facility revenue from export sales*

Proportional Case Scenario

The estimation of trade impacts for closures assigned to the proportional case is based on the international trade performance of the MP&M sector from which the facility receives the most revenue. Specifically, the assignment of the closing facility's domestic and export sales between domestic and foreign producer is based on the current allocation of export and domestic sales between foreign and domestic producers for the MP&M sector. In the proportional case, domestic producers are assumed to compete as well on the margin

for retaining export and domestic markets as the relevant MP&M sector competes on average in export and domestic markets.

Foreign producers are assumed to capture the same share of the facility's former *domestic* sales as the share of total domestic sales in the relevant MP&M sector that is held, in aggregate, by foreign producers. Said another way, foreign producers will be approximately as competitive on the margin in capturing the former domestic sales of closing facilities as they have been historically in gaining a share of U.S. markets in the relevant sector. If **J** denotes the share of domestic sales for the relevant MP&M sector from all sources accounted for by foreign producers, then **J** can be calculated as follows:

$$\mathbf{J} = \mathbf{M} / (\mathbf{VS} - \mathbf{X} + \mathbf{M})$$

where:

J	=	*Foreign producers' (import) share of domestic sales (1991, by sector)*
M	=	*total U.S. imports (1991, by sector)*
VS	=	*total U.S. value of shipments (1991, by sector)*
X	=	*total U.S. exports (1991, by sector)*

The denominator in the above expression measures the value of domestic sales from all sources. The U.S. value of shipments less exports (**VS - X**) is the value of domestic sales from domestic producers; imports (**M**) are the value of domestic sales from foreign sources; and domestic sales from domestic producers plus imports (**VS - X +M**) is total domestic sales from both domestic and foreign producers.

The allocation of a facility's former *export* sales between domestic and foreign producers is based on the historical success of domestic producers in achieving export sales in relation to total domestic sales for the relevant MP&M sector. That is, domestic producers are assumed to retain the same share of the closing facility's former export sales as the average share of exports to total domestic sales.[4] In other words, domestic producers are assumed to be approximately as competitive at the margin in retaining closing facilities' export markets as

[4] While the ideal ratio to use is the ratio of U.S. exports to worldwide trade in the relevant industry sector, export figures from other countries are not available with useful accuracy in the detail needed for this analysis. The measure used in this analysis is a suitable substitute that exhibits some desired characteristics. If U.S. producers are not able to compete at all with foreign producers in export markets, then the marginal competitiveness and, accordingly the calculated ratio, should be 0. As U.S. competitive strength in foreign markets increases, the ratio should increase correspondingly. If U.S. producers completely dominate world trade markets, then the marginal competitiveness and the calculated ratio should be 1. The ratio used in this analysis does exhibit these characteristics.

they are on average in achieving export sales out of the total domestic market. The ratio of exports to domestic sales, **K**, is calculated as follows:

$$\mathbf{K} = \mathbf{X / (VS - X + M)}$$

where

K = *Ratio of exports to total domestic sales (1991, by sector)*

Applying these ratios to the revenues from facilities projected to close, the changes in export and imports for facilities assigned to the proportional case were calculated as follows:

$$\Delta \mathbf{X} = [\mathbf{R} \times \mathbf{SHARE_X}] \times \mathbf{K}$$

$$\Delta \mathbf{M} = [\mathbf{R} \times (1 - \mathbf{SHARE_X})] \times \mathbf{J}$$

$$\Delta \mathbf{X} + \Delta \mathbf{M} = [\mathbf{R} \times \mathbf{SHARE_X}] \times \mathbf{K} + [\mathbf{R} \times (1 - \mathbf{SHARE_X})] \times \mathbf{J}$$

where

$\Delta \mathbf{X}$ = *Decline in exports (portion of former export sales captured by foreign producers)*

$\Delta \mathbf{M}$ = *Increase in imports (portion of former domestic sales captured by foreign producers)*

$\Delta \mathbf{X} + \Delta \mathbf{M}$ = *Deterioration in net trade balance associated with an projected facility closure assigned to the proportional impact case*

Combining Results over Facilities from the Three Trade Impact Scenarios

The changes in exports and imports accruing from the projected sample facility closures were calculated using the method for the foreign trade impact case to which each estimated sample facility closure was assigned. The facility-specific changes in exports and imports were then multiplied by the facility sample weights and summed to yield an estimate of the aggregate impact on imports, exports and the trade balance resulting from promulgation of the proposed MP&M effluent guidelines.

7.4 Findings

Table 7-2 shows the number of effluent discharging MP&M Phase I facilities that are estimated to belong to each of the foreign trade impact scenarios.

Table 7-2: Trade Impact Scenarios, Facility Population Distribution (National Estimates)		
Scenario	**No. of Facilities**	**Percent**
Worst Case: Total replacement of lost output by foreign production.	3,974	37.5%
Proportional Case: Proportional replacement of lost output by foreign production.	2,924	27.6%
Best Case: Zero replacement of lost output by foreign production.	3,703	34.9%
All Facilities	10,601	100%
Source: Environmental Protection Agency		

Table 7-3 presents the results from the foreign trade impact analysis. It shows that, even under the conservative zero-cost-pass-through assumption, the proposed effluent guidelines will have a negligible impact on U.S. imports, exports and the trade balance.

On the basis of sample-weighted national estimates, exports are not projected to change measurably as a result of the proposed regulatory option, Option 2A/2. Post-compliance increases in imports would amount to approximately $5.3 million. which is approximately 0.01 percent of 1991 imports. The net effect on the trade balance is a decline of $5.3 million, or approximately 0.01 percent of the 1991 trade balance for the MP&M Phase I industry.

Table 7-3: Estimated Foreign Trade Impacts of MP&M Phase I Regulation *Sample Weighted National Estimates, Proposed Option, Option 2A/2 ($ million)*			
	Exports	**Imports**	**Trade Balance**
Baseline	112,565.1	72,157.1	40,408.0
Post-Compliance Change	0.0	5.3	-5.3
% Change From Baseline	0.00%	0.01%	-0.01%
Source: EPA / Department of Commerce			

Chapter 8

Assessment of Firm-Level Impacts

8.1 Introduction

While Chapter 4 assessed the facility-level impacts of an MP&M effluent guideline, this chapter estimates the impacts on firms, because firm-level impacts may exceed those assessed at the facility level, particularly when a firm owns more than one facility that will be subject to regulation..

Firms differ from facilities in that firms are business entities or companies, which may operate at several physical locations. Facilities are individual establishments defined by their physical location, whether or not they constitute an independent business entity on their own. Some facilities in the Survey sample are single-facility firms. In these cases, the firm-level impact depends only on the facility-level impact. In other cases, though, sampled facilities are owned by multi-facility firms, so that the impact on the owning firm depends not only on that facility, but also on the impacts on and characteristics of other facilities owned by the same firm.

This chapter does not examine the ability of firms to transfer capital, labor and technology between facilities. This is a conservative omission, since such transfers would reduce the economic impact of effluent guidelines. This chapter applies all of the financial impacts on facilities to their parent firms, by summing facility impacts within each firm. Also, while this chapter examines all 396 sample facilities, with no allowance for closures, facilities in fact have the option of closing rather than incurring impacts associated with effluent guideline compliance. Some facilities (56, on an unweighted basis) were projected to close even under baseline, pre-compliance conditions. Either kind of closures can ameliorate any impacts found in this firm-level analysis.[1]

EPA assessed firm-level impacts on the basis of changes in measures of profitability and interest coverage, as calculated from firm financial statements. These measures are the same as those used in the Analysis of Financial Stress Short of Closure. When applied to firms, these measures indicate the firm's ability to attract

[1] Excluding closing facilities can diminish firm-level impacts in three ways. First, it may exclude facilities associated with post-compliance firm failures. Second, a choice to close must be no more costly than compliance, to a rational firm. Otherwise, it would not choose to close. Therefore, the impact of closures on firms can be no greater than the compliance costs experienced by firms in this analysis, so allowing closures can have only a neutral or ameliorating effect on firm-level impacts. Finally, excluding closing facilities would decrease the MP&M Phase I share of production for multi-facility firms, as will be explained in the methodology section, thus decreasing the significance of facility compliance costs.

and service debt associated with new capital needed for expansion in the normal course of business or for pollution control investments associated with effluent guideline compliance.

EPA conducted the firm-level impact analysis under the zero-cost-pass-through scenario. Since the Survey sample was not designed as a random sample of firms, but was instead toward estimating national characteristics of facilities, the Survey data used in this analysis is not sample weighted. The findings apply only to firms that own sample facilities and do not represent national estimates of firm-level impacts.

The principal difficulty in conducting the firm-level analysis is that the Survey did not request information from respondents about other facilities owned by the respondent's firm. Although the Survey yielded measures of firm — as opposed to facility — revenues, the revenue is not divided between revenue from water-discharging, MP&M Phase I activities and revenue from other activities, and there is no indication of how many other facilities the firms owns nor how many of these are water-discharging MP&M Phase I facilities. Therefore, the analysis of firm-level impacts requires additional assumptions about the relationship between the sample facilities and their owning firms.

EPA finds that the proposed effluent guideline will not be accompanied by unreasonable economic burdens on firms engaged in MP&M Phase I activity. From the sample, EPA identified 263 single- and multi-facility firms for which data were available for the firm-level analysis. Only six out of 263 firms analyzed are projected to pass the baseline financial tests and fail these tests post-compliance. Three of the six firms are associated with facilities that have already been identified as facilities failing the Analysis of Financial Stress Short of Closure. Revenues from the six facilities that fail the firm-level impact analysis amount to less than 0.002 *percent* of all revenues earned by sampled firms active in water-discharging, MP&M Phase I activities.

The following sections describe the sources and methodology used in the firm-level analysis. The chapter concludes by presenting the analytical findings.

8.2 Sources

This analysis requires data about facilities, firms, and the relationship between facilities and firms. In order to assess the significance of firm-level financial impacts, the analysis also requires data about the industries in which MP&M firms compete.

The Survey described in Chapter 3 provides the facility data used to estimate facility-level impacts. The Survey also indicates whether the responding facility is part of a single- or multi-facility firm. If the latter, the survey then asks for identifying data for the owning firm. The analysis uses Survey data regarding firm revenues only when secondary source financial reports are not available. When both secondary source and Survey data were available, this analysis used secondary source data, because these were calculated from public filings in a manner that was most likely to be consistent with similar calculations for other facilities.

If the respondent failed to provide an accurate name for its parent firm, Dun & Bradstreet's *Million Dollar Directory* was consulted to determine that information. Given the name of the owning firm, EPA was able to retrieve income statement and balance sheet information about publicly reporting firms from *Moody's Industrial Manual* and from Standard & Poor's *American, New York* and *NASDAQ Stock Exchange Reports*. Thresholds to determine the significance of firm-level impacts are the same as those used in the Analysis of Financial Stress Short of Closure. They are based on industry statistics from Robert Morris Associates' *Annual Statement Studies* and are presented in Appendix B.

8.3 Methodology

The impact of effluent guidelines on firms is assessed by measuring affected firms' pre- and post-compliance returns on assets (ROA) and interest coverage ratios (ICR), defined in detail in the facility impact analysis chapter[2]. In the case of firms consisting of only the responding facility, the impact on each firm's ROA and ICR is identical to the unweighted facility impact.

It is more difficult, however, to estimate multi-facility firm impacts from facility data, given that the Survey was not directed toward firms and does not address the firm's share of revenues subject to MP&M effluent guidelines. While the Survey did ask facilities that were part of multi-facility firms to indicate firm revenues as well as facility revenues, it is possible that the firm might own other facilities that are also subject to MP&M effluent guidelines but were not sampled. If all of a firm's revenues come from MP&M Phase I production, the impact of effluent guidelines on that firm will clearly be greater than the impact on a firm that participates minimally in MP&M Phase I production, all other things being equal. Similarly, a firm whose production is heavily concentrated in foreign facilities would also experience smaller impacts than firms primarily producing in the U.S. and therefore subject to the MP&M effluent guideline.

[2] See the Analysis of Financial Stress Short of Closure in Chapter 4.

This analysis estimates impacts based on a range of possible relationships between facilities in the sample and the firms that own them. Facility balance sheet and income statement changes are extrapolated to changes in the owning firm's balance sheet and income statement to yield post-compliance measures of firm-level ROA and ICR. These values are compared to the thresholds presented in Chapter 4. Firms that exceed both the ROA and ICR thresholds before compliance but fall below either threshold after compliance are deemed to experience significant adverse impacts from the effluent guidelines.

This is a conservative analysis because, in practice, firms may reduce any adverse impacts estimated in this firm-level analysis in several ways. First, contrary to the zero-cost-pass-through assumption used, firms are likely to pass some costs of pollution control to customers through higher prices. Second, firms may shift resources and activities among their facilities to meet effluent guidelines in less costly ways than indicated by facility analyses alone. The current analysis does not examine such infra-firm transfers.

8.3.A Identifying Firm Financial Data

The Survey asked facilities to name the firms that own them and to indicate whether these firms were single- or multi-facility firms. Facilities that were subsidiaries of a common parent firm were grouped together. This effort yielded a list of 355 unique firm names from the 396 sample facilities, including both publicly reporting and non-publicly reporting firms. Of these, 185 are single-facility firms and 170 are multi-facility firms.

The balance sheet and income statement data for publicly reporting multi-facility firms were gathered from *Moody's Industrial Manual* and from Standard & Poor's *American, New York* and *NASDAQ Stock Exchange Reports*. These data, together with the Survey data for single-facility firms, provided the necessary information to calculate baseline ROA and ICR values for all single-facility firms and for publicly reporting multi-facility firms (see Table 8-1). Firm financial data were not available for 94 non-public multi-facility firms., nor for 6 of the 76 publicly reporting multi-facility firms.[3] The analysis for the 70 publicly reporting firms for which data was available is offered as the best estimate of impacts on non-publicly reporting multi-facility firms. Overall, the firm-level analysis is applied to 255 firms that own 290 of the 396 facilities sampled by the Survey. These 255 firms include all 185 single-facility firms and the 70 multi-facility firms for which data were available.

[3] Historical data were unavailable for six firms because of changes in firm ownership.

Table 8-1: Sources of Firm Financial Data		
	Publicly Reporting Firms	**Non-Publicly Reporting Firms**
Single-Facility Firms	§308 Survey (8 firms)	§308 Survey (177 firms)
Multi-Facility Firms	Standard & Poor's/Moody's (70 firms, data available 6 firms, data unavailable)	Data Not Available (94)

Where identification of parent firms was absent or unclear, Dun & Bradstreet's *Million Dollar Directory* provided supplementary information.

8.3.B Calculating Baseline Firm Financial Conditions

To provide a baseline against which the financial condition of firms after compliance with effluent guidelines can be compared, the analysis begins with the calculation of baseline firm financial performance, as measured by returns on assets (ROA) and interest coverage ratios (ICR). ROA, a measure of profitability, indicates a firm's viability as an ongoing enterprise and its ability to attract new capital. ICR indicates a firm's likely ability to support the cost of financing new capital expenditures, such as business expansion or pollution control investments. As in Chapter 4, these measures are defined as:

ROA = [REV - (TC - TAX - INT)] / TA *Return on Assets*

ICR = [REV - (TC - TAX - INT)] / INT *Interest Coverage Ratio*

where:

REV = Revenue;

TC = Total Costs;

TAX = Tax Expense;

INT = Interest Expense;

TA = Total Assets

Baseline ROA and ICR values were calculated for all firms for which data was available.[4] If *either* ROA *or* ICR fell below the thresholds given in Table 8-2, then the corresponding firm was considered to be a baseline failure. Baseline failures were excluded from further analysis in that firm impacts attributed to MP&M effluent

[4] The firm financial analysis includes compliance costs for facilities projected to close because of poor financial performance or condition. Therefore, the post-compliance firm financial analysis likely represents a conservative upper bound on firm impacts, since not all facilities would actually choose to incur pollution control costs. For some facilities, closure might be a financially superior option.

guidelines are measured as *incremental* failures with respect to the baseline firm financial tests. Failure of the firm financial analysis is not a projection of firm closure, but rather a projection that the firm is likely to face difficulties financing or attracting capital investments, including any effluent guideline related investments.

Table 8-2: Firm Financial Impact Thresholds	
Return on Assets	2.86%
Interest Coverage Ratio	2.11
Source: Environmental Protection Agency	

The thresholds are calculated as 1989 shipments-weighted averages of 25th percentile ROA and ICR values across MP&M Phase I industries.

8.3.C Calculating Post-Compliance Firm Financial Conditions

The income statements and balance sheets of firms that survive the baseline firm financial tests are then changed to reflect pollution control activities and outlays or savings accompanying Option 1A effluent guidelines, as determined by EPA engineering analysis. For single-facility firms, these are the same total annualized changes in after-tax cash flows as those used in the facility impact analysis in Chapter 4, under the zero-cost-pass-through assumption.

For multi-facility firms, the compliance costs for each sampled facility within each firm are summed. The sum of sampled facility compliance costs is then multiplied by a factor that accounts for the estimated share of the firm's MP&M Phase I production that was not included in the sample. For example, if a multi-facility firm is represented by two sample facilities, then extrapolating from the two facilities' compliance costs to the firm's compliance costs depends on how much of the unsampled portion of the firm's production would be subject to the effluent guidelines. If no other production at the firm is an MP&M Phase I activity, then the summed sample facility costs are the same as the firm's compliance costs. If the entire firm is comprised of MP&M Phase I facilities, though, then the firm's compliance costs should be a multiple of the sum of the firm's sampled facility compliance costs. In this case, the multiplication factor is the ratio of firm to facility revenues. Extrapolating facility-level compliance costs or savings in this way applies the same relationship between costs and revenues observed in the sampled facilities to the entire firm[5].

[5] This assumption excludes economies or dis-economies of scale for the individual firm being analyzed. However, the sample of firms used in this analysis includes firms represented by a wide range of facilities, whose compliance costs reflect varying relationships, such as relative scale, between the sampled facility and its firm. Therefore, the aggregate results

This analysis tests the entire range of possible assumptions about the proportion of firm production subject to effluent guidelines. While the maximum MP&M Phase I share of firm production is 100 percent, the minimum possible proportion is the proportion of the sampled facilities' revenue to their parent firm's revenue. To illustrate, if a firm is represented in the Survey by facilities whose revenues sum to one-third of the firm's revenues, then the proportion of the firm's revenues from MP&M activities can be no less than one-third. However, that proportion could be as high as one if all the firm's unsampled facilities are also subject to the MP&M Phase I effluent guidelines. Thus, for each multi-facility firm, two firm-level impact cases were analyzed:

- *Minimum proportion* Within each firm, only revenues associated with sampled MP&M Phase I facilities are subject to the regulation.

- *Maximum proportion* Within each firm, all revenues are subject to the regulation.

The post-compliance firm ROA and ICR are therefore calculated as follows:

$ROA = [REV - (TC - TAX - INT + TCC_{firm})] / [TA + TI_{firm}]$ *Return on Assets*

$ICR = [REV - (TC - TAX - INT + TCC_{firm})] / [INT + \Delta INT_{firm}]$ *Interest Coverage Ratio*

where:

REV = Revenue;

TC = Total Costs;

TAX = Tax Expense;

INT = Interest Expense;

TA = Total Assets;

TCC_{firm} = Total Annualized Compliance Cost for the firm including an annualized share of the capital investment (TI, below).

TI_{firm} = Total effluent guideline-related pollution control investment by the firm

ΔINT_{firm} = Change in interest paid by the firm due to pollution control investment

and,

$TCC_{firm} = 1/k \times TCC_{facilities}$

$TCC_{facilities}$ = Sum of total annualized costs of compliance for each sampled facility within the firm

presented in this chapter do reflect the diversity of facility characteristics within firms.

TI_{firm}	=	$1/k \times TI_{facilities}$
$TI_{facilities}$	=	Sum of pollution control investments for each sampled facility within the firm
ΔINT_{firm}	=	$1/k \times \Delta INT_{facilities}$
$\Delta INT_{facilities}$	=	Sum of changes in interest expense paid by each sampled facility within the firm
k	=	Range of values from 1 to $REV_{firm} / REV_{facilities}$

While, in this analysis, k, the share of firm revenue subject to regulation, is allowed to vary over the full range from 1 to $REV_{firm} / REV_{facilities}$, its actual value would depend on the proportion of the firm's revenue that is not subject to MP&M Phase I effluent guidelines, whether because the revenue is not associated with a water-discharging, MP&M Phase I facility or because the production that generates the revenue does not take place in the United States. While some information about the location of sales is available, information regarding location of production is not consistently available, so the possibility of foreign-based production, for at least some of the revenue, is included as one of the possible sources of variation in k.

Because the firm-level analysis uses the zero-cost-pass-through scenario, firm revenues do not change, post-compliance. This is an extremely conservative assumption. Allowing firms to benefit from partial pass-through of compliance costs would reduce the firm-level impacts.

The post-compliance values of ROA and ICR for each firm that passes the baseline analysis are compared to the same thresholds as in the baseline case (see Table 8-2). If a firm fails to meet either threshold, it is deemed an incremental failure.

8.4 Results

The firm-level analysis identifies, from Survey facilities, 185 single-facility firms and 170 multi-facility firms. Of the latter, 76 were publicly reporting firms in 1989. Financial data were gathered for all of the single-facility firms and for 70 of the 76 publicly reporting, multi-facility firms[6].

Of the 255 firms analyzed, 73 firms, or slightly less than 29 percent, failed one or both of the firm financial tests pre-compliance and are therefore classified as financially weak in the baseline case, independent of the MP&M regulation. Of these, 39 baseline failures are associated with facilities projected to close under the facility-level baseline closure test. The firm-level impact analysis seeks indications that a firm would have

[6] Historical data were unavailable for six firms because of changes in firm ownership.

significant difficulty in attracting or financing capital. This is a less severe impact than closure. Therefore, the fact that some but not all of the baseline failures in the firm-level impact analysis are also associated with baseline facility closures is not unexpected. The 29 percent failure rate is also consistent with the use, in this analysis, of the lowest quartile values of each financial measure as thresholds. Even in the select group of loan applicants in the Robert Morris Associates database, 25 percent of firms do not meet both thresholds.

Of the total of 182 firms that pass the baseline firm financial test, only one failed either test under Option 2A, even under the extremely conservative zero-cost-pass-through assumption (see Table 8-3). This was a single-facility firm that accounted for less than 0.0001 *percent* of revenues earned by all 255 sampled firms in the firm-level impact analysis. These results are independent of the assumptions about the share of firm revenue derived from water-discharging MP&M activities. That is, the tests were applied first assuming that among multi-facility firms, no unsampled facilities would be subject to effluent guidelines, and then assuming that all of each firm's unsampled facilities would be subject to those guidelines. The results were identical in each case.

Table 8-3: Firm Impact Analysis Results

Number of Firms in Analysis	255
Baseline Failures	73
Incremental Post-Compliance Failures	1
Source: Environmental Protection Agency	

Chapter 9
Impacts on New Sources

The proposed regulation includes limitations that will apply to new direct and indirect discharging sources within the MP&M Phase I category. In this chapter, EPA examines the impact of these regulations for new dischargers to determine if they would impose an undue economic and financial burden on new sources seeking to enter the MP&M Phase I industry.

EPA proposes to set New Source Performance Standards (NSPS), which apply to new facilities that discharge directly to receiving waters, on the basis of the Best Achievable Technology (BAT) limitations as specified by the proposed Option 2 for existing direct dischargers. Thus, the new source limitations for direct dischargers are the same as those proposed for existing direct discharge facilities.

In addition, EPA proposes to set Pretreatment Standards for New Sources (PSNS), which apply to new indirect discharging facilities (i.e., that will discharge to POTWs), on the basis of the discharge limitations in PSES Option 2, as analyzed for existing indirect discharging facilities. Thus, the new source limitations for indirect discharging facilities will differ from the PSES limitations proposed for existing indirect discharge facilities. Specifically, the proposed PSES option for existing indirect discharge facilities, Option 2a, applies no limitations on low flow indirect discharge facilities (i.e., facilities discharging less than 1,000,000 gallons per year) while applying the mass-based limitations of Option 2 to large flow indirect discharge facilities (i.e., facilities discharging at least 1,000,000 gallons per year). However, the proposed PSNS limitations will apply the mass-based limitations of Option 2 regardless of the new facility's discharge volume.

In general, EPA estimates that, when new and existing sources face the same discharge limitations, new sources will be able to comply with those limitations at the same or lower costs than those incurred by existing sources. Engineering analysis indicates that the cost of installing pollution control systems during new construction is generally less than the cost of retrofitting existing facilities. Thus, a finding that discharge limitations are economically achievable by existing facilities will also mean that those same discharge limitations will be economically achievable to new facilities.

In its analysis of regulatory impacts on existing facilities, EPA found that the mass-based limitations of PSES Option 2 would be economically achievable by indirect discharging facilities regardless of discharge

volume. For this reason, EPA concludes that the new source limitations applicable to new indirect discharging facilities will be economically achievable for these new sources.

EPA notes that one of the important reasons for not applying limitations to the lower flow class of existing indirect dischargers (less than 1,000,000 gallons per year) is to reduce the administrative burden to permit writers that would result from writing mass-based permits for the large number of existing low flow indirect dischargers. EPA estimates that approximately 63 percent of the existing facilities to which the regulation will apply are indirect dischargers with a flow less than one million gallons per year. However, applying the mass-based concentration requirements of Option 2 to new facilities will not impose as large an administrative burden, as new facilities enter gradually over time.

In addition to determining economic achievability, EPA also examined whether the proposed PSNS rule would create barriers to entry and diminish the competitiveness of MP&M markets. Under Option 2a/2, potential entrants would see substantially the same production costs of complying with effluent guidelines as existing facilities that are considering expansion of production by adding capacity. In the short run, however, existing low-flow, indirect dischargers may benefit from a cost advantage over potential entrants, to the extent that these existing facilities can increase production by raising their utilization of current capacity, which would not trigger the imposition of effluent limitations.

Chapter 10
Regulatory Flexibility Analysis

10.1 Introduction

This chapter examines the expected effects of the proposed effluent limitations guidelines and standards for the Metal Products and Machinery (MP&M) Industry on small entities pursuant to the Regulatory Flexibility Act. The Regulatory Flexibility Act (Public Law 96-354) calls for the Agency to prepare a Regulatory Flexibility Analysis (RFA) for regulations that are expected to have a significant impact on a substantial number of small entities. The purpose of the Act is to ensure that, while achieving statutory goals, government regulations do not impose disproportionate impacts on small entities.

The Regulatory Flexibility Act also calls for record-keeping and reporting requirements to be indicated, as well as any federal rules that duplicate, overlap, or conflict with the proposed rule. The proposed regulation imposes no reporting and record-keeping requirements. In addition, no known Federal rules duplicate, overlap, or conflict with the proposed rule.

As discussed in this chapter, EPA finds that the proposed regulation will not impose significant impacts on a substantial number of small entities. In developing the proposed regulation, EPA sought from the outset to define a regulation that would not unreasonably burden small entities. In particular, EPA considered a number of regulatory alternatives for indirect and direct dischargers, each of which was assessed to have varying degrees of impact on small entities. In selecting the proposed regulation from among these alternatives, EPA balanced several factors, including: the need for additional reduction in effluent discharges from the MP&M industry; the fact (as discussed below) that the MP&M industry is largely comprised of small business entities; and the need to achieve additional reduction in effluent discharges without imposing unreasonable burdens on small entities. As a result of these considerations, EPA expressly framed the proposed regulation to reduce impacts on small entities.

Specifically, as discussed in Chapter 1, EPA settled on the proposed regulation for indirect dischargers, Option 2a, after considering and rejecting the initial Option 2. On the basis of the facility impact analyses presented in Chapter 4, EPA determined that Option 2 would be economically achievable by indirect discharging facilities. In accordance with this finding, EPA initially considered adopting the more stringent, mass-based requirement of Option 2 for all indirect discharging facilities. However, further

analysis indicated that Option 2 would place additional financial burdens on smaller facilities (beyond the level imposed by Option 1) and, moreover, would substantially burden permitting authorities by requiring that mass-based standards be written for all indirect discharging facilities, regardless of size and amount of discharge reduction to be achieved. For these reasons, EPA defined and evaluated two additional options for regulating indirect discharging facilities:

1. Option 1a, which applies the more stringent, mass-based requirement of Option 2 to "large" flow facilities (annual discharge volume of at least 1,000,000 gallons per year), and the modestly less stringent, concentration-based requirement of Option 1 for "low" flow indirect dischargers (annual discharge volume of less than 1,000,000 gallons per year); and

2. Option 2a, which applies the requirements of Option 2 to large flow facilities while exempting low flow indirect discharging facilities from regulation.

EPA found that both of these additional options would mitigate the burden of regulation on small businesses and permitting authorities. However, EPA found that the latter option, Option 2a, much more substantially reduced the closure impacts and financial burdens among MP&M facilities owned by small business and, as well, the regulatory implementation burden on permitting authorities. After considering other factors that also favored Option 2a — namely, cost effectiveness — EPA decided to propose Option 2a as the PSES option for indirect discharging facilities.

For this Regulatory Flexibility Analysis, EPA performed a number of analyses aimed at understanding the role of small entities in the MP&M industry and the impacts expected to be imposed on small entities by the proposed regulation. These analyses showed that the MP&M industry is largely comprised of small business entities as defined on the basis of Small Business Administration criteria and other measures of business size. As such, the regulation is expected to apply to a substantial number of small entities. EPA also analyzed the expected level of impacts and compliance costs imposed on small business entities under the proposed and alternative regulatory options. From these analyses, EPA found that the proposed regulation will impose significant economic impacts (i.e., facility closures) more frequently among small business entities than among MP&M facilities generally. In addition, these analyses indicated that the compliance cost burden (as measured by total annual compliance costs as a percent of facility revenue) is expected to be greater among small business entities than among MP&M facilities generally. However, for both of these measures of small business impact — frequency of facility closures and compliance cost burden — EPA found that the absolute levels of impacts were so slight as to

not constitute a significant economic impact on small entities. Moreover, the impact levels under the proposed regulation are much lower than those that would be expected under any of the other options that EPA considered for proposal.

In view of this analysis and in recognition of the Agency's efforts to define the proposed option in a way that would reduce impacts to small entities, EPA concluded that the facility closure impacts and compliance cost burdens of the proposed option will not constitute an undue impact on small business entities. Pursuant to Section 605(b) of the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Agency certifies that the proposed regulation will not have a significant economic impact on a substantial number of small entities.

The following sections of this chapter describe the Regulatory Flexibility Analysis undertaken for the MP&M regulation. Section 10.2 discusses the definitions of small entities used in this analysis. Section 10.3 then examines the role of small business entities in the MP&M industry. Section 10.4 presents the analyses of the impact of the proposed and alternative regulatory options on small business entities, including analyses of facility closure impacts and compliance costs by business size criteria.

10.2 Defining Small Entities

For this analysis, EPA used two approaches to define small business entities and to characterize regulatory impacts on them. The first approach used Small Business Administration (SBA) business size criteria that are compared with the estimated employment of the *firms* that own MP&M facilities while the second approach was based on the employment size distribution of *facilities* expected to be subject to regulation.

The first approach for defining and characterizing small business entities used SBA business size criteria to identify facilities that are owned by a small business *firm*, as defined by SBA. By being based on a measure of firm size (as opposed to facility size), this approach follows EPA's traditional framework for assessing regulatory impacts. This approach recognizes that firm size measures will generally provide more meaningful insight than facility size measures into the ability of businesses to manage financing needs and absorb compliance costs. For this approach, EPA developed a composite firm employment size criterion for each Phase I MP&M sector. Each sector's employment size criterion was calculated as the weighted average of the small business employment criteria for each 4-digit SIC code in the sector, weighted by the

three-year average (1987-1989) of shipments for the SIC code as obtained from Department of Commerce data. The resulting employment size criteria are summarized in Table 10-1.

Table 10-1: Composite Firm Employment Size Criteria for Small Businesses, Based on Small Business Administration Criteria

MP&M Phase I Sector	Employment Criterion
1. Hardware	503
2. Aircraft	1,284
3. Electronic Equipment	721
4. Stationary Industrial Equipment	637
5. Ordnance	1,122
6. Aerospace	1,000
7. Mobile Industrial Equipment	636

Source: Small Business Administration and Environmental Protection Agency

To determine whether a sample facility was owned by a small business firm, EPA compared the *firm-level* employment for the facility to the composite employment size criterion for the MP&M business sector from which the facility received the greatest revenue. For those facilities that reported being single facility businesses in their §308 survey responses, EPA used the facility's reported employment as firm-level employment. For facilities *that reported being part of a multiple facility firm*, it was necessary to estimated firm-level employment because the §308 questionnaire did not ask respondents the number of firm-level employees. For these facilities, EPA estimated firm-level employment by multiplying the reported number of facility employees per dollar of facility revenue *times* reported firm-level revenue. That is, the employment intensity of revenue for the firm was assumed to be the same as that for the facility as reported in the facility's §308 questionnaire response. A facility was characterized as being owned by a small business if its estimated firm-level employment was less than the composite employment size criterion for the applicable MP&M business sector. As discussed in more detail in the next section, this approach to defining small business entities showed that the MP&M industry is heavily dominated by small businesses. Over 75 percent of the estimated population of water-discharging facilities were found to be owned by a small business.

With over 75 percent of the facilities expected to be subject to regulation defined as small businesses, EPA developed additional size classification criteria to permit a more detailed understanding of how regulatory impacts would be distributed among facilities of differing sizes. This second approach to classifying entity size differs from the first approach in that it is based on the employment size distribution of *facilities* instead of firms. The analyses with respect to facility size are intended to provide additional

insight into how *smaller facilities* are likely to be affected by the proposed regulation. Specifically, EPA used the first quartile and median values of sample-weighted facility employment reported in §308 Survey responses, as additional bases for characterizing impacts among smaller entities in the MP&M industry. From the analysis of the facility employment distribution, EPA estimated that 25 percent of water-discharging facilities have 9 or fewer employees and that 50 percent of water-discharging facilities have 79 or fewer employees. Accordingly, these quartile ranges of facility employment size — 9 or fewer employees (first quartile), and 10 to 79 employees (second quartile) — were used as additional facility classifications for understanding the impact of the proposed regulation on small business entities — defined, in this case, as facilities instead of firms. While the first and second quartile ranges of facility employment size may not be interpreted as absolute definitions of *smallness* in the MP&M industry, they necessarily define ranges of facility size (based on facility employment) that are small in relation to the general set of water-discharging facilities in the industry.

10.3 Small Business in the MP&M Industry

To understand the potential breadth of impacts among small business entities, EPA examined the participation and role of small business entities in the MP&M industry. This examination was based on both Department of Commerce economic data for establishments operating in MP&M Phase I SIC codes and data from the §308 Survey of MP&M facilities expected to be subject to regulation.

Small Business Participation Based on Department of Commerce Data

By a number of measures, small businesses contribute substantially to economic activity in the MP&M industry. Table 10-2 summarizes the participation and contribution by establishments of varying employment size in terms of number of establishments (or facilities), employment, shipments, and value added. For each economic activity measure (e.g., shipments), the table lists the total value over all MP&M Phase I sectors and also by each MP&M sector individually. To aid in understanding the role of small businesses in the industry group, the table also lists the percentage of the economic activity measure contributed by establishments in 7 employment size classes ranging from fewer than 10 employees to 500 or more employees. These data were developed from Department of Commerce, Annual Survey of Manufacturers data for 1989 and apply to *all* establishments in the MP&M Phase I industry group, regardless of water use and water discharge status and, accordingly, include facilities that would not be affected by the proposed MP&M regulation (e.g., non-water users or non-dischargers). Sector-level values

were calculated by summing data reported at the 4-digit SIC code level according to the composition of MP&M sectors by 4-digit SIC code groups. All dollar values are in millions of 1989 dollars.

Table 10-2: Contribution of Small Establishments to Economic Activity in MP&M Phase I Sectors
Number of Establishments, Employees, Shipments and Value Added, 1989
Includes Water Users and Non-Water Users, Dischargers and Non-Dischargers
Totals by Sector and Percentage Distribution by Employment Size Class of Establishment

Data Category and Sector	Total Values	Establishment Size Classes, Number of Employees						
		1-9	10-19	20-49	50-99	100-249	250-499	500+
Number of Establishments								
Hardware	40,396	45.2%	20.2%	19.8%	8.3%	4.7%	1.3%	0.4%
Aircraft	1,621	33.9%	14.3%	18.4%	9.9%	9.9%	5.9%	7.8%
Electronic Equipment	6,741	38.8%	14.1%	18.6%	11.3%	10.3%	3.8%	3.1%
Stationary Industrial Equipment	37,848	56.5%	17.6%	14.1%	5.6%	3.9%	1.4%	0.9%
Ordnance	376	46.8%	10.9%	10.4%	4.8%	9.0%	6.4%	11.7%
Aerospace	141	13.5%	9.2%	17.0%	9.2%	10.6%	6.4%	34.0%
Mobile Industrial Equipment	3,773	44.8%	18.6%	17.6%	7.8%	6.9%	2.5%	1.9%
Total, Phase I Sectors	90,896	49.2%	18.4%	17.2%	7.4%	5.0%	1.7%	1.1%
Number of Employees								
Hardware	1,329,100	5.8%	8.8%	19.3%	18.1%	22.6%	15.2%	10.2%
Aircraft	602,400	0.3%	0.5%	1.6%	1.9%	4.3%	5.6%	85.8%
Electronic Equipment	584,500	1.5%	2.2%	6.6%	9.0%	17.9%	15.6%	47.1%
Stationary Industrial Equipment	1,288,800	6.3%	7.4%	13.2%	11.9%	19.3%	16.5%	25.4%
Ordnance	77,000	0.8%	0.5%	1.4%	1.5%	14.7%	11.7%	69.5%
Aerospace	221,000	1.1%	0.0%	0.3%	0.4%	0.9%	1.5%	95.8%
Mobile Industrial Equipment	236,900	3.0%	4.4%	9.4%	9.4%	17.6%	15.9%	40.3%
Total, Phase I Sectors	4,339,700	4.1%	5.5%	11.4%	11.1%	16.9%	13.6%	37.5%
Shipments ($000,000)								
Hardware	132,153	4.5%	7.2%	17.7%	18.4%	24.4%	17.0%	10.8%
Aircraft	83,980	0.2%	0.3%	0.9%	1.3%	3.1%	4.1%	90.0%
Electronic Equipment	66,745	1.0%	1.5%	4.5%	6.1%	14.2%	15.0%	57.7%
Stationary Industrial Equipment	147,309	3.8%	4.9%	10.5%	10.7%	19.8%	17.6%	32.7%
Ordnance	7,342	0.6%	0.4%	1.0%	1.2%	17.1%	9.2%	70.6%
Aerospace	29,498	0.5%	0.0%	0.3%	0.2%	0.6%	1.4%	96.9%
Mobile Industrial Equipment	37,853	1.9%	2.8%	6.4%	6.6%	14.1%	16.2%	52.0%
Total, Phase I Sectors	504,879	2.6%	3.7%	8.8%	9.4%	15.7%	13.5%	46.2%
Value Added ($000,000)								
Hardware	70,828	4.8%	7.8%	18.0%	18.1%	23.3%	16.8%	11.2%
Aircraft	44,889	0.2%	0.4%	1.1%	1.6%	3.6%	5.0%	88.0%
Electronic Equipment	37,691	1.0%	1.6%	4.6%	6.3%	14.8%	14.2%	57.5%
Stationary Industrial Equipment	79,984	4.5%	5.6%	11.4%	11.1%	19.3%	17.3%	30.8%
Ordnance	5,118	0.5%	0.4%	0.9%	0.9%	15.5%	8.6%	73.1%
Aerospace	19,143	0.4%	0.0%	0.3%	0.2%	0.6%	1.3%	97.1%
Mobile Industrial Equipment	17,119	2.0%	3.1%	6.7%	6.7%	13.8%	14.5%	53.2%
Total, Phase I Sectors	274,772	2.8%	4.0%	9.0%	9.3%	15.3%	13.2%	46.3%

Source: Department of Commerce and Environmental Protection Agency

Although the role of smaller establishments varies by sector, these data show that smaller establishments — for example, those with fewer than 100 employees — generally play an important role in MP&M economic activity according to the four measures summarized:

Number of Establishments (or facilities). In terms of number of establishments, smaller establishments heavily dominate all sectors. Over 90 percent of establishments in the total group have fewer than 100 employees. Within specific sectors, the Aircraft, Ordnance, and Aerospace sectors have the least domination by smaller establishments; however, even these values are substantial at 76.4 percent, 72.9 percent, and 48.9 percent, respectively.

Number of Employees. Because of the larger number of employees and value of economic activity in larger establishments, the distributions of total employment and economic value measures necessarily favor the larger employment establishments in comparison to the distributions for number of establishments. Still, in terms of number of employees, smaller establishments play a substantial role, with 32.0 percent of total group employment in facilities of fewer than 100 employees. Only the Aircraft, Ordnance, and Aerospace sectors have small percentages of total employment in establishments of fewer than 100 employees, at 4.3 percent, 4.1 percent, and 1.9 percent, respectively.

Shipments. The distribution of shipments by employment size of establishment shows a lesser, but still substantial, contribution by smaller establishments than exhibited for number of employees. Overall, 24.5 percent of total MP&M shipments derive from establishments with fewer than 100 employees. Again, the Aircraft, Ordnance, and Aerospace sectors are the only sectors with single-digit contributions from establishments with fewer than 100 employees at 2.8 percent, 3.2 percent, 1.1 percent, respectively.

Value Added. The distribution of value added by employment size of establishment follows a similar pattern to that for shipments, with 25.2 percent of total MP&M value added contributed by facilities with fewer than 100 employees. The values for the three sectors that are less dependent on smaller employment establishments are: Aircraft, 3.4 percent; Ordnance, 2.8 percent; and Aerospace, 1.0 percent.

Although some sectors are relatively less dominated by smaller establishments in terms of number of employees and the value of economic activity — namely, the Aircraft, Ordnance, and Aerospace

sectors — the data in Table 10-2 show that the MP&M industry is largely comprised of smaller establishments and that smaller establishments make substantial economic contributions in every sector. Because the data in Table 10-2 reflect all facilities in the MP&M Phase I industry whether or not they discharge waste water, the numbers of facilities in the table overstate the number of facilities to which the regulation will apply. Nevertheless, because the aggregate industry is so heavily dominated by small facilities, the data suggest that an effluent guideline for the MP&M industry will likely affect a large number of smaller establishments, based on the number of employees per establishment.

Small Business Participation Based on §308 Survey Data

In addition to looking at the participation and role of small businesses in the MP&M industry based on Department of Commerce establishment-level data, EPA also analyzed the participation of small business entities in the industry based on §308 Survey data. Analysis of these data indicated that the water discharging segment of the MP&M industry is largely comprised of facilities that are owned by a small business firm or that have small facility-level employment. As such, these data confirm that the MP&M regulation will necessarily apply to a large number of small business entities. Table 10-3 summarizes business size information for the population of water-discharging facilities expected to be subject to regulation, using the two approaches to classifying small businesses as defined above. The set of establishments on which these data are calculated differs from that in the preceding discussion by including only water discharging facilities. On the basis of the §308 Survey data, EPA estimates that over 75 percent of discharging facilities are owned by a small business according to SBA business size criteria. Within the two discharger subclasses — indirect and direct dischargers — the estimated small business ownership varies modestly with a higher percentage of direct dischargers (83.6 percent) estimated to be owned by small businesses than that for indirect dischargers (73.4 percent).

On the basis of reported facility employment, EPA estimates that about one-quarter of facilities have nine or fewer employees and the next quartile of facilities have between 10 and 79 employees. With 50 percent of facilities having 79 of fewer employees, the MP&M industry is clearly dominated by small facilities. The facility employment data also show that indirect discharge facilities have somewhat higher facility employment than direct discharging facilities: 19.5 percent of indirect dischargers have 9 or fewer employees in comparison to 51.0 percent for direct dischargers. In addition, 28.0 percent of indirect dischargers employ 10 to 79 employees in comparison to 9.9 percent for direct dischargers.

Table 10- 3: MP&M Water-Discharging Facilities by Business Size (based on §308 Survey response data)			
	Discharge Class		
Facility Classifications	All	Indirect	Direct
Total Discharging Facilities	10,601	8,706	1,895
By SBA Firm-Size Criteria			
Small Business-Owned	7,974	6,390	1,584
(as percent of total)	75.2%	73.4%	83.6%
Other (not Small Business)	2,627	2,316	311
(as percent of total)	24.8%	26.6%	16.4%
By Facility Employment Class			
1 - 9 Employees	2,666	1,700	966
(as percent of total)	25.1%	19.5%	51.0%
10 - 79 Employees	2,629	2,441	188
(as percent of total)	24.8%	28.0%	9.9%
80 or more Employees	5,306	4,565	741
(as percent of total)	50.0%	52.4%	39.1%
Source: Environmental Protection Agency			

From both the Department of Commerce and §308 Survey data, the MP&M industry is substantially dominated by small businesses entities. Moreover, small businesses play an important role in the overall economic activity of the MP&M industry group.

10.4 Impact of the Proposed Regulation on Small Business

EPA performed a number of analyses to gauge the impact of the proposed and alternative regulatory options on small business entities. These analyses showed that small business entities — as classified on the basis of both EPA's usual firm-level analysis (using SBA firm-level employment criteria), and the facility employment analysis (using the first and second quartiles of facility employment) — are more likely than MP&M facilities generally to incur significant economic impacts in terms of facility closures under the proposed regulation. In addition, the compliance cost burden (as measured by total annual compliance costs as a percent of facility revenue) was found to be greater among small business entities than among MP&M facilities generally. However, for both of these measures of small business impact — frequency of facility closures and compliance cost burden — EPA found that the absolute levels of impacts were so slight as to not constitute a significant economic impact on small entities. The following sections discuss these analyses of the regulatory impact on small business entities.

Facility Closure Impacts by Business Size

As discussed in Chapter 4, EPA performed a facility impact analysis to identify facilities that were expected to close as the result of an MP&M effluent guideline. This analysis was performed in two steps.

The first analysis, the baseline closure analysis, identified facilities that are in jeopardy of financial failure independent of an MP&M effluent guideline. The baseline closures were excluded from the second analysis, the post-compliance closure analysis. Table 10-4 summarizes the facilities by business size that remained in the impact analysis after excluding these closures. Overall, the distribution of facilities in the impact analysis by business size is largely the same as that for all discharging facilities. Notably, the percentage of facilities that is estimated to be owned by a small business is the same — 75.2 percent — both before and after excluding baseline closures. Said another way, the frequency of baseline closures is the same for both small business-owned facilities and other facilities. Modest differences are noted, however, in the distributions based on facility employment. In particular, the smallest employee-size class of indirect dischargers (9 or fewer employees) declines from 19.5 percent of indirect discharging facilities before excluding baseline closures to 14.6 percent of facilities passing the baseline analysis. Thus, the smallest employment class of indirect discharging facilities was somewhat more likely than other facilities to close in the baseline closure analysis. At the outset, then, this class of facilities — indirect discharging facilities with 9 or fewer employees — would appear to be in financially weaker condition overall than other water-discharging facilities in the impact analysis. It should be noted that decisions to close small facilities (whether in the baseline or post-compliance) may not mean a full loss to the MP&M industry of the employment and production in those facilities. In particular, the production and employment in smaller facilities that are part of a multi-facility firm may be consolidated at larger facilities.

Table 10-4: Facilities in Impact Analysis by Business Size

Facility Classifications	Discharge Class		
	All	Indirect	Direct
Total Facilities Passing Baseline Analysis	9,130	7,293	1,837
By SBA Firm-Size Criteria			
Small Business-Owned	6,869	5,315	1,555
(as percent of total)	75.2%	72.9%	84.6%
Other (not Small Business)	2,261	1,979	282
(as percent of total)	24.8%	27.1%	15.4%
By Facility Employment Class			
1 - 9 Employees	2,029	1,063	966
(as percent of total)	22.2%	14.6%	52.6%
10 - 79 Employees	2,401	2,242	159
(as percent of total)	26.3%	30.7%	8.7%
80 or more Employees	4,700	3,988	712
(as percent of total)	51.5%	54.7%	38.8%

Source: Environmental Protection Agency

In the post-compliance closure analysis, EPA found that small business facilities — whether defined on the basis of SBA firm-size criteria or the first and second facility employment quartiles — were

more likely to close than MP&M facilities generally. These findings mean: (1) that facilities owned by small business firms are more likely to close, and (2) that smaller facilities, whether or not owned by a small business firm, are more likely to close. As noted above, in the face of compliance costs, multiple facility firms may close their smaller facilities and consolidate production within larger facilities. EPA found these disparate effects for both indirect and direct dischargers, and in all the regulatory options that were considered for proposal.

Indirect Dischargers

Table 10-5 summarizes facility closure impacts by business size for indirect dischargers. The first three columns — Option 1, Option 2, and Option 3 — report results for the three options that EPA initially defined and evaluated for indirect discharging facilities. The latter two columns reflect the additional options that were subsequently developed for indirect dischargers: Option 1a and Option 2a. As shown in the table, all estimated facility closures for Options 1, 2, 1a/2, and 2a/2 occur among small business-owned facilities, as defined on the basis of SBA criteria. Only under Option 3 are closures estimated to occur among facilities not owned by small businesses. The analysis according to facility employment size class gives similar results with estimated facility closures concentrated in the two smaller employment size classes.

Table 10-5: Facility Closure Impacts by Business Size, Indirect Dischargers

Facility Classifications	Regulatory Option				
	Initial Options			Subsequent Options	
	Option 1	Option 2	Option 3	Option 1a	Option 2a
Total Estimated Facility Closures	161	151	227	151	7
(as percent of facilities in impact analysis)	2.2%	2.1%	3.1%	2.1%	0.1%
Closures By SBA Firm-Size Criteria					
Small Business-Owned	161	151	203	151	7
(as percent of class†)	3.0%	2.8%	3.8%	2.8%	0.1%
Other (not Small Business-Owned)	0	0	24	0	0
(as percent of class)	0.0%	0.0%	1.2%	0.0%	0.0%
Closures By Facility Employment Class					
1 - 9 Employees	65	65	65	65	0
(as percent of class)	6.1%	6.1%	6.1%	6.1%	0.0%
10 - 79 Employees	95	84	105	84	5
(as percent of class)	4.3%	3.7%	4.7%	3.7%	0.2%
80 or more Employees	0	2	56	2	2
(as percent of class)	0.0%	0.1%	1.4%	0.1%	0.1%

† "Class" refers to the indicated sub-group of facilities (e.g., Small Business-Owned Facilities) and "percent of class" means the percentage of that group expected to incur facility closure impacts.
Source: Environmental Protection Agency

Although closure impacts are concentrated among small entities, the expected level of closures under the proposed option is extemely low for the small entity categorizations analyzed: 0.1 percent of small business-owned facilities; 0.0 percent of facilities with 9 or fewer employees; and 0.2 percent of facilities with 10 to 79 employees. Notably, closures among the small entity categorizations are substantially higher for all the other options analyzed. To illustrate, for small business-owned facilities, the closure rate ranges from 2.8 percent to 3.8 percent for the other four options presented in the table. Overall, EPA finds that the rate of expected facility closures among small business entities is well within acceptable bounds.

Direct Dischargers

As shown in Table 10-6, the overall pattern of facility closures for direct discharging facilities is similar to that for indirect dischargers. Again, all closures are estimated to occur among small business-owned facilities for Options 1 and 2, and only under Option 3 do closures occur among other facilities. However, at 1.1 percent, the predicted level of closures among small business-owned facilities under Options 1 and 2 remains relatively low. Also, the predicted level of closures among small business-owned facilities is higher at 2.9 percent under the more stringent Option 3 than under Option 2, the proposed option for direct dischargers, at 1.1 percent.

Table 10-6: Facility Closure Impacts by Business Size, Direct Dischargers

Facility Classifications	Regulatory Option		
	Option 1	Option 2	Option 3
Total Estimated Facility Closures	18	18	90
(as percent of direct dischargers in analysis)	1.0%	1.0%	4.9%
Closures By SBA Firm-Size Criteria			
Small Business-Owned	18	18	45
(as percent of class)	1.1%	1.1%	2.9%
Other (not Small Business-Owned)	0	0	46
(as percent of class)	0.0%	0.0%	16.1%
Closures By Facility Employment Class			
1 - 9 Employees	18	18	18
(as percent of class)	1.8%	1.8%	1.8%
10 - 79 Employees	0	0	27
(as percent of class)	0.0%	0.0%	17.1%
80 or more Employees	0	0	46
(as percent of class)	0.0%	0.0%	6.4%

Source: Environmental Protection Agency

With regard to the distribution of impacts by facility employment class, all closures are estimated to occur among the smallest employment size class of facilities (9 or fewer employees) under Options 1 and 2. Again, the percentage of closures among these facilities is quite low at 1.8 percent. Under the more

stringent Option 3, the predicted level of closures among the smallest employment size class of facilities is the same; however, estimated closures in the next higher employment size class (10 to 79 employees) are much more substantial at 17.1 percent.

All Dischargers

Table 10-7 summarizes closures for indirect and direct dischargers, combined. The first three columns — Option 1, Option 2, and Option 3 — combine the results for indirect and direct dischargers for each of those options. The latter two columns reflect the additional options that were developed for indirect dischargers — Option 1a and Option 2a — combined with Option 2 for direct dischargers. Specifically, the rightmost column, which is labeled Option 2a/2, combines results for Option 2a for indirect dischargers and Option 2 for direct dischargers and thus represents the proposed regulatory option. The next column to the left, which is labeled Option 1a/2, combines results for Option 1a for indirect dischargers and Option 2 for direct dischargers and represents the other option that EPA defined as an alternative to the initially selected Option 2 for indirect and direct dischargers.

Table 10-7: Facility Closure Impacts by Business Size, All Dischargers

Facility Classifications	Regulatory Option				
	Initial Options			Subsequent Options	
	Option 1	Option 2	Option 3	Option 1a/2	Option 2a/2
Total Estimated Facility Closures	178	169	317	169	25
(as percent of facilities in impact analysis)	2.0%	1.8%	3.5%	1.8%	0.3%
Closures By SBA Firm-Size Criteria					
Small Business-Owned	178	169	248	169	25
(as percent of class†)	2.6%	2.5%	3.6%	2.5%	0.4%
Other (not Small Business-Owned)	0	0	69	0	0
(as percent of class)	0.0%	0.0%	3.1%	0.0%	0.0%
Closures By Facility Employment Class					
1 - 9 Employees	83	83	83	83	18
(as percent of class)	4.1%	4.1%	4.1%	4.1%	0.9%
10 - 79 Employees	95	84	132	84	5
(as percent of class)	4.0%	3.5%	5.5%	3.5%	0.2%
80 or more Employees	0	2	102	2	2
(as percent of class)	0.0%	0.1%	2.2%	0.1%	0.1%

Source: Environmental Protection Agency

The results presented in this table confirm the observations made for the separate discharger classes. In particular, although closure impacts are concentrated among smaller facilities, the expected level of closures under the proposed option is very low for the small entity categorizations analyzed: 0.4 percent of small business-owned facilities; 0.9 percent of facilities with 9 or fewer employees; and 0.2 percent of

facilities with 10 to 79 employees. Moreover, closures among the small entity categorizations increase substantially under the alternative Option 1a/2 as well as the other regulatory options analyzed.

Compliance Cost Impacts by Business Size

In addition to examining the distribution of expected closures among facilities by business size, EPA also considered the compliance costs likely to be incurred by facilities in complying with the proposed regulation. EPA assessed compliance costs and their impact on small business entities in two ways:

1. EPA considered the total annual compliance costs expected to be imposed on facilities according to business size for the proposed and alternative regulatory options. This analysis shows how the absolute cost of compliance would be expected to vary by regulatory option for the different business size classifications of facilities.

2. EPA analyzed total annual compliance cost as a percentage of facility revenue as a measure of the relative burden of compliance costs. This analysis examines whether compliance costs are likely to constitute a significant burden on facilities by comparing expected compliance costs to pre-compliance revenue.

These analyses considered the distribution of compliance costs among facilities based on the SBA size classification of the owning firm and on the employment size of the facilities. As noted above, EPA bases its findings regarding acceptability of small business impacts on the distribution of impacts according to the SBA size classification of the owning *firm*. The analysis of cost impacts according to employment size of *facilities* is meant to provide additional insight into how smaller facilities are likely to be affected by regulation but in themselves do not conclusively determine the acceptability of small business impacts.

From these analyses, EPA found that the proposed regulation would impose a moderate but manageable cost burden on small business entities. In particular, the proposed regulation is expected to impose only modestly higher total costs on small business entities than the least stringent regulatory option considered, and would impose considerably less total cost than the most stringent option considered. In terms of the relative cost burden, EPA found that all of the regulatory options considered were likely to impose a higher relative cost burden on small business entities than on MP&M facilities generally. However, EPA judges that the expected cost burden on small entities is manageable based on accepted standards of cost severity. Specifically, in previous regulatory analysis and development efforts, EPA has generally regarded compliance costs less than 5 percent of revenue as being manageable and not likely to

impose significant impacts. For the proposed regulatory option, EPA found that the relative cost burden among small entities, *on average*, is expected to be well less than 5 percent of total facility revenue, and that only a very slight percentage of small entities (less than one percent of facilities in each of the small entity criteria) is expected to encounter compliance costs exceeding 5 percent of revenue.

Analysis of Total Annual Compliance Costs

Table 10-8 summarizes total annual compliance costs by business size classification of facility for the alternative regulatory options. Total annual compliance costs are calculated as the annual after-tax cash flow impact on facilities and reflect private costs of capital and the expected tax treatment of capital outlays and operating costs of compliance. The column labeled Option 2a/2 combines results for Option 2a for indirect dischargers and Option 2 for direct dischargers, and thus represents the proposed regulatory option. Overall, this analysis shows that the aggregate compliance costs to small entities are substantially lower under the proposed Option 2a/2 than under all the other options analyzed. At $54.5 million, the estimated annual compliance cost for small business-owned facilities under the proposed Option 2a/2 is approximately 40 percent less than the cost estimated for either the initially selected Option 2 or the other secondarily defined option, Option 1a/2. The analysis based on facility employment size class further confirms the reduced impact of the proposed Option 2a/2 on small entities: the total costs of Option 2a/2 among facilities with 9 or fewer employees are only about 9 percent of the costs for Option 2 or Option 1a/2; and the costs for Option 2a/2 among facilities with 10 to 79 employees are about half of the costs for Option 2 or Option 1a/2. That the cost burden of Option 2a/2 on small business entities is so much lower than that estimated for the other options supports EPA's choice of Option 2a/2 as the proposed regulatory option and the finding that Option 2a/2 will not impose a significant economic impact on small entities.

Analysis of Compliance Costs Relative to Facility Revenue

Table 10-9 summarizes the relative compliance cost burden among facilities by business size classification. For this analysis, the compliance cost burden was assessed as the ratio of total annual compliance cost (defined in the preceding section) to facility revenue. Table 10-9 indicates for each option the average value of compliance costs as a percentage of revenue for facilities falling in the various facility size classes being analyzed. In addition, the table lists the percentage of facilities in each size class expected to incur compliance costs exceeding 5 percent of revenue. In a number of previous regulation development and promulgation activities, EPA judged annual compliance costs that are less than five percent of facility

revenue as not likely to impose a significant financial burden on the complying entity.[1] This 5 percent rule-of-thumb is used to evaluate the expected burden to small entities from the MP&M regulation.

Table 10-8: Total Annual Compliance Costs by Business Size, All Dischargers ($000, 1989)					
	Regulatory Option				
	Initial Options			Subsequent Options	
Facility Classification	Option 1	Option 2	Option 3	Option 1a/2	Option 2a/2
All Facilities	186,399	197,710	579,912	.193,541	137,067
By SBA Firm-Size Criteria					
Small Business-Owned	78,015	91,370	281,815	89,978	54,539
Other (not Small Business-Owned)	108,384	106,339	298,097	103,563	82,528
By Facility Employment Class					
1 - 9 Employees	9,384	9,613	10,054	9,332	831
10 - 79 Employees	29,400	32,351	74,660	31,828	15,910
80 or more Employees	147,615	155,746	495,198	152,380	120,326
Source: Environmental Protection Agency					

As shown in Table 10-9, compliance costs as a percentage of facility revenue are overall quite low even for the most stringent and costly Option 3. Average compliance costs as a percentage of revenue range from 0.10 percent for the proposed Option 2a/2, to a high of 0.65 percent for Option 3.

At the same time, under all regulatory options, estimated compliance costs as a percentage of facility revenue are higher for small entities than for MP&M facilities generally both for the proposed Option 2a/2 and, as well, for the other options considered. However, for Option 2a/2, the difference in the cost burden between small entities and the larger size classifications is much less than for the regulatory options considered. Specifically, for the proposed Option 2a/2, total annual compliance costs for small business-owned facilities are estimated to average a very low 0.11 percent of revenue while averaging 0.06 percent for facilities not owned by a small business. In contrast, the disparity in cost burden between small and not-small businesses is much greater for the other options: under the Option 1a/2, the cost burden for small business-owned facilities averages 0.53 percent while averaging 0.11 percent for facilities not owned by a small business. The findings are similar on the basis of the facility employment class sizes. The smaller facility employment size classes bear a very slightly higher cost burden under Option 2a/2: 0.10 percent for facilities with 9 or fewer employees and 0.12 percent for facilities with 10 to 79 employees, compared to 0.09 percent for facilities with 80 or more employees. However, this difference is again much

[1] For example, see the economic impact analysis documents for the recently proposed effluent guideline for the Pesticide Formulating, Packaging, and Repackaging Industry and the final effluent guideline for the Pesticide Manufacturers Industry.

less than the disparity in cost burden estimated for the other options. Under Option 1a/2, the comparable values are: 1.08 percent for facilities with 9 or fewer employees, 0.42 percent for facilities with 10 to 79 employees, and 0.13 percent for facilities with 80 or more employees

Table 10-9: Total Annual Compliance Costs as a Percentage of Facility Revenue *All Dischargers, by Business Size Criteria*					
	Regulatory Option				
	Initial Options			Subsequent Options	
Facility Size Classes	Option 1	Option 2	Option 3	Option 1a/2	Option 2a/2
Compliance Costs as a Percentage of Facility Revenue, Average Values by Facility Class					
All Facilities	0.41%	0.42%	0.65%	0.41%	0.10%
By SBA Firm-Size Criteria					
Small Business-Owned Facilities	0.51%	0.53%	0.78%	0.51%	0.11%
Other (not Small Business-Owned)	0.11%	0.11%	0.26%	0.11%	0.06%
By Facility Employment Class					
1-9 Employees	1.09%	1.12%	1.20%	1.08%	0.10%
10-79 Employees	0.41%	0.42%	0.79%	0.42%	0.12%
80 or more Employees	0.12%	0.13%	0.36%	0.13%	0.09%
Percentage of Facilities by Class with Compliance Costs Exceeding Five Percent of Revenue					
All Facilities	0.52%	0.47%	1.35%	0.52%	0.19%
By SBA Firm-Size Criteria					
Small Business-Owned Facilities	0.69%	0.63%	1.79%	0.69%	0.26%
Other (not Small Business-Owned)	0.00%	0.00%	0.00%	0.00%	0.00%
By Facility Employment Class					
1-9 Employees	1.27%	1.27%	2.78%	1.27%	0.00%
10-79 Employees	0.94%	0.76%	2.49%	0.93%	0.73%
80 or more Employees	0.00%	0.00%	0.17%	0.00%	0.00%
Source: Environmental Protection Agency					

Moreover, in comparing compliance costs with the 5 percent of revenue threshold, EPA found that small entity impacts are also very slight under the proposed regulatory option. Specifically, under Option 2a/2, a very small percentage of small business-owned facilities, only 0.26 percent, are expected to incur total annual compliance costs exceeding 5 percent of revenue. In the analysis with respect to facility employment classes, *none* of the facilities with 9 or fewer employees and only 0.73 percent of facilities with 10 to 79 employees are expected to incur compliance costs exceeding 5 percent of revenue. Again, independent of the method for classifying entities as small, the extent of cost burdens as measured relative to the 5 percent threshold is quite low under the proposed regulatory option. Accordingly, EPA judges that the proposed regulation's cost burden on small entities would be manageable based on accepted standards of cost severity.

In view of this analysis and in recognition of the Agency's efforts, as summarized above, to define the proposed option in a way that would reduce impacts to small entities, EPA concluded that the facility

closure impacts and compliance cost burdens of the proposed option will not constitute an undue impact on small business entities. Pursuant to Section 605(b) of the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Administrator certifies that the proposed regulation will not have a significant economic impact on a substantial number of small entities.

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Appendix A

Methodology for Estimating the Cost of Capital

A.1 Overview of Real Weighted Average, After-Tax Cost of Capital

The cost of capital is the expected total payment required by providers of a firm's capital for financing the firm's assets. The cost of capital is generally accepted as the relevant measure for discounting firm or project cash flows as the basis for firm or project valuation. In the MP&M impact analysis, the cost of capital is used for discounting facility cash flows both in the baseline financial viability analysis and in the analysis of compliance investment decisions. The concept of cost of capital used for the impact analysis is the Real, (i.e., absent the effects of inflation) Weighted Average, After-Tax Cost of Capital (RWACC). RWACC for a facility was calculated by first estimating a nominal, weighted average, after-tax cost of capital (WACC) for the facility and then adjusting this value for the effects of inflation. WACC is defined as follows:

$$WACC = [(DBT/TA) \times i \times (1 - t)] + [(EQTY/TA) \times e]$$

where:

WACC	=	Nominal, weighted average, after-tax cost of capital;
DBT	=	Debt component of total capital;
TA	=	Total assets;
i	=	Nominal interest rate on debt;
t	=	Corporate income tax rate (0.34);
EQTY	=	Equity component of total capital, or net worth; and
e	=	Nominal cost of equity.

Apart from the simple numerical computation of the WACC formula, calculation of WACC for a facility involved three major elements: (1) the facility interest rate (i); (2) the facility cost of equity (e); and (3) the facility debt and equity weightings (DBT/TA and EQTY/TA). Each component requires several steps, as summarized below.

A.2 Calculating the Facility Interest Rate

1. Compute an interest rate premium for each facility. From data in the facility DCP, EPA computed the premium of reported interest rate relative to prime rate at the time of DCP preparation, 1991. DCP respondents were asked to provide a borrowing cost for capital investments. Most respondents gave an explicit interest rate value while some gave the value as a premium to prime rate (e.g., "prime plus 1"). To provide a basis for generalizing the cost of capital to a longer period than the year in which DCP responses were provided, all interest rate values were converted to a premium relative to prime rate. Specifically, *for all facilities not reporting interest rates as a premium to prime*, the average prime rate for 1991, 8.46 percent, was subtracted from the reported interest rate value. For facilities reporting their interest rate as a premium to prime, the reported premium was used in the interest rate analysis.

2. Calculate a generalized facility interest rate. To generalize the facility's interest rate to a longer analysis period, the prime rate premium was added to the average prime rate observed over the period 1980-1991. This 12-year period covers a relatively broad set of economic conditions, including relatively high inflation (1980-81), two recessions (1981-1982 and 1990-1991), two periods of credit tightness (1980-82 and 1989-90), and a period of relatively stable, sustained economic growth from 1983-1989. Thus, the average prime rate over this period, 11.42 percent, may be considered representative of values likely to be observed in an indeterminate future. Accordingly, the facility's estimated cost of debt capital was calculated as the interest rate premium added to 11.42 percent.

A.3 Calculating the Facility Cost of Equity

The calculation of cost of equity is based on the principles of the Capital Asset Pricing Model (CAPM). The CAPM theory posits that the cost of equity to a firm varies with the riskiness of the firm's equity returns relative to that of general investment opportunities. Under this theory, the cost of equity can be decomposed into several components: a base required rate of return associated with riskless investments; a premium rate of return associated with a general portfolio of investments that are riskier than the so-called "riskless investments;" and a multiplicative adjustment to the premium rate of return based on the riskiness of the individual firm's equity returns relative to that of the general portfolio of investments. The application of this theory to the current analysis means that the cost of equity for a facility can be expressed as follows:

$$e = R_r + (R_m - R_r) \times ß$$

where:

e	=	Nominal required return on equity for a particular firm;
R_r	=	Return on so-called "riskless" assets;
R_m	=	Return on a general portfolio (market) of investments; and
ß	=	Ratio of the covariance of firm and general market returns to the variance of returns for the general market (the "Beta" coefficient).

These parts of the CAPM relationship were determined as follows:

1. Return on riskless assets (R_r) was taken as the average return on U.S. Treasury long-term bonds over the period 1980-1991, or 10.06 percent. This return is presumed to be riskless except for the expected long-term effects of inflation, which are discounted from the cost of capital in a later step.

2. The market return premium (R_m - R_r), or the premium of market returns over the return on riskless assets, was taken as the long-term premium of return earned on the broad stock market relative to U.S. Treasury bond returns. The estimated premium value used in this analysis is 8 percent.

3. The *Beta* coefficient (ß) was determined differently depending on whether the facility is part of a firm whose securities are traded in public markets and for which a measure of ß is calculated by secondary sources. For facilities owned by publicly-traded firms whose securities are rated by the *Value Line Investment Survey*, ß is taken directly from *Value Line Investment Survey* reports. For all other facilities, ß is determined on the basis of the industry ß calculated by *Value Line* for the industry that most nearly matches the MP&M sector from which the facility receives the largest share of its revenues.

With these data, the estimated value for e, the nominal cost of equity, was calculated using the CAPM relationship.

A.4 Facility Debt and Equity Weightings

The total cost of capital to a firm was calculated by combining the costs of debt and equity according to the blend of debt and equity financing of the firm's assets. For facilities owned by public reporting firms, the weightings used in the MP&M impact analysis were taken from public financial data

as summarized in *Value Line Investment Survey* for the firm's fiscal year most nearly coinciding with calendar year 1989. For all other facilities, the debt and equity weightings were taken from the balance sheet information provided in the DCP response. Public financial report information, where available, were used for setting the debt and equity weights because the financial structure of the consolidated firm is more likely to represent the long-term blend of debt and equity used to finance both ongoing and new facility assets. In contrast, because of the broad latitude available to DCP respondents in deciding how to allocate firm-level debt to the facility, facility-level financial structure data are highly subjective and may not meaningfully depict the blend of equity and debt used in financing facility assets, and, in conjunction, the cost of capital incurred by the firm.

The debt weighting (DBT/TA) used for facilities not owned by public-reporting firms was calculated by first computing the ratios of debt to total assets for each year for which data were available. Debt is considered to be the sum of all reported liabilities, both current and long-term. Total assets is the sum of all assets, again both current and long-term, reported in the DCP. The individual yearly values were averaged arithmetically to give a debt-to-total asset ratio for the facility. The equity weighting (EQTY/TA) was calculated as "one minus the debt weighting" (i.e., EQTY/TA = 1 - [DBT/TA]).

A.5 Calculating the Weighted Average Cost of Capital

With three main pieces of the equation available, the remaining parts of the calculation of WACC followed the WACC formula outlined above. The remaining item of interest is the use of the tax rate to account for the deductibility of interest payments in computing income taxes. In this analysis, EPA used the highest federal corporate tax rate of 0.34 (based on the 1992 Internal Revenue Code). This rate is encountered as soon as a firm has total taxable income exceeding $335,000. If total taxable income would be less than this amount, the use of the 0.34 tax rate will overstate the value of the interest tax shield in reducing cost of capital. Also, EPA did not consider the joint effect of federal and *state* tax deduction of interest. This exclusion may understate the value of tax deductibility of interest; however, the effect on the total cost of capital should be minor.

A.6 Adjusting for Inflation

The remaining step in calculating the cost of capital for facilities is to remove the effects of inflation. *Real* cash flows — that is, absent the effects of inflation — were used to value the facility, both pre- and post-compliance with an effluent guideline. Correspondingly, the cost of capital for discounting the cash flows should be a real rate. The formulation for the real cost-of-capital is as follows:

$$RWACC = (WACC - g) / (1 + g)$$

where:

RWACC = Real, weighted average cost-of-capital; and

g = Expected rate of inflation over the period of the investment under consideration.

For this analysis, EPA used the average rate of inflation observed over the period 1980-1991, 4.7 percent, as an indicator of possible future inflation. The resulting value of RWACC was carried forward to the impact analysis and was used in the valuation of facilities, pre- and post-compliance, and in adjusting the facility liquidation value, which is assumed to be received over a three-year period, to a single year value.

Appendix B
Summary of Threshold Values for Analysis of Financial Stress Short of Closure

This appendix details the sources and methodology used to derive the threshold values for return on assets (ROA) and interest coverage ratio (ICR) used in the Analysis of Financial Stress Short of Closure. These thresholds were compared to pre- and post-compliance ROA and ICR values for sample facilities in order to determine if facilities choosing to remain in business after promulgation of effluent guidelines would experience moderate impacts on their ability to attract and finance new capital.

The thresholds depend on 1989 financial data from Robert Morris Associates' (RMA) *Annual Statement Studies,* giving income and financial structure information about 4-digit SIC industry groups. These data include quartile values for a population of firms having less than $250 million in total assets submitting financial statements to banks. These criteria introduce some bias, since firms with particularly poor financial statements might be less likely to apply to banks for loans, and some types of firms may be more likely to use bank financing than others. However, the Robert Morris Associates data offers the advantages of being available for individual 4-digit SIC industry groups and for quartile ranges.

To streamline the data collection effort, the 44 largest 4-digit SIC industry groups, by value of shipments, were selected to cover at least 75 percent of value of shipments from each of the seven MP&M Phase I sectors. The average coverage was 80.5 percent of value of shipments. Data gathering efforts focused on this select group of industries.

The data gathered from Robert Morris Associates' *Annual Statement Studies* include:

1. $ICR_{25\%}$ — Average ratio of earnings before interest and taxes (EBIT, defined below) to interest expense for the lowest quartile of values in each 4-digit industry group

2. $ICR_{50\%}$ — Median ratio of earnings before interest and taxes to interest expense

3.	Net Profit	Median net profit
4.	Depreciation/Sales	Median ratio of depreciation expense to sales
5.	Sales	Median sales
6.	OPINC	Median operating profit

These industry-specific values are consolidated into weighted sector averages, weighted by value of shipments within each sector. The remainder of the steps below are conducted for each sector.

Interest Coverage Ratio Threshold

RMA provides a measure of interest coverage that approximates the one needed for the Analysis of Financial Stress Short of Closure. This is the EBIT/INT ratio, designated ICR_{RMA}:

$$ICR_{RMA} = \text{EBIT} / \text{INT}$$

EBIT, or earnings before interest and taxes is conventionally defined as follows:

$$\text{EBIT} = \text{Total Revenue} - \text{Total Costs} + \text{Interest} + \text{Tax}$$

By substituting this definition of EBIT into the definition of ICR_{RMA},

$$ICR_{RMA} = (\text{Total Revenue} - \text{Total Cost} + \text{Interest} + \text{Taxes}) / \text{Interest}$$

The definition of ICR needed for the Analysis of Financial Stress Short of Closure is:

$$ICR_{AFSSC} = \frac{(\text{Total Revenue} - \text{Total Cost} + \text{Interest} + \text{Taxes} + \text{Depreciation})}{\text{Interest}}$$

The relationship between the two can be expressed as the ratio:

$$\frac{ICR_{AFSSC}}{ICR_{RMA}} = \frac{\text{(Total Revenue - Total Cost + Interest + Taxes + Depreciation)}}{\text{(Total Revenue - Total Cost + Interest + Taxes)}}$$

$$= 1 + \text{Depreciation / (Total Revenue - Total Cost + Interest + Taxes)}$$

$$= \text{RATIO}$$

The denominator is analogous to RMA's Operating Income (OPINC), which is defined as:

OPINC = Total Revenue - Total Cost + Interest + Taxes)

Therefore, substituting,

RATIO= 1 + Depreciation / OPINC

And

Depreciation = Depreciation to Sales Percentage x Sales / 100

Therefore,

ICR_{AFSSC} = ICR_{RMA} x RATIO

and the threshold value is

$ICR_{threshold}$ = $ICR_{25\%}$ x RATIO

Return on Assets

A threshold for ROA is calculated in a way similar to ICR, by calculating an ratio to adjust RMA values to values defined and used in the Analysis of Financial Stress Short of Closure.

Observing, as above, that

EBIT = Total Revenue - Total Costs + Interest + Tax

then interest expense is calculated as a function of RMA's median ICR as follows:

Interest Expense = OPINC / ICR_{RMA}

RMA's return on assets is:

ROA_{RMA} = (Total Revenue - Total Costs + Tax) / Assets

= Net Profit / Assets

while the formulation of ROA needed for the Analysis of Financial Stress Short of Closure is:

ROA_{AFSSC}= (Net Profit + Interest + Depreciation) / Assets

Therefore, the ratio of the Analysis of Financial Stress Short of Closure measure to the RMA measure of ROA is:

RATIO = Net Profit + Interest + Depreciation) / (Net Profit)

= 1 + (Interest + Depreciation) / Net Profit

The threshold value of ROA can thus be calculated from the 25th percentile value of ROA using the following definition:

$ROA_{threshold}$= ROA_{RMA} x RATIO

The resulting threshold values for ICR and ROA are:

Thresholds for Financial Stress Short of Closure		
Sector	Pre-Tax Return on Assets (%)	Interest Coverage Ratio
1. Hardware	2.82	2.10
2. Aircraft	2.86	2.11
3. Electronic Equipment	1.51	1.89
4. Stationary Industrial Equipment	3.09	2.15
5. Ordnance	2.86	2.11
6. Space	2.86	2.11
7. Mobile Industrial Equipment	1.86	1.76
Source: Environmental Protection Agency		