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Visit http://www.epa.gov/waterscience/316b/ for more information on this rule.

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INTRODUCTION

This chapter assesses the expected economic effect of the regulatory analysis options considered for regulation of Phase III Manufacturing Facilities on the Manufacturers that would be subject to national categorical requirements under each analysis option. The analysis focuses on impacts in six key manufacturing industries – Paper, Chemicals, Petroleum, Aluminum, Steel, and Food and Kindred Products (the "Primary Manufacturing Industries") – in which a substantial number of ***facilities*** would be subject to regulation. EPA's analysis of the regulation's expected impact in these industries is based on a statistically valid sample survey of facilities in these six industries. The sample survey indicates that the regulation would potentially subject as many as 155 facilities in the Primary Manufacturing Industries[1] to national requirements.

CHAPTER CONTENTS

This chapter also considers the effect of the regulation on facilities in other industries ("Other Industries") that would be within the scope of the regulatory options. The facility impact analysis for Other Industries is restricted to a sample of 4 facilities for which EPA received surveys, but which are not part of the statistically valid sample. As a result, EPA's analysis for the Other Industries group is limited to these known facilities. EPA has not estimated the number of facilities in the Other Industries group that may be subject to the regulation because EPA does not believe that this number can be reliably extrapolated from the sample of known facilities in this group. However, because the statistically valid survey group of six industries (i.e., for the six Primary Manufacturing Industries and Electric Generators) reflects 99% of total cooling water withdrawals, EPA believes that few additional facilities in the Other Industries group are potentially subject to the regulatory analysis options.

Although EPA was able to undertake impact analysis for the Other Industries group using only the sample of known facilities for this group, EPA believes that its analysis for the Other Industries group provides a sufficient basis for regulation development. EPA's review of the engineering characteristics of cooling water intake and use in the Other Industries group indicates that cooling water intake and use in these industries do not differ materially from cooling water intake and use in the electric power industry and the Primary Manufacturing Industries. In addition, EPA specifically analyzed the economic impacts of the three regulatory analysis options on the 4 sample facilities in the Other Industries group and found no economic impact of the regulatory analysis options on these facilities. For these reasons, EPA believes that its findings of no economic impact to the known

[1] EPA applied sample weights to 199 sample facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 1999).

facilities in the Other Industries group, and thus the practicability of the three regulatory analysis options, are generally applicable to the full breadth of industries, including the Other Industries group, within the regulation's scope. [2]

Based on the sum of the sample-weighted estimate of 155 facilities in the Primary Manufacturing Industries and the 4 known facilities in the Other Industries group, EPA included a total of 159 potentially regulated facilities in the economic impact analysis for the Manufacturers segment. The total number of Manufacturers segment facilities considered in the economic impact analysis (159) differs from the number of facilities potentially subject to regulation (161), as reported in *Chapter A1: Introduction*, and as used as the basis for calculating the social costs of the regulatory analysis options. EPA determined that the survey responses of 6 sample facilities lacked certain financial data needed for the facility impact analysis while containing sufficient data to support estimates of facility counts and compliance costs. EPA therefore retained these sample facilities (8 sample weighted facilities) in the analyses to estimate the total number of Manufacturers facilities potentially subject to regulation and for the calculation of social cost but excluded them from the economic impact analysis. When these sample facilities were excluded from the impact analysis, the sample weights for remaining facilities within the affected sample frames were adjusted upwards to account for their removal. The difference in the reported facility totals in the impact and social cost analyses reflects the removal of these 6 facilities and the use of adjusted sample weights. Both values are valid statistical estimates of the same, but unknown, value of the Manufacturers' facility population.

EPA undertook the economic impact analysis to aid in assessing the economic achievability of alternative regulatory options and, on the basis of that assessment, to aid in defining a potential final regulation. Measures of economic impact include facility closures and associated losses in employment, financial stress short of closure ("moderate impacts"), and firm-level impacts. ***Severe impacts*** are facility closures and the associated losses in jobs at facilities that close due to the regulation. EPA also assessed moderate economic impacts to support its evaluation of regulatory options and to understand better the regulation's economic impacts. ***Moderate impacts*** are adverse changes in a facility's financial position that are not threatening to its short-term viability. The firm impact analysis assesses whether firms that own multiple facilities are likely to incur more significant impacts than indicated by the facility impact analysis. Impacts may be more significant at the firm level than at the facility level if a firm owns a number of facilities that incur significant cost. In addition, a firm-level analysis is needed to assess impacts on small businesses, as required by the Regulatory Flexibility Act and SBREFA. Other chapters consider the impacts on small entities (*Chapter D1: Regulatory Flexibility Analysis*) and impacts on governments (*Chapter D2: UMRA Analysis*).

This chapter presents the impact analysis results for the three regulatory analysis options: the "50 MGD for All Waterbodies" option ("50 MGD All"), the "200 MGD for All Waterbodies" option ("200 MGD All"), and the "100 MGD for Certain Waterbodies" Option ("100 MGD CWB"). These options differ with regard to (1) their design intake flow (DIF) applicability thresholds (50, 100, and 200 MGD, respectively); and (2) the type of waterbodies to which they would apply (the options with the 50 and 200 MGD applicability thresholds would apply to all waterbody types while the 100 MGD applicability threshold option would apply only to certain waterbody types – an ocean, estuary, tidal river/stream, or one of the Great Lakes). Facilities meeting these applicability criteria would be required to meet similar requirements to those required in the final Phase II regulation, including a 80-95% reduction in impingement mortality and a 60-90% reduction in entrainment. Facilities not meeting these criteria would have continued to be subject to 316(b) requirements established by permit writers based on their Best Professional Judgment (BPJ). As a result, the number of facilities required to meet the national categorical requirements would vary under each of the three regulatory analysis options. Of the

[2] Measures of economic impact include facility closures and associated losses in employment, financial stress short of closure ("moderate impacts"), and firm-level impacts.

three options presented here, the 100 MGD for Certain Waterbodies Option would subject the smallest number of facilities to national categorical requirements, with the 200 MGD for All Waterbodies Option and the 50 MGD for All Waterbodies Option subjecting successively larger numbers of facilities to national requirements.

As outlined in *Chapter A1: Introduction*, EPA considered several additional regulatory options based on varying flow regimes and waterbody types, in arriving at the regulatory analysis options. Summary results for these supplemental options can be found in *Appendix B3A1* to this chapter.

This chapter describes the methodology used to assess economic impacts for the Manufacturers' facilities, and presents the results of the analyses.

C3-1 DATA SOURCES

The economic impact analyses rely on data provided in the financial portion of the detailed questionnaires distributed by EPA to facilities potentially subject to the Phase III regulation. The survey financial data included facility and parent firm income statements and balance sheets for the three years 1996, 1997, and 1998.

In addition to the survey data, a number of secondary sources were used to characterize economic and financial conditions in the industries subject to the final Phase III regulation. Secondary sources used in the analyses include:

- Department of Commerce economic census and survey data, including the *Census of Manufactures*, *Annual Surveys of Manufactures*, and international trade data;
- U.S. *Industry and Trade Outlook*, published by McGraw-Hill and the U.S. Department of Commerce;
- Value Line Investment Survey;
- *Annual Statement Studies*, published by Risk Management Association (RMA); and
- Statistics of U.S. Businesses (SUSB).

C3-2 METHODOLOGY

The impact analysis starts with compliance cost estimates from the EPA engineering analysis and then calculates how these compliance costs would affect the financial condition of Section 316(b) Manufacturers. EPA included the following compliance cost categories in this analysis: capital cost, annual ***operating and maintenance*** cost, administrative cost, and the loss of business income from potential shutdown of facilities during installation of compliance equipment[3]. Of these cost categories, only operating and maintenance and certain administrative costs recur annually. The remaining costs occur only once at the beginning of compliance or on a multi-year interval over the period of the compliance analysis. Some of the impact analyses require combining the annually recurring and non-recurring costs into a single, annual equivalent value. For combining the annually recurring and non-recurring costs in this analysis, EPA calculated the annual equivalent cost of the non-recurring cost categories and added these *annualized* costs to the annually recurring operating and maintenance cost.

To derive the constant annual value of the non-annual costs, EPA annualized each cost component over the component's estimated useful life, using a 7.0% discount rate. The cost of compliance equipment, which includes fine-mesh traveling screens, with and without fish handling, and fish handling and return systems, was annualized over 10 years; initial permitting cost and the income loss from installation shutdown were annualized over 30

[3] See *Appendix C3A2* for details of the downtime cost calculation.

years; and re-permitting cost was annualized over 5 years[4]. For more information on the compliance cost components developed for this analysis, see *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* and *Technical Development Document for the Final Section 316(b) Phase III Existing Facilities Rule* (U.S. EPA, 2006).

As discussed in *Chapter C1*, the various economic information used in this analysis were initially provided in dollars of different years. For example, facility financial data obtained in the 316(b) survey for Manufacturers are for the years 1996, 1997, and 1998, while the technology costs of regulatory compliance were estimated in dollars of the year 2002. To support a consistent analysis using these data that were initially developed in dollars of different years, EPA needed to bring the dollar values to a common analysis year. For this analysis, EPA adjusted all dollar values to constant dollars of the year 2004 (average or mid-year, depending on data availability) using an appropriate inflation adjustment index. For adjusting compliance costs, EPA used the ***Construction Cost Index (CCI)*** published by the Engineering News-Record. For financial statement information, EPA used the ***Gross Domestic Product Implicit Price Deflator (GDP Deflator)*** to bring dollar values to mid-2004. The values used to adjust the dollar values to constant dollars can be found in *Chapter B1*.

For the impact analysis, EPA first eliminated from analysis those facilities showing materially inadequate financial performance in the baseline, that is, in the absence of the regulation. EPA judged these facilities, which are referred to as ***baseline closures***, to be at substantial risk of financial failure regardless of any financial impacts of the 316(b) regulation. Second, for the remaining facilities, EPA evaluated how compliance costs would likely affect facility financial health. A facility is identified as a ***regulatory closure*** if it would have operated under baseline conditions but would fall below an acceptable financial performance level when subject to the new regulatory requirements.

EPA's analysis also identified facilities that would likely incur moderate impacts from compliance with the regulation. EPA anticipates that these facilities would experience moderate deterioration of financial performance but not at a level sufficient to cause the facility to fail financially. The test of moderate impacts examined two financial ratios – pre-tax return on assets and interest coverage ratio – calculated on a baseline and post-compliance basis. Incremental moderate impacts are attributed to the regulation if both financial ratios exceeded threshold values in the baseline (i.e., no moderate impacts in the baseline), but at least one financial ratio fell below the threshold value in the post-compliance case.

For the assessment of firm-level effects, EPA compared annualized after-tax compliance cost to firm revenue and reports the estimated number and percentage of firms incurring compliance cost in three cost-to-revenue ranges: less than 1.0%; at least 1.0% but less than 3.0%; and 3.0% or greater. Although EPA's sample-based data support specific estimates of the number of facilities, these data do not support a specific estimate of the number of entities that own these facilities. As a result, EPA estimated the number of entities owning facilities in the manufacturing industries as a range, based on alternative assumptions about the potential ownership of regulated facilities. In its comparison of compliance cost to firm revenue, EPA also used this same range concept, which yields approximate upper and lower bound estimates of the value of compliance cost that might be incurred by an entity, based on the number of regulated facilities that it owns.

[4] The annualization approach used for the facility impact analysis differs from that used to develop the social cost estimate presented in *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities*. For the analysis of the social cost, the present value of total cost and the constant annual equivalent to that present value (annualized cost) were calculated as of the expected effectiveness date of the Phase III final regulation for Phase III facilities, beginning of year 2007. In contrast, for the impact analysis, the present value and annualized value of compliance cost were determined as of the first year of compliance of each facility (for this analysis, assumed to be 2010 to 2014).

Key steps in the facility- and firm-level impact methodologies are described in the following discussions. In addition, seven appendixes to this chapter provide detail of specific aspects of the impact analysis methodologies.

C3-2.1 Market-Level Impacts

Increased cost from the regulation may affect industry-level prices and output. In some instances, facilities incurring compliance costs may be able to pass part of these costs through to customers as price increases and thus reduce the compliance cost burden borne directly by complying facilities. On the basis of analysis presented in *Appendix C3A3* and the findings from the industry profile analyses as discussed in the preceding chapter, *Chapter C2: Profile of Manufacturers*, EPA determined that an assumption of zero ***cost pass-through*** is appropriate for its analysis of the effect of the 316(b) regulation on manufacturing industries. The assumption of zero cost pass-through assumes that facilities must bear all compliance costs within baseline cash flow. Because facilities may be able to pass compliance costs through to consumers in some markets, this assumption may understate the ability of facilities to withstand the cost of 316(b) regulatory compliance without material financial impact.

C3-2.2 Impact Measures

C3-2.2.1 Test of Severe Impacts

The assessment of severe impacts for 316(b) manufacturing facilities is based on the change in the facility's estimated business value, as determined from a discounted present value analysis of baseline cash flow and the change in cash flow resulting from regulatory compliance. If the estimated discounted cash flow value of the facility is positive before considering the effects of regulatory compliance but becomes negative as a result of compliance outlays, then the facility is considered a regulatory closure. In this impact test, the estimated ongoing business value of the facility is compared with a threshold value of zero for the closure decision: as long as the discounted cash flow value of the facility is greater than zero, the business is earning its cost of invested capital and continuation of the business is warranted. If the discounted cash flow value of the facility is less than zero in the baseline or becomes less than zero as a result of compliance outlays, then the business would not earn its cost of invested capital and the business owners would be better off financially by terminating the business. As noted in earlier discussion, facilities for which EPA estimated a negative baseline value were considered baseline closures and were not tested for additional adverse impacts from regulatory compliance.

In an alternative formulation of this concept, business owners would compare the discounted cash flow value of the facility with the value that the facility's assets would bring in liquidation. In this case, the estimated ongoing business value would be compared with a value that may be different from zero: ***liquidation value*** could be positive or negative. When liquidation value is positive, business owners might benefit financially by terminating a business and seeking its liquidation value even when the ongoing business value is positive but less than the estimated liquidation value. With negative liquidation value – which generally would result from business termination liabilities (e.g., site clean-up) – the opposite result could occur: business owners may find it financially advantageous to remain in business *even though the business earns less than its cost of invested capital*, if the liquidation value of the business is "more negative", and thus less in value, than the ongoing business based on the discounted cash flow analysis. EPA attempted to implement this alternative impact test formulation. EPA judges that the liquidation value estimates are substantially speculative and subject to considerable error because such an assessment requires detailed facility specific financial and operational history. For these reasons, EPA decided against using liquidation value for comparison with ongoing business value in the closure test.

The cash flow concept used in calculating ongoing business value for the closure analysis is ***free cash flow*** available to all capital. Free cash flow is the cash available to the providers of capital – both equity owners and

creditors – on an after-tax basis from business operations, and takes into account the cash required for ongoing replacement of the facility's capital equipment. Free cash flow is discounted at an estimated after-tax total ***cost of capital*** to yield the estimated business value of the facility. Details of the calculation of free cash flow and the discounting of free cash flow to yield the facility's estimated value are explained in the following sections.

❖ ***Calculation of Baseline Free Cash Flow and Performance of Baseline Closure Test***

Calculation of baseline free cash flow and performance of the baseline closure test involved the following steps:

1. *Average survey income statement data over response years and convert to mid-year 2004 dollars:* EPA first adjusted facility income statement data for 1996, 1997, and 1998 to the year 1998, using the GDP Deflator. These data were then averaged over the months and/or years for which survey respondents reported data to develop an annual average income statement in 1998 constant dollars. For example, if a facility reported income statement data for 1996, 1997, and 1998, then a simple average was calculated for the three reported years. The annual average income statement in 1998 was then brought forward from 1998 to 2004, again using the GDP Deflator.

2. *Calculate after-tax income excluding the effects of financial structure:* The questionnaire responses include a calculation of after-tax income in accord with conventional accounting principles. However, this calculation reflects the financial structure of the business, which may include debt financing and thus interest charges against income. Because the cash flow concept to be discounted in the business value analysis is cash flow available to *all* capital, it is necessary to restate after-tax income to exclude the effects of debt financing, or on a *before-interest* basis. This restatement involves: (1) increasing after-tax income by the amount of interest charges and (2) increasing taxes (and thereby reducing after-tax income) by the amount of tax reduction provided by interest deductibility. This adjustment amounts to adding tax-adjusted interest expense to after-tax income and yields an estimate of after-tax income *independent of capital structure or financing effects*. In calculating the tax adjustment for interest, EPA used a combined federal/state corporate income tax rate. For this calculation, EPA used a tax rate that integrates the federal corporate income tax rate (35%) and state-specific state corporate income tax rates, based on facility location.

   The combined federal/state corporate income tax rate was calculated as follows:

$$\tau = \tau_S + \tau_F - (\tau_S * \tau_F) \qquad \text{(C3-1)}$$

   where:
   τ = estimated combined federal-state tax rate;
   τ_S = state tax rate; and
   τ_F = federal tax rate (35%).

   After-tax income, *before interest,* was calculated as follows:

$$\text{ATI-}BI = \text{ATI} + \text{I} - \tau\text{I} \textit{ or}$$
$$\text{ATI-BI} = \text{ATI} + (1 - \tau)\text{I} \qquad \text{(C3-2)}$$

   where:
   ATI-*BI* = after-tax income *before interest*;
   ATI = after-tax income from baseline financial statement;
   I = interest charge from baseline financial statement; and
   τ = estimated combined federal-state tax rate.

3. *Calculate after-tax cash flow from operations, before interest, by adjusting income for non-cash charges:* The calculation of after-tax income may include a non-cash charge for depreciation (and potentially amortization). To convert income to ***after-tax cash flow (ATCF)*** from operations, it is therefore necessary to add back any depreciation charge to the calculation of after-tax income, before interest. Cash flow, *before interest*, was calculated as follows:

$$\text{ATCF-}BI = \text{ATI-}BI + D \qquad \text{(C3-3)}$$

where:

ATCF-*BI*	=	after-tax cash flow *before interest*;
ATI-*BI*	=	after-tax income *before interest*; and
D	=	baseline depreciation.

As a final step in the calculation of after-tax cash flow before interest, EPA eliminated the implied cash flow benefit of any negative taxes, as reported in the facility's income statement and after adjustment for removal of interest. That is, in these calculations, negative taxes increase after-tax income and cash flow, and thus appear to improve the financial performance and value of the facility in terms of cash flow from operations. However, whether *and when* the implied cash flow benefit of negative taxes can be realized depends on the overall profitability and tax circumstances of the total enterprise, including any other facilities owned by the same firm, and the extent of profitability in periods before or after the survey data periods. To ensure this effect is not overstated, EPA therefore assumed that a facility would not receive the implied cash flow benefit from negative taxes – negative taxes, after adjustment for interest, were set to zero in the baseline analysis. This assumption is consistent with a later step in the post-compliance analysis in which EPA limited the cash flow benefit of tax deductions on compliance outlays not to exceed the amount of taxes paid as reported in the baseline income statement (and adjusted for interest). In theory, the application of this limit could cause some facilities that would otherwise pass the baseline closure analysis, instead to fail the analysis if the reported amount of negative tax, after adjustment for interest, would be sufficient to offset the negative cash flow from operations independent of taxes. In practice, though, this limitation did not affect the findings of the baseline closure analysis. This limit was applied as a check and did not cause a different outcome.

4. *Adjust after-tax cash flow to reflect estimated real change in business performance from the time of survey data collection to the present:* EPA adjusted facility baseline cash flow to reflect the estimated real change (i.e., independent of inflation) in business performance in the manufacturing industries from the time of the facility survey, 1996-1998, to the present. This adjustment is intended to address two potential concerns that could lead to biased findings from the regulatory impact assessment:

   - First, EPA was concerned that facility survey data might have been collected during a period that deviated cyclically from the longer-term trend of business performance for the 316(b) manufacturing industries. Given the knowledge that U.S. business conditions during the latter half of the 1990s were cyclically strong, EPA wanted to account for the possibility that business conditions during the 316(b) survey period (1996-1998) might be uncharacteristically favorable for some of the Primary Manufacturing Industries. In this case, the business performance and valuation measures, based on survey data, used to assess the burden of regulatory compliance costs might overstate industry's ability to bear these costs and therefore understate the potential impact of the regulatory options.
   - Second, apart from the issue of short-term deviation from trend caused by a cyclically strong economy, EPA was also aware from its profile analyses that some of the industries might be experiencing a longer-term trend of deteriorating performance. Using sample facility data that don't reflect such possible trends would again potentially overstate industry's ability to bear compliance costs and therefore understate the potential impact of the regulatory options.

To calculate the adjustment factor, EPA collected data on after-tax cash flow for public firms in the 316(b) manufacturing industry sectors over a 14-year period and developed adjustment factors by industry and/or key industry segment (details of this analysis are contained in *Appendix C3A4*)[5]. Adjusted after-tax cash flow is calculated as follows:

$$\text{ATCF-}BI_{\text{ADJ}} = \text{ATCF-}BI * \text{Adj} \qquad \text{(C3-4)}$$

where:

ATCF-BI_{ADJ}	=	after-tax cash flow *before interest* adjusted to reflect the real change in business performance;
ATCF-*BI*	=	after-tax cash flow *before interest*; and
Adj	=	adjustment factor to reflect the real change in business performance.

5. *Calculate free cash flow by adjusting after-tax cash flow from operations for ongoing capital equipment outlays:* The measure of after-tax cash flow from the previous step, cash flow from operations, reflects the cash receipts and outlays from ordinary business operations, but includes no allowance for replacement of the facility's existing capital equipment. To sustain ongoing operations, however, a business must expend cash for capital replacement. Accordingly, to understand the true cash flow of a business and thus provide a conceptually valid cash flow measure for business valuation, it is necessary to reduce cash flow from operations by an allowance for capital replacement. For the calculation of free cash flow, EPA estimated baseline capital outlays from a regression analysis of capital expenditures by public firms in the 316(b) industry sectors over an 11-year period (details of this analysis and estimation framework are contained in *Appendix C3A5*). Free cash flow is calculated as follows:

$$\text{FCF} = \text{ATCF-}BI_{\text{ADJ}} - \text{CAPEX} \qquad \text{(C3-5)}$$

where:

FCF	=	free cash flow
ATCF-BI_{ADJ}	=	after-tax cash flow *before interest* adjusted to reflect the real change in business performance; and
CAPEX	=	estimated baseline capital outlays.

Or on a more detailed accounting statement basis:

$$\text{FCF} = \text{REV} - \text{TC} - \text{T} - \tau\text{I} - \text{CAPEX} \qquad \text{(C3-6)}$$

where:

FCF	=	free cash flow
REV	=	revenue
TC	=	total operating costs, *excluding interest, depreciation, and taxes*
T	=	baseline income tax

[5] EPA also undertook an alternative case analysis in which it further adjusted baseline cash flow to reflect costs that facilities might incur from compliance with Federal environmental regulations that were recently promulgated and whose costs are not likely to be reflected fully in the ATCF adjustment analysis. This analysis, which is documented in *Appendix C3A8*, found no material effect on the facility impact analysis, as reported in this chapter. The alternative case analysis, which incorporated estimated compliance costs from the recent Federal environmental regulations, found one additional baseline closure and no change in post-compliance closures.

τ	=	estimated combined federal-state tax rate;
I	=	interest charge from baseline financial statement;
τI	=	the increase in tax liability resulting from calculating income on a pre-interest basis; and
CAPEX	=	estimated annual baseline capital outlays.

This calculation of free cash flow is based on a static representation of a facility's business. With the exception of bringing estimated cash flow forward from the time of the survey, 1996-1998, to approximately the present, 2005, the facility impact analysis assumes, in effect, that the facility's business will continue in the future – absent the effects of regulation – exactly as reflected in the baseline financial statements provided in the survey questionnaire

6. *Calculate baseline facility value as the present value of free cash flow over a 10-year analysis horizon:* To calculate baseline business value, EPA discounted free cash flow over a 10-year period at an estimated real (i.e., excluding the effects of inflation), after-tax cost of capital of 7.0%. The use of 10 years as the discounting horizon reflects the expected useful life of capital equipment to be installed for 316(b) regulation compliance. Facility baseline business value is calculated as follows:

$$VALUE = \sum_{t=0}^{9} \frac{FCF}{(1+CoC)^{t}} \qquad \text{(C3-7)}$$

where:

VALUE	=	estimated baseline business value of the facility
FCF	=	free cash flow
CoC	=	after-tax cost-of-capital (7.0%); and
t	=	year index, t = 0-9 (10-year discounting horizon).

In the present value calculation, yearly cash flows accrue at the beginning of the year. As a result, the first year of cash flows is not discounted – i.e., t = 0 for the first year of the analysis – and cash flows in the tenth and final year of the analysis period are discounted over a 9-year period – i.e., t = 9 in the final year of the analysis.

As explained above, EPA considered a facility to be a baseline closure if its estimated business value was negative before incurring regulatory compliance costs. Baseline closures were neither tested for adverse impact in the post-compliance impact analysis nor were their compliance costs included in the tally of total costs of 316(b) regulatory compliance.

❖ *Calculation of Post-Compliance Free Cash Flow and Performance of Post-Compliance Closure Test*

For the post-compliance closure analysis, EPA recalculated annual free cash flow, accounting for changes in annual expenses and taxes that are estimated to result from compliance-related outlays. EPA combined the post-compliance free cash flow value and the estimated compliance capital outlay in the present value framework to calculate business value on a post-compliance basis.

Calculation of post-compliance free cash flow and performance of the post-compliance closure test involved the following steps:

1. *Adjust baseline annual free cash flow to reflect compliance expense effects:* Compliance-related effects on annual free cash flow include: annually recurring operating and maintenance costs; the annual equivalent of permitting and re-permitting costs, which recur on other than an annual basis over the life of

the analysis; the annual equivalent of the income loss from installation downtime (see Appendix 2); and related changes in taxes[6]. The change in taxes includes: (1) the tax effect of these annually recurring and annualized expenses and (2) the tax effect from depreciation of initial compliance outlays. For calculating the tax effect of depreciation, EPA assumed that compliance capital outlays would be depreciated for tax purposes on a 10-year straight-line schedule. Post-compliance free cash flow was calculated as follows:

$$FCF_{PC} = FCF_{BL} - \Delta TC - \tau(- \Delta TC - \Delta D) \quad \text{(C3-8)}$$

where:

FCF_{PC}	=	post-compliance free cash flow;
FCF_{BL}	=	baseline free cash flow, as calculated above;
ΔTC	=	change in total facility annual costs (excluding interest, depreciation and taxes), calculated as the cost of operating and maintaining compliance equivalent plus the annual equivalent of certain non-annual costs, as described above;
T	=	marginal tax rate for calculating compliance-related tax effects (combined federal-state tax rate); and
ΔD	=	change in depreciation expense, calculated as compliance capital outlay (CC) divided by 10.

2. *Limit tax adjustment to not exceed taxes as reported in baseline financial statement:* The tax effect of compliance outlays is to reduce tax liability. As a result, in the free cash flow calculation, the tax adjustment generally increases cash flow and business value and, all else equal, reduces the likelihood that a facility will fail the post-compliance closure test. However, the extent to which a facility would realize this contribution to cash flow depends on its tax circumstances. In particular, some businesses may not be paying sufficient taxes in the baseline to take full benefit of the implied tax reduction *at the facility level* – unless the unused tax loss can be transferred to other, profitable business units in the firm, these businesses would not be able to use fully the implied tax reduction on a current basis. Also, the marginal tax rate for businesses with relatively lower pre-tax income may be less than the combined Federal/State tax rate used in the analysis. While businesses may be able to carry forward tax losses to reduce taxes in later years, EPA recognizes that the implied cash flow benefit from tax reduction may not be fully realized, particularly in circumstances involving single-facility firms. To reduce the risk of over stating this effect in its analysis, EPA therefore limited the amount of tax reduction from compliance outlays to be no greater than the amount of tax paid by facilities as reported in the baseline financial statement. The analysis effectively assumes that facilities will not be able to offset an implicit negative tax liability against positive tax liability elsewhere in the owning firm's operations or to carry forward (or back) the negative income and its implicit negative tax liability to other positive income/positive tax liability operating periods. Nevertheless, some businesses may be able to benefit from tax reductions that

[6] For the facility cash flow analysis, EPA treated the income loss from installation downtime on an annual equivalent basis even though this financial event occurs only once, and at the beginning of the assumed analysis period. EPA treated the installation downtime on an annualized basis for two reasons. First, the installation downtime is assumed to have a useful "financial life" of 30 years to reflect the total potential business life of the facility (note that reinstallation of the basic capital equipment, which is assumed to recur on a 10-year interval, does not require a new round of downtime). Since compliance capital equipment is assumed to have a 10-year useful life and the discounted cash flow analysis is accordingly structured as a 10-year analysis, including the income loss from installation downtime (which is assumed to have a 30-year useful life) as a one-time up-front cost would overstate its impact in the discounted cash flow calculation. Second, calculation of the downtime cost on an annual basis allows the tax effect from the one-time income loss to be summed with other annual tax effects for applying the limit to tax offsets, as explained in the next step of the analysis.

exceed facility baseline taxes, especially if the facility is owned by a multiple-site firm. Accordingly, EPA constrained the tax effect term in the free cash flow calculation, [-τ(- ΔTC - ΔD)] as specified above, to be no greater than baseline financial statement tax liability, T.

3. *Calculate post-compliance facility value, including post-compliance free cash flow and the compliance capital outlay:* As in the baseline analysis, EPA calculated post-compliance facility value as the present value of free cash flow and accounting for the compliance capital outlay as an undiscounted cash outlay in the first analysis period. Facility post-compliance business value was calculated as follows:

$$VALUE_{PC} = \sum_{t=0}^{9} \frac{FCF_{PC}}{(1+CoC)^{t}} - CC \qquad \text{(C3-9)}$$

where:

$VALUE_{PC}$	=	estimated post-compliance business value of the facility
FCF_{PC}	=	estimated post-compliance free cash flow
CoC	=	after-tax cost-of-capital (7.0%);
t	=	year index, t = 0-9 (10-year discounting horizon); and
CC	=	compliance capital outlay.

EPA considered a facility to be a post-compliance closure if its estimated business value was positive in the baseline but became negative after adjusting for compliance-related cost, revenue and tax effects. In addition to tallying closure impacts in terms of the number of estimated facility closures, EPA also measured the significance of closures in terms of losses in employment and output. Employment losses equal the number of employees reported by closure facilities in survey responses; output losses equal total revenue reported for regulatory closure facilities. EPA estimated national results by multiplying facility results by facility sample weights.[7]

C3-2.2.2 Test of Moderate Impacts

EPA also conducted an analysis of financial stress short of closure to identify the regulation's moderate impacts. Facilities incurring moderate impacts are not projected to close due to the regulatory analysis options. The regulation, however, might reduce their financial performance to the point where they incur greater difficulty and higher costs in obtaining financing for future investments.

The analysis of moderate impacts examined two financial measures:

Pre-Tax Return on Assets (PTRA): ratio of pre-tax operating income – earnings before interest and taxes (EBIT) – to assets. This ratio measures the operating performance and profitability of a business' assets independent of financial structure and tax circumstances. PTRA is a comprehensive measure of a firm's economic and financial performance. If a firm cannot sustain a competitive PTRA on a post-compliance basis, it will likely face difficulty financing its investments, including the outlay for compliance equipment.

Interest Coverage Ratio (ICR): ratio of pre-tax operating cash flow – earnings before interest, taxes, and depreciation (EBITDA) – to interest expense. This ratio measures the facility's ability to service its debt on the basis of current, ongoing financial performance and to borrow for capital investments. Investors and creditors will be concerned about a firm whose operating cash flow does not comfortably exceed its contractual obligations. As ICR increases, the firm's general ability to meet interest payments and carry

[7] For the analysis of options presented in this chapter, none of these impact measures (e.g., employment loss, output loss) were in fact relevant because none of the three regulatory analysis options resulted in regulatory closures.

credit also increases. ICR also provides a measure of the amount of cash flow available for equity after interest payments.

Creditors and equity investors review the above two measures as criteria to determine whether and under what terms they will finance a business. PTRA and ICR also provide insight into a firm's ability to generate funds for compliance investments from internally generated equity, i.e., from after-tax cash flow. The measures are defined as follows:

Pre-Tax Return on Assets

$$PTRA = \frac{EBIT}{TA} \quad \text{(C3-10)}$$

where:

PTRA	=	pre-tax return on assets,
EBIT	=	pre-tax operating income, or *earnings before interest and taxes*, and
TA	=	total assets.

Or, stated in terms of 316(b) income statement accounts,

$$PTRA = \frac{REV - (TC + D)}{TA} \quad \text{(C3-11)}$$

where:

PTRA	=	pre-tax return on assets;
REV	=	revenue;
TC	=	total operating costs (excluding interest, taxes, and depreciation/amortization);
D	=	depreciation; and
TA	=	total assets.

Interest Coverage Ratio

$$ICR = \frac{EBITDA}{I} \quad \text{(C3-12)}$$

where:

ICR	=	interest coverage ratio;
EBITDA	=	pre-tax operating cash flow, or *earnings before interest, taxes, and depreciation (and amortization)* and
I	=	interest expense.

Or, stated in terms of 316(b) income statement accounts,

$$ICR = \frac{REV - TC}{I} \quad \text{(C3-13)}$$

where:

ICR	=	interest coverage ratio;
REV	=	revenue;
TC	=	total operating costs (excluding interest, taxes, and depreciation/amortization); and
I	=	interest expenses.

Including the effects of 316(b) compliance costs, post-compliance PTRA and ICR are:

$$PTRA_{pc} = \frac{\left[REV - \left(TC + \Delta TC + D + \Delta D\right)\right]}{\left(TA + CC\right)} \quad \text{(C3-14)}$$

$$ICR_{pc} = \frac{\left[REV - \left(TC + \Delta TC\right)\right]}{\left(I + \Delta I\right)} \quad \text{(C3-15)}$$

where:

PTRApc	=	pre-tax return on assets, post-compliance;
ICRpc	=	interest coverage ratio, post-compliance;
ΔTC	=	change in total facility operating costs (excluding interest, depreciation and taxes), calculated as operating and maintenance costs of compliance;
ΔD	=	change in depreciation expense, calculated as compliance capital outlay (CC) divided by 10;
CC	=	compliance capital outlay (assuming all of the outlay would be capitalized and reported as an addition to assets on the balance sheet); and
ΔI	=	incremental interest expense from financing of compliance capital outlay. As a simplifying, conservative assumption, incremental interest expense is calculated assuming that the compliance capital outlay is fully debt financed at the overall real cost-of-capital of 7.0%. The annual incremental interest value is calculated as the annualized value of interest payments over 10 years, assuming a constant annual payment of principal and interest.

In calculating the baseline values of the PTRA and ICR measures, EPA applied the same cash flow adjustments as described above for the facility closure analysis, to the numerators of the PTRA and ICR measures. In the same way as described for the facility closure analysis, these adjustments are intended to capture the change in the financial performance of firms in the Primary Manufacturing Industries between the time of the 316(b) Phase III survey and 2003 (see *Appendix C3A4*).

For evaluating 316(b) manufacturing facilities according to the moderate impact measures, EPA compared baseline and post-compliance PTRA and ICR to 316(b) industry-specific thresholds that were developed from data compiled by Risk Management Association, Inc. (RMA). RMA compiles and reports financial statement information by industry as provided by member commercial lending institutions. The threshold values represent the 25th percentile values of PTRA and ICR for statements received by RMA for the eight years from 1994 to 2001 within relevant industries. EPA developed 316(b) industry-level values by weighting and summing the RMA industry values according to the definition of 316(b) industries[8]. Thresholds by sector ranged from 1.8% to 2.9% for PTRA and from 2.0 to 2.4 for ICR. Because the financial statements received by RMA are for businesses applying for credit from member institutions, the data don't represent a random sample. In particular, the RMA data likely exclude representation from the financially weakest businesses, which are unlikely to seek financing from RMA member lending institutions. As a result, EPA views the threshold values as somewhat likely to overestimate the occurrence of moderate impacts.

Both measures are important to financial success and firms' ability to attract capital. Facilities failing at least one of the moderate impact measures in the baseline were deemed to be already experiencing moderate financial weakness and were not tested for additional financial impact in the moderate impact analysis. Facilities that passed both moderate impact tests in the baseline but failed one or both threshold comparisons, post-compliance,

[8] See *Appendix C3A6* for details of moderate impact threshold development and sector-specific threshold values.

were considered to incur moderate financial impacts, short of closure, as a result of the final Section 316(b) regulation.

C3-2.2.3 Firm Level Impacts

The analysis of impact on firms builds on the facility impact analysis to assess whether firms that own multiple facilities are likely to incur more significant impacts than indicated by the facility impact analysis. For the assessment of firm-level effects, EPA calculated annualized after-tax compliance costs as a percentage of firm revenue and reports the estimated number and percentage of affected firms incurring compliance costs in 3 cost-to-revenue ranges: less than 1.0%; at least 1.0% but less than 3.0%; and 3.0% or greater. These ranges are accepted by EPA for screening of firm-level impacts.

EPA's sample-based facility analysis supports specific estimates of (1) the number of facilities expected to be subject to the regulation and (2) the total compliance costs expected to be incurred in these facilities. However, the sample-based analysis does not support specific estimates of the number of firms that own manufacturing facilities. In addition, and as a corollary, the sample-based analysis does not support specific estimates of the number of regulated facilities that may be owned by a single firm, or the total of compliance costs across regulated facilities that may be owned by a single firm.

For the firm level analysis, EPA therefore considered two cases based on the sample weights developed from the facility survey. These cases provide approximate upper and lower bound estimates on: (1) the number of firms incurring compliance costs and (2) the costs incurred by any firm owning a regulated facility. The cases are as follows:

Case 1: Upper bound estimate of number of firms owning facilities that face requirements under the regulation; lower bound estimate of total compliance costs that a firm may incur.

For this case, EPA assumed (1) that a firm owns only the regulated sample facility(ies) that it is known to own from the sample analysis and (2) that this pattern of ownership, observed for sampled facilities and their owning firms, extends over the facility population represented by the sample facilities. This case minimizes the possibility of multi-facility ownership by a single firm and thus maximizes the count of affected firms, but also minimizes the potential cost burden to any single firm.

For each firm that owns one sample facility, no firm is assumed to own more than one regulated facility, and the analysis is straightforward: the firm owns one regulated facility and incurs compliance costs only for that facility. This configuration is assumed to exist as many as times as the facility's sample weight. However, EPA found that 28% of the firms identified as owning a sample facility, own more than one sample facility. Where the multiple facilities owned by the same firm have the same sample weight, the analysis is also straightforward: the firm is assumed to own and incur the compliance costs of the identified sample facilities, and the configuration is assumed to exist as many times as many times as the uniform sample weight of the multiple facilities.

In some instances, however, the sample facilities that are owned by the same firm have different sample weights. In these cases, which required a more complex analysis, EPA accounted for the ownership of multiple sample facilities by a single firm, but restricted the count of the multiple facilities and their configuration of ownership for the firm-level cost analysis based on the sample weights of the individual sample facilities. Specifically, the *firm* is assumed to exist on a sample-weighted basis as many times as the *highest* of the sample weights among the sample facilities known to be owned by the firm. However, sample facilities with a smaller sample weight, *and their compliance costs*, can be included in the total instances of ownership by the firm for only as many times as their sample weights. Otherwise, the total facility count implied in the firm analysis would exceed the sample-based estimated total of facilities; correspondingly, the total of compliance costs accounted for in the firm level analysis would exceed the sample-based estimated total of facility compliance costs. For implementation, this

concept means that *all* of the sample facilities known to be owned by the same firm, *and their compliance costs*, can be included in the ownership configuration for only as many sample weighted instances as the smallest sample weight among the multiple facilities owned by the firm. Once the sample weight of the smallest sample weight facility is "used up," a new multiple facility ownership is configured including only the costs for those facilities with weights greater than the weight of the smallest sample weight facility. This configuration is assumed to exist for as many sample weighted instances as the difference between the lowest sample weight and the next higher sample weight among the facilities owned by the firm. This process is repeated – with successive removal of the new lowest sample weight facility, and its compliance cost– as many times as necessary until only the highest sample weight facility remains in the ownership configuration.

The survey asked respondents to provide firm-level revenue for the parent firm. For single-facility firms, firm revenue and compliance costs are identical to those for the facility. For multi-facility firms, EPA grouped together all facilities with a common parent firm from the surveys. For each firm in the analysis, firm-level compliance cost is:

$$CC_{firm} = \sum_{i} CC_i \qquad \text{(C3-16)}$$

where:

CC_{firm} = firm-level compliance cost

CC_i = compliance cost for the surveyed facility *i*, known to be owned by the *firm*

Case 2: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; upper bound estimate of total compliance costs that a firm may incur.

For this case, EPA inverted the prior assumption and assumed that any firm owning a regulated sample facility(ies), owns the known sample facility(ies) and all of the sample weight associated with the sample facility(ies). This case minimizes the count of affected firms, while tending to maximize the potential cost burden to any single firm.

For this case, EPA grouped together all facilities with a common parent firm from the surveys and sample weighted the facility compliance costs. EPA calculated the firm-level compliance cost as:

$$CC_{firm} = \sum_{i} CC_i \qquad \text{(C3-17)}$$

where:

CC_{firm} = firm-level compliance cost

CC_i = compliance cost for surveyed facility *i* owned by the firm

W_i = sample weight for surveyed facility *i* owned by the firm

As stated above, for the analysis of firm-level impacts, EPA calculated annualized after-tax compliance costs as a percentage of firm revenue. EPA judged that firms with annualized after-tax compliance cost of less than 1.0% of revenue would not be materially affected by the regulation. EPA identified firms as subject to potentially more serious impacts if annualized compliance cost exceeded 3.0% of revenue.

C3-3 RESULTS

This section presents the results of the facility impact analysis. The first section presents the results of the baseline closure analysis. The subsequent sections report the impact analysis results for the three regulatory

analysis options. Section C3-3.2 presents the number of facilities with regulatory requirements under the different options. Section C3-3.3 reviews post-compliance impacts. Section C3-3.4 summarizes total annualized compliance costs on an after-tax basis by option. Section C3-3.5 summarizes the estimated impacts by option, including facility impacts and total annualized compliance costs on both a pre-tax and after-tax basis. Section C3-3.6 presents the results of the firm-level analysis for the two analytic cases described above.

C3-3.1 Baseline Closures

Table C3-1 reports estimated baseline closures for existing facilities in the six Primary Manufacturing Industries and the additional known facilities in Other Industries. EPA determined that 15 facilities (or 9.4%) of the estimated 155 regulated facilities in the six Primary Manufacturing Industries have a negative business value before incurring regulatory compliance costs. The highest percentages of baseline closures occur in the Petroleum industry sector (18.7%) and Paper industry sector (11.1%). One additional facility (or 25%) of the four known facilities in Other Industries is assessed as a baseline closure. These facilities are projected to close in the baseline and are not considered in the analysis of impacts attributable to the regulation.

Appendix C3A7 provides information on historical establishment closure rates in the 316(b) industries. EPA compared the percentage of facilities assessed as baseline closures to typical establishment closure rates in the six Primary Manufacturing Industries, as reported in Statistics of U.S. Businesses (SUSB). SUSB data indicate that between 1.4% and 14.4% of all facilities in these industries close annually. The baseline closure rates for facilities in the Paper and Petroleum industry facilities are higher than the observed closure rates in these industries, as reported in SBA data. However, EPA based its analysis on survey data provided by the facilities and judges that these data and analysis provide an accurate representation of the financial condition of the facilities that would subject to the Phase III regulation.

Table C3-1: Summary of Baseline Closures by Sector for existing facilities estimated subject to the Phase III regulation

Sector	Total Number of Facilities	Number of Baseline Closures	Percentage Closing in Baseline	Number Operating in Baseline
Paper	41	5	11.1%	37
Chemicals	56	4	7.8%	52
Petroleum	17	3	18.7%	14
Steel	27	3	9.2%	25
Aluminum	5	0	0.0%	5
Food	9	0	0.0%	9
Total Facilities in Primary Manufacturing Industries	**155**	**15**	**9.4%**	**141**
Additional known facilities in Other Industries[a]	*4*	*1*	*25.0%*	*3*

[a] Totals may not sum due to independent rounding.

Source: U.S. EPA analysis, 2006.

C3-3.2 Number of Facilities with Regulatory Requirements

Of the three regulatory analysis options (50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, and 200 MGD for All Waterbodies), the 50 MGD All option would subject the largest number of facilities, 144 facilities, or 141 facilities in the Primary Manufacturing Industries and 3 known facilities in Other Industries to national categorical requirements (see Table C3-2). The other two options would subject fewer facilities to national requirements. The 200 MGD for All Waterbodies, would have subjected 30 facilities, or 29 facilities in

the Primary Manufacturing Industries and 1 of the known facilities in Other Industries, to national requirements. The 100 MGD for Certain Waterbodies Option, would have subjected the smallest number of facilities to national requirements: 24 facilities, or 22 facilities in the Primary Manufacturing Industries and 2 known facilities in the Other Industries.

Table C3-2: Number of Facilities with Regulatory Requirements by Sector and Option

Sector	Total Operating in Baseline	Number of Facilities with Regulatory Requirements					
		50 MGD All		200 MGD All		100 MGD CWB	
		Number	Percentage	Number	Percentage	Number	Percentage
Paper	37	37	100.0%	3	8.2%	0	0.0%
Chemicals	52	52	100.0%	5	9.7%	9	16.7%
Petroleum	14	14	100.0%	4	32.1%	5	33.5%
Steel	25	25	100.0%	12	49.5%	9	36.4%
Aluminum	5	5	100.0%	1	27.8%	0	0.0%
Food	9	9	100.0%	3	33.3%	0	0.0%
Total Facilities in Primary Manufacturing Industries	**141**	**141**	100.0%	**29**	**20.7%**	**22**	**15.8%**
Additional known facilities in Other Industries	*3*	*3*	100.0%	*1*	*33.3%*	*2*	*66.7%*

Source: U.S. EPA analysis, 2006.

C3-3.3 Post-Compliance Impacts

Of the 144 facilities estimated subject to regulation after baseline closures, EPA estimated that no facilities would close or incur employment losses as a result of the regulatory analysis options.

EPA also found that none of the existing facilities would incur a moderate impact (i.e., financial stress short of closure) under any of the three regulatory analysis options.

C3-3.4 Compliance Costs

Table C3-3 reports the estimated total after-tax compliance cost to facilities in the Primary Manufacturing Industries and the known facilities in Other Industries by sector and for each of the three regulatory analysis options. The reported costs exclude costs in baseline closures. The total annualized, after-tax compliance cost reported in Table C3-3 represents the cost actually incurred by complying firms, assuming no recovery of costs from customers through increased prices and taking into account the reductions in tax liability resulting from incurrence of compliance outlays. The after-tax analysis uses a combined Federal/State tax rate, and accounts for facilities' baseline tax circumstances. Specifically, tax offsets to compliance costs are limited not to exceed facility-level tax payments as reported in facility questionnaire responses. The total annualized, after-tax compliance cost reported here is the sum of annualized, after-tax costs by facility at the year of compliance. This cost calculation differs in concept from the calculation of compliance costs as included in the calculation of the total social costs of the regulatory options. For the social cost calculation, which is presented in *Chapter E1: Summary of Social Costs*, the year-by-year stream of total pre-tax compliance costs for all facilities is discounted to the assumed year of promulgation of the 316(b) final regulation for Phase III facilities – i.e., beginning of year 2007 – and then annualized. Two social discount rate values, 3% and 7%, are used in the social cost analysis.

Of the three regulatory analysis options, the 50 MGD All option has the highest total after-tax compliance cost, $26.8 million: $26.0 million for facilities in the Primary Manufacturing Industries, and $0.8 million for known facilities in Other Industries. The 100 MGD for Certain Waterbodies has the next higher total after-tax compliance cost, $12.1 million: $11.5 million for facilities in the Primary Manufacturing Industries, and $0.6

million for known facilities in Other Industries. The 200 MGD Option for All Waterbodies, would have the lowest cost, $11.8 million: $11.4 million for facilities in the Primary Manufacturing Industries, and $0.4 million for known facilities in Other Industries.

Table C3-3: Total Annualized Facility Compliance Cost[a] by Sector and Regulatory Option (millions, $2004)

Sector	After-Tax Costs		
	50 MGD All	200 MGD All	100 MGD CWB
Paper	4.3	1.8	0.0
Chemicals	12.6	3.6	6.4
Petroleum	2.4	0.9	1.4
Steel	5.3	4.2	3.7
Aluminum	0.4	0.0	0.0
Food	0.9	0.9	0.0
Total Facilities in Primary Manufacturing Industries	**$26.0**	**$11.4**	**$11.5**
Additional known facilities in Other Industries	*$0.8*	*$0.4*	*$0.6*

[a] This table reflects the cost incurred by complying businesses and does not represent the cost to society from regulatory compliance. *Chapter E1: Summary of Social Costs* discusses the social cost of the final regulation and the other options. The values in this table exclude baseline closures.

Source: U.S. EPA analysis, 2006.

C3-3.5 Summary of Facility Impacts

Table C3-4 summarizes the estimated impacts of the three regulatory analysis options for existing facilities, as reported in the preceding sections.

Table C3-4: Regulatory Impacts for All Facilities by Option, National Estimates

	50 MGD All	200 MGD All	100 MGD CWB
Primary Manufacturing Industries			
Number of Facilities Operating in Baseline	141	141	141
Number of Facilities with Regulatory Requirements	141	29	22
Percentage of Facilities with Regulatory Requirements	100.0%	20.7%	15.8%
Number of Closures (Severe Impacts)	0	0	0
Percentage of Facilities with Regulatory Requirements Predicted to Close	0.0%	0.0%	0.0%
Number of Facilities with Moderate Impacts	0	0	0
Percentage of Facilities with Regulatory Requirements with Moderate Impacts	0.0%	0.0%	0.0%
Annualized Compliance Costs (after tax, million $2004)	26.0	11.4	11.5
Additional Known Facilities in Other Industries			
Number of Facilities Operating in Baseline	3	3	3
Number of Facilities with Regulatory Requirements	3	1	2
Percentage of Facilities with Regulatory Requirements	100.0%	33.3%	66.7%
Number of Closures (Severe Impacts)	0	0	0
Percentage of Facilities with Regulatory Requirements Predicted to Close	0.0%	0.0%	0.0%
Number of Facilities with Moderate Impacts	0	0	0
Percentage with Moderate Impacts	0.0%	0.0%	0.0%
Annualized Compliance Costs (after tax, million $2004)	0.8	0.4	0.6

Source: U.S. EPA analysis, 2006.

C3-3.6 Firm Impacts

As previously discussed, EPA's analysis of firm-level impacts considered two analytic cases:

- Case 1: Approximate upper bound estimate of number of firms owning facilities that face requirements under the regulation; approximate lower bound estimate of total compliance costs that a firm may incur, and
- Case 2: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; approximate upper bound estimate of total compliance costs that a firm may incur.

Based on these two analytic cases, EPA estimated the number of firms owning regulated facilities in the Primary Manufacturing Industries to range from 50 (Case 2 estimate) to 116 (Case 1 estimate), depending on the assumed ownership cases outlined above for firms that own a facility with a DIF of 50 MGD or greater. An additional 2 firms are known to own facilities in Other Industries. EPA included the additional known facilities in Other Industries in the firm impact analyses but since these facilities have no sample weight (i.e., they are not modeled to represent facilities other than themselves), the upper and lower bound estimates were not applicable to them.

Under both Case 1 and Case 2, no firms are estimated to incur total compliance costs equal to or exceeding 1.0% of annual revenue under any of the three regulatory analysis options (See Table C3-5, following page).

Table C3-5: Firm-Level After-Tax Annual Compliance Costs as a Percentage of Annual Revenue

Number of Firms in the Analysis	Number and Percentage with After Tax Annual Compliance Costs/Annual Revenue Equal to:								
	Total	No Costs		Less than 1%		1-3%		At Least 3%	
		Number	%	Number	%	Number	%	Number	%
Primary Manufacturing Industries[a]									
Case 1: Upper bound estimate of number of firms owning facilities that face requirements under the regulation; lower bound estimate of total compliance costs that a firm may incur									
50 MGD All	116	0	0%	116	100%	0	0%	0	0%
200 MGD All	116	87	75%	29	25%	0	0%	0	0%
100 MGD CWB	116	91	78%	25	22%	0	0%	0	0%
Case 2: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; upper bound estimate of total compliance costs that a firm may incur									
50 MGD All	50	0	0%	50	100%	0	0%	0	0%
200 MGD All	50	33	66%	17	34%	0	0%	0	0%
100 MGD CWB	50	36	72%	14	28%	0	0%	0	0%
Other Industries									
50 MGD All	2	0	0%	2	100%	0	0%	0	0%
200 MGD All	2	2	100%	0	0%	0	0%	0	0%
100 MGD CWB	2	1	50%	1	50%	0	0%	0	0%

[a] One known facility in Other Industries is owned by a firm that owns at least one facility in the Primary Manufacturing Industries and is included in this category.

Source: U.S. EPA analysis, 2006.

GLOSSARY

after-tax cash flow (ATCF): The cash generated from business operations, after-tax, that is available to providers of capital – equity and debt – or for reinvestment in the business.

baseline closures: Facilities showing inadequate financial performance in the baseline, that is, in the absence of the regulation. EPA's analysis assumes these closures would have occurred with or without the regulation.

Construction Cost Index (CCI): Measures the cost of a hypothetical package of general construction goods and services compared a base year. The CCI can be used where labor costs are a high proportion of total costs. The CCI uses 200 hours of common labor, multiplied by the 20-city average rate for wages and fringe benefits. (http://www.enr.com/cost/costfaq.asp)

cost of capital: Costs incurred for a firm to obtain financing from all capital sources including, in particular, equity and debt.

cost pass-through: Calculates the percentage of compliance costs that EPA expects firms subject to regulation to recover from customers through increased revenue.

facility: A contiguous set of buildings or machinery on a piece of land under common ownership.

free cash flow: Cash flow generated by the company that is available to all providers of the company's capital, both creditors and shareholders.

Gross Domestic Product (GDP) Implicit Price Deflator: The GDP Deflator is a quarterly series that measures the implicit change in prices, over time, of the bundle of goods and services comprising gross domestic product.

interest coverage ratio (ICR): Ratio of cash operating income to interest expenses. This ratio measures the facility's ability to service its debt and borrow for capital investments.

liquidation value: Net amount that could be realized by selling the assets of a firm after paying debt.

moderate impacts: Adverse changes in a facility's financial position that weaken financial performance and may increase cost of financing but are not threatening to short-term viability.

operating and maintenance: Costs estimated to result from operating and maintaining pollution controls adopted to comply with effluent guidelines. Operating costs include the costs of monitoring.

pre-tax return on assets (PTRA): Ratio of cash operating income to assets. This ratio measures facility profitability.

regulatory closure: A facility that is predicted to close because it can not afford the costs of complying with the regulation.

severe impacts: Facility closures and the associated losses in jobs, earnings, and output at facilities that close due to the regulation.

ABBREVIATIONS

ATCF: after-tax cash flow

CCI: construction cost index

ICR: interest coverage ratio

PTRA: pre-tax return on assets

REFERENCES

Engineering News-Record (ENR). 2006. *Construction Cost Index.* Available at: http://enr.ecnext.com/free-scripts/comsite2.pl?page=enr_document&article=fecosu0603-constIndexHist. (Historical data requires subscription or purchase.)

Federation of Tax Administrators (FTA). 2006. *Range of State Corporate Income Tax Rates (for tax year 2005)*. http://www.taxadmin.org/fta/rate/corp_inc.html. Accessed January 20, 2006.

McGraw-Hill and U.S. Department of Commerce, International Trade Administration. *U.S. Industry & Trade Outlook.*

McKinsey & Company, Inc., et al. 2000. *Valuation: Measuring and Managing the Value of Companies*, 3rd edition. New York: John Wiley & Sons, Inc.

Risk Management Association (RMA). 1997-1998. *Annual Statement Studies*.

Risk Management Association (RMA). 2000-2001. *Annual Statement Studies*.

Risk Management Association (RMA). 2001-2002. *Annual Statement Studies*.

U.S. Department of Commerce (U.S. DOC). 2006. Bureau of Economic Analysis (BEA). Gross Domestic Product. *Table 1.1.9: Implicit Price Deflators for Gross Domestic Product (GDP)*. Release December 12, 2005. Available at: http://www.econstats.com/gdp/gdp__q4.htm.

U.S. Department of Commerce (U.S. DOC). 2006. Bureau of the Census. International Trade Administration. *Industry, Trade, and the Economy: Data and Analysis*. Data by NAICS and SIC. Available at: http://www.ita.doc.gov/td/industry/otea/industry_sector/tables_naics.htm.

U.S. Department of Commerce (U.S. DOC). 1989, 1992, 1997, and 2002. Bureau of the Census. *Census of Manufactures*.

U.S. Department of Commerce (U.S. DOC). 1988-1991, 1993-1996, 1998-2001, and 2003-2004. Bureau of the Census. *Annual Survey of Manufactures.*

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Technical Development Document for the Final Section 316(b) Phase III Existing Facilities Rule*. EPA-821-R-06-003. June 2006.

U.S. Environmental Protection Agency (U.S. EPA). 1999. *Information Collection Request (ICR), Detailed Industry Questionnaires: Phase II Cooling Water Intake Structures & Watershed Case Study Short Questionnaire.* August 1999.

U.S. Small Business Administration (U.S. SBA). 1989-2003. *Statistics of U.S. Businesses*. Available at: http://www.sba.gov/advo/research/data.html.

Value Line. 2006. *Value Line 3.0 Investment Analyzer*.

Value Line. 2003. *Value Line Investment Survey.*

APPENDICES TO CHAPTER C3

Chapter C3 includes 8 appendices, which are contained in the following pages:

- Appendix C3A1: Summary of Results for Supplemental Options
- Appendix C3A2: Calculation of Installation Downtime Cost
- Appendix C3A3: Cost Pass-Through Analysis
- Appendix C3A4: Adjusting Baseline Facility Cash Flow
- Appendix C3A5: Estimating Capital Outlays for Section 316(b) Phase III Manufacturing Sectors Discounted Cash Flow Analyses
- Appendix C3A6: Summary of Moderate Impact Threshold Values by Industry
- Appendix C3A7: Analysis of Baseline Closure Rates
- Appendix C3A8: Analysis of Other Regulations.

Appendix C3A1: Summary of Results for Supplemental Options

INTRODUCTION

This appendix presents results for 8 additional regulatory options evaluated by EPA. For these options, facility counts and other results include only those Phase III Manufacturers that are (1) non-baseline closures and (2) subject to national categorical requirements under the option. See the main body of this chapter for a description of data sources and methodologies used in these analyses. In the following tables, results are presented for the following options evaluated:

- For Electric Generator facilities with a DIF of 2 MGD or greater, but less than 50 MGD:
  - Impingement-only (I-only) requirements for all facilities on all waterbodies;
  - Phase II-like requirements for all facilities on all waterbodies; and
  - Impingement and Entrainment (I&E) requirements for all facilities on all waterbodies.
- For Manufacturing facilities with a DIF of 2 MGD or greater, but less than 50 MGD:
  - Impingement-only (I-only) requirements for all facilities on all waterbodies;
  - Phase II-like requirements for all facilities on all waterbodies; and
  - Impingement and Entrainment (I&E) requirements for all facilities on all waterbodies.
- For Manufacturing facilities with a DIF of 50 MGD or greater:
  - Impingement-only (I-only) requirements for all facilities on all waterbodies;
  - Phase II-like requirements for all facilities on all waterbodies (the *Final Regulation*); and
  - Impingement and Entrainment (I&E) requirements for all facilities on all waterbodies.

APPENDIX CONTENTS

C3A1-1 NUMBER OF FACILITIES WITH REGULATORY REQUIREMENTS

Table C3A1-1: Number of Facilities with Regulatory Requirements by Sector and Option

Sector	Total Operating in Baseline	Number of Facilities with Regulatory Requirements		
		I-Only Everywhere	I&E like Phase II	I&E Everywhere
Electric Generators 2-50 MGD	114	114	114	114
Manufacturers 2-50 MGD	355	355	355	355
Manufacturers 50+ MGD	144	144	144	144
Total	613	613	613	613

Source: U.S. EPA analysis, 2006.

C3A1-2 POST-COMPLIANCE CLOSURES

For a description of this analysis, see *Section B3-2.3*, above.

Table C3A1-2: Number of Facilities Estimated as Post-Compliance Closures by Option

Sector	Total Operating in Baseline	Number of Post-Compliance Closures		
		I-Only Everywhere	I&E like Phase II	I&E Everywhere
Electric Generators 2-50 MGD[a,b]	114	n/a	1	n/a
Manufacturers 2-50 MGD	355	0	0	0
Manufacturers 50+ MGD	144	0	0	0
Total	613	0	1	0

[a] Impacts on Electric Generators under the I&E like Phase II option were performed using a methodology not comparable to the results presented here for manufacturers. See *Chapter B5: Economic Impact Analysis for Electric Generators* of the E*conomic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities* for a discussion of impacts on Electric Generators.

[b] Analyses were not performed for the I-only Everywhere and I&E Everywhere options.

Source: U.S. EPA analysis, 2006.

C3A1-3 MODERATE IMPACTS

For a description of this analysis, see *Section C3-2.3*, above. Impacts on Electric Generators were performed using a methodology not comparable to the results presented here for manufacturers. See the *Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities* for a discussion of impacts on Electric Generators.

Table C3A1-3: Number of Facilities Estimated as Moderate Impacts by Option

Sector	Total Operating in Baseline	Number of Moderate Impacts		
		I-Only Everywhere	I&E like Phase II	I&E Everywhere
Manufacturers 2-50 MGD	355	0	0	0
Manufacturers 50+ MGD	144	0	0	0
Total	499	0	0	0

Source: U.S. EPA analysis, 2006.

C3A1-4 AFTER-TAX COMPLIANCE COSTS

For a description of this analysis, see *Section C3-2.3* above.

Table C3A1-4: Total Annualized Facility[a] After-Tax Compliance Cost by Option (millions, $2004)

Sector	I-Only Everywhere	I&E like Phase II	I&E Everywhere
Electric Generators 2-50 MGD	$2.3	$3.3	$7.9
Manufacturers 2-50 MGD	$19.8	$31.5	$50.6
Manufacturers 50+ MGD	$16.0	$26.7	$36.8
Total	$38.2	$61.6	$95.3

[a] This table reflects the cost incurred by complying businesses and does not represent the cost to society from regulatory compliance. *Chapter E1: Summary of Social Costs* discusses the social cost of the final rule and other regulatory analysis options. The estimates in this table exclude baseline closures but include regulatory closures.

Source: U.S. EPA analysis, 2006.

C3A1-5 OVERVIEW OF IMPACTS

For a description of this analysis, see *Section C3-2.3*, above.

Table C3A1-5: Regulatory Impacts for All Facilities by Option, National Estimates

	I-Only Everywhere	I&E like Phase II	I&E Everywhere
Electric Generators 2-50 MGD			
Number of Facilities Operating in Baseline	114	114	114
Number of Facilities with Regulatory Requirements	114	114	114
Percentage of Facilities with Regulatory Requirements	100.0%	100.0%	100.0%
Number of Closures (Severe Impacts)[a,b]	n/a	1	n/a
Percentage of Facilities with Regulatory Requirements Predicted to Close	n/a	0.01%	n/a
Number of Facilities with Moderate Impacts[a,b]	n/a	n/a	n/a
Percentage of Facilities with Regulatory Requirements with Moderate Impacts	n/a	n/a	n/a
Annualized Compliance Costs (after tax, million $2004)	$2.3	$3.3	$7.9
Manufacturers 2-50 MGD			
Number of Facilities Operating in Baseline	355	355	355
Number of Facilities with Regulatory Requirements	355	355	355
Percentage of Facilities with Regulatory Requirements	100%	100%	100%
Number of Closures (Severe Impacts)	0	0	0
Percentage of Facilities with Regulatory Requirements Predicted to Close	0%	0%	0%
Number of Facilities with Moderate Impacts	0	0	0
Percentage of Facilities with Regulatory Requirements with Moderate Impacts	0%	0%	0%
Annualized Compliance Costs (after tax, million $2004)	$19.8	$31.5	$50.6
Manufacturers 50+ MGD			
Number of Facilities Operating in Baseline	144	144	144
Number of Facilities with Regulatory Requirements	144	144	144
Percentage of Facilities with Regulatory Requirements	100%	100%	100%
Number of Closures (Severe Impacts)	0	0	0
Percentage of Facilities with Regulatory Requirements Predicted to Close	0%	0%	0%
Number of Facilities with Moderate Impacts	0	0	0
Percentage of Facilities with Regulatory Requirements with Moderate Impacts	0%	0%	0%
Annualized Compliance Costs (after tax, million $2004)	$16.0	$26.7	$36.8

[a] Impacts on Electric Generators under the I&E like Phase II option were performed using a methodology not comparable to the results presented here for manufacturers. See the Chapter B5: Economic Impact Analysis for Electric Generators of the Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities for a discussion of impacts on Electric Generators.

[b] Analyses were not performed for the I-only Everywhere and I&E Everywhere options.

Source: U.S. EPA analysis, 2006.

C3A1-6 FIRM IMPACTS

For a description of this analysis, see *Section C3-2.3*, above.

Table C3A1-6: Firm-level After-Tax Annual Compliance Costs as a Percentage of Annual Revenue

Number of Firms in the Analysis	Number and Percentage with After Tax Annual Compliance Costs/Annual Revenue Equal to:								
	Total	No Costs		Less than 1%		1-3%		At Least 3%	
		Number	%	Number	%	Number	%	Number	%
Primary Manufacturers[a]									
Case 1: Upper bound estimate of number of firms owning facilities that face requirements under the regulation; lower bound estimate of total compliance costs that a firm may incur									
I-only Everywhere	339	0	0%	339	100%	0	0%	0	0%
I&E like Phase II	339	0	0%	339	100%	0	0%	0	0%
I&E Everywhere	339	0	0%	339	100%	0	0%	0	0%
Case 2: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; upper bound estimate of the total compliance cost that a firm may incur									
I-only Everywhere	109	0	0%	109	100%	0	0%	0	0%
I&E like Phase II	109	0	0%	109	100%	0	0%	0	0%
I&E Everywhere	109	0	0%	109	100%	0	0%	0	0%

[a] An additional 7 known facilities incur costs of less than 1% of firm revenues under each option. EPA included the additional known facilities in Other Industries in the firm impact analyses but since these facilities have no sample weight (i.e., they are not modeled to represent facilities other than themselves), the upper and lower bound estimates were not applicable to them.

Source: U.S. EPA analysis, 2006.

Appendix C3A2: Calculation of Installation Downtime Cost

INTRODUCTION

APPENDIX CONTENTS:

Depending on the engineering design of a facility's cooling water intake system, installation of some of the compliance technologies considered for the regulatory analysis options could require a one-time, temporary shutdown of the facility's cooling water system. During this period, the facility's cooling-water dependent operations would most likely be halted, with a potential loss of revenue and income from those operations. Accordingly, a key element of the potential cost to facilities in complying with the 316(b) Phase III regulation is the loss in income from installation downtime. Installation downtime may also present a cost to society, depending upon assumptions about the cost structure of the production to replace the goods and services not produced by complying facilities during the installation downtime.

Unlike the capital and operating cost elements of total compliance, this cost element is not estimated based solely on engineering analysis of compliance technology specifications. Instead, the cost of installation downtime depends on a number of factors additional to the engineering assessment of compliance requirements. Specifically, the cost of installation downtime depends on the estimated length of time that a facility's cooling water intake system would be removed from service, the extent to which the facility's business operations depend on cooling water, and the revenue and operating cost structure of those cooling water dependent operations. Of these items, the length of time that the facility's cooling water intake system would be out of service was estimated as part of the engineering analysis of compliance requirements. The remaining items – the extent to which the facility's business operations depend on cooling water, and the revenue and operating cost structure of the facility's cooling water dependent operations – were obtained from the facility's response to the economic/ financial section of the 316(b) Phase III questionnaire. EPA used this information to calculate the pre-tax income loss from installation downtime.

The following sections of this appendix present the methodology used to estimate the income loss from installation downtime. For a detailed discussion of how facility downtime estimates were derived, see Chapter 5 of the *Technical Development Document for the Final Section 316(b) Phase III Existing Facilities Rule* (U.S. EPA, 2006b).

C3A2-1 ESTIMATED SHUT-DOWN PERIOD FOR INSTALLING COMPLIANCE EQUIPMENT

Installation of some of the compliance technologies considered for the regulatory analysis options would require a one-time, temporary shutdown of the facility's cooling water intake system. Table C3A2-1, below, lists the estimated durations of net system downtime, in weeks, for each of the compliance technology modules considered for compliance with the 316(b) Phase III regulatory options. The *net* downtime duration accounts for any expected annual period of cooling water system downtime for regular maintenance and repair – the net downtime is the number of weeks the cooling water system would need to be out of service above and beyond any regular maintenance downtime period. Most of the technology modules are expected to be able to be installed without any additional net system downtime. However, several of the technology modules are expected to require a net

downtime ranging from a month or less to just over two months. For a detailed discussion of how facility downtime estimates were derived see Chapter 5 of the Phase III Technical Development Document (U.S. EPA, 2006, DCN 9-0004)

Table C3A2-1: Estimated Average Cooling Water System Downtime by Technology Module

Module #	Description	Net Downtime (Weeks)
1	Fish handling and return system	0
2	Fine mesh traveling screens with fish handling and return	0
3	New larger intake structure with fine mesh, handling and return	0 - 2
4	Passive fine mesh screens with 1.75 mm mesh size at shoreline	7 - 9
5	Fish barrier net	0
6	Gunderboom	0
7	Relocate intake to submerged offshore with passive fine mesh screen with 1.75 mm mesh size	7 - 9
8	Velocity cap at inlet of offshore submerged	0
9	Passive fine mesh screen with 1.75 mm mesh size at inlet of offshore submerged	0
10	Shoreline tech for submerged offshore	0
11	Double-entry, single-exit with fine mesh and fish handling and return	0
12	Passive fine mesh screens with 0.75 mm mesh size at shoreline	7 - 9
13	Relocate intake to submerged offshore with passive fine mesh screen with 0.75 mm mesh size	0
14	Passive fine mesh screen at inlet of offshore submerged with 0.75 mm mesh size	7 - 9

Source: U.S. EPA analysis, 2006, DCN 9-0004.

C3A2-2 CALCULATING THE IMPACT OF INSTALLATION DOWNTIME ON COMPLYING FACILITIES

Installation downtime may affect a facility's business operations in several ways:

1. The facility will be unable to perform production or other business operations that depend on cooling water.
2. The facility will lose revenue from the production and sale of the goods and services that otherwise would have been produced by the affected production operations during the period of downtime.
3. The facility will shed the variable cost of producing the goods and services not able to be produced during the period of installation downtime. However, the facility will continue to incur the fixed costs of production associated with the affected operations.
4. If, as part of its cooling water dependent operations, the facility generates electricity for its own use, and some part of this self-generated electricity continues to be needed during the period of installation downtime, the facility may need to purchase replacement electricity.

Together, these effects lead to a loss in pre-tax income, which EPA calculated and used as the cost of installation downtime in its analysis of facility impacts. EPA calculated the loss in pre-tax income by first calculating the *annual* loss in revenue in cooling water dependent operations *less* the variable production costs associated with those operations *plus* the cost of purchasing electricity to replace any own-generated electricity that is used by the facility. Second, EPA adjusted this *annual* pre-tax loss value to reflect the length of net installation downtime as estimated in the engineering analysis of compliance technology requirements. Specific elements of these calculations are summarized below for (1) business effects not associated with electric power generation, and (2) electric power generation-related effects.

Business Effects Not Associated with Electric Power Generation

The 316(b) Phase III questionnaire included a series of questions aimed at understanding the potential financial effect of temporary or permanent shutdown of a facility's cooling water intake system. A key data item obtained from the questionnaire response is the fraction of a facility's non-electric revenue that depends on cooling water. This information coupled with facility income statement information obtained from the questionnaire response provided the basis for calculating the income loss in non-electric power-related operations. Steps in the calculation are as follows:

1. Calculate the annual revenue loss from curtailment of cooling water-dependent operations by multiplying the fraction of cooling water-dependent revenue by the total reported non-electric revenue.
2. Calculate the variable production cost offset to this revenue loss by multiplying *materials expense*, as reported on the facility's income statement provided in the questionnaire, by the fraction of cooling water-dependent revenue, as described above. This approach assumes that the variable production cost structure for cooling water-dependent operations is the same as that for non-cooling water-dependent operations. Since other cost accounts or the services they provide – e.g., labor – might also be curtailed and/or applied to some other beneficial service within the enterprise, the use of *materials expense* as the only component of facility operating costs that may be shed during a period of installation downtime may not capture all of the offset that may be available at a particular facility, but it is the only expense that would be uniformly available for all facilities unlike the other cost accounts.
3. Calculate *annual* loss in pre-tax income from curtailment of the facilities cooling water intake system *from non-electric power-related operations* as estimated revenue loss *less* estimated reduction in variable production cost.
4. Calculate pre-tax income loss in non-electric power-related operations, from installation downtime, by multiplying the annual pre-tax income loss by the fraction of the year indicated as the net downtime required for installing compliance equipment.

Business Effects Associated with Electric Power Generation

The analysis of installation downtime costs for cooling water-dependent electric power generation activities is the same in concept as that outlined for non-electric power-related operations, with the exception that facilities may need to incur an additional cost for purchasing replacement electricity if some of the facility's electric power needs were met from its own generation. Key information obtained from facility questionnaires for calculating the income loss in electric power-related operations includes: (1) annual electric revenue reported as cooling water dependent, (2) the fuel cost of electric power generation, which is assumed to be shed during the period of curtailed operations, (3) the quantity of electricity consumed by the facility, and (4) the quantity of electricity generated by the facility. The remaining key input required for this analysis is the unit price of replacement electricity: for this item, EPA used the average electricity price for industrial customers by state, using data from the Department of Energy, Energy Information Administration, for August, 2004. EPA calculated the pre-tax income loss effect for electric power generation activities as follows.

1. Annual electric revenue from cooling water-dependent generation is obtained directly from the facility questionnaire. This value is assumed to be the annual revenue loss in electric power generation, from curtailment of cooling water-dependent operations.
2. Annual fuel cost of electric power generation is obtained directly from the facility questionnaire. EPA assumes that this value is shed during the period of curtailed operations.
3. Calculate self-generated electricity that is consumed by the facility as the lesser of (a) the facility's own electricity generation or (b) the electricity used within the facility.

4. Calculate the quantity of replacement electricity to be purchased by the facility, by multiplying the quantity of own-generated electricity that is consumed by the facility by the fraction of non-electric revenue that is cooling water dependent *but subject to* a maximum reduction in electricity need of 75 percent. That is, the facility is assumed to need replacement electricity in proportion to the fraction of non-electric revenue *that is not cooling water-dependent.* As the fraction of revenue dependent on cooling water, and thus affected by installation downtime, increases, the need for replacement electricity decreases. However, even in the case where the fraction of revenue that is cooling water dependent is very large (e.g., 100 percent), the analysis assumes that the facility will not shed all of its electricity needs: the facility is assumed to always require 25 percent of its baseline electricity consumption from self-generated electricity. The assignment of the 25 percent minimum electricity replacement need is an estimate that reflects the reality that less electricity is likely to be needed to serve a lower level of operations during a cooling water system shutdown, while also acknowledging that all electricity need cannot be shed, regardless of the reduction in non-electric generating activity. The numerical consequence on imposing the 25 percent electricity requirement floor (as opposed to a floor of zero percent) is very small.
5. Calculate the cost of electricity purchased to replace self-generated electricity used by the facility by multiplying the quantity of replacement electricity by the average electricity price, by state, for industrial customers.
6. Calculate *annual* loss in pre-tax income for electric power-related operations as estimated revenue loss from cooling water-dependent generation *less* estimated annual fuel cost of electric power generation *plus* cost of electricity purchased to replace own-generated electricity.
7. Calculate pre-tax income loss in electric power-related operations, from installation downtime, by multiplying the annual pre-tax income loss by the fraction of the year indicated as the net downtime required for installing compliance equipment.

These values are summed to yield the total pre-tax income loss to the facility from installation downtime.

Under the 50 MGD All Option, 3 manufacturing facilities have non-zero downtime. Of these, 2 have non-zero cost of downtime. The facility with zero downtime costs reported that none of its revenue was cooling water dependent. Of the 2 facilities with non-zero downtime cost, downtime cost as a fraction of annual revenue ranges from 9.2% to 11.3%. Under the 200 MGD All Option, 1 manufacturing facility has non-zero downtime. Downtime cost as a fraction of annual revenue for this facility equals 9.2%. Under the 100 MGD CWB Option, none of the manufacturing facilities have non-zero downtime.

C3A2-3 CALCULATING THE COST TO SOCIETY OF INSTALLATION DOWNTIME

The preceding discussion describes the calculation of the pre-tax income loss from installation downtime as used in the facility impact analysis. For the analysis of cost to society, the concept of cost of installation downtime differs from that for the private impact analysis. Specifically, under the assumption that the total quantity of goods and services produced and sold by the affected industries would not change as a result of the regulation (see Chapter E1 for further detail on the social cost analysis framework), the cost to society from installation downtime is the *increase* in cost for producing the goods and services that would otherwise have been produced by the affected facilities. That is, other producers are assumed to replace the production of goods and services lost due to installation downtime, and the cost to society is the amount, if any, by which the cost of these goods and services exceeds the cost at which the affected facilities would have produced these goods and services.

In concept, the cost to society could vary over a broad range depending on the structure of, and character of competition in, the production of goods and services in the individual markets affected by the 316(b) Phase III regulation.

- At the low end of this possible range, if the replacement goods and services can be provided by other producers (or even the same producer but at a time before or after the downtime period) at the same variable production cost as otherwise would have been incurred by the affected 316(b) Phase III facilities, then the cost to society of installation downtime would be zero. Because the cost for alternative producers is the same as for the producers incurring downtime, society incurs no incremental resource cost when other producers provide the replacement goods and services. In this case, although the affected 316(b) Phase III facilities might incur a financial impact from installation downtime, this impact – the loss in pre-tax income described in the preceding section – becomes a transfer from the producers incurring installation downtime losses to the producers who make up the lost production.
- At the high end of this possible range, the cost to society would be approximately equal to the pre-tax income loss incurred by facilities due to installation downtime. That is, the cost to society would again be the lost revenue from installation downtime *less* the variable cost of producing the goods and services not produced due to the installation downtime. In this case, the variable production cost for other producers to replace the lost goods and services is assumed to be essentially the same as the *price* received for the sale of the goods and services not produced by the facilities incurring the installation downtime. This assumption is consistent with a competitive market model of increasing marginal production cost, such that the variable production cost of the marginal supplier of goods and services produced and sold in any period is approximately equal to the price received for those goods and services in the market.

The likely reality is that the cost to society from installation downtime lies somewhere between these cases. Because EPA lacked specific knowledge of the overall production cost structure of the affected industries and for the numerous goods and services provided by the affected industries, EPA adopted the latter of the two analytic cases outlined above for its analysis. That is, EPA assumed that the cost to society from installation downtime would be the same as that estimated as the pre-tax cost of installation downtime for Manufacturers' facilities. Thus the cost to society of installation would be lower to the extent that the variable production cost for replacement goods and services is less than the selling price of those goods and services.

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Appendix C3A3: Cost Pass-Through Analysis

INTRODUCTION

This appendix presents the assessment of cost pass-through (CPT) potential for six Primary Manufacturing Industry sectors in which a substantial number of facilities are expected to be subject to the Section 316(b) Phase III regulatory analysis options. This analysis considered the following six industry sectors:

- SIC 20: Food and kindred products
- SIC 26: Paper and allied products
- SIC 28: Chemicals and allied products
- SIC 29: Petroleum Refining
- SIC 331: Steel
- SIC 333/5: Aluminum

APPENDIX CONTENTS

The purpose of the CPT analysis is to estimate the extent to which cost increases incurred by facilities in complying with the Section 316(b) Phase III regulatory options can be reasonably expected to be passed on to consumers in the form of higher prices.

This appendix begins with a review of approaches for assessing CPT potential associated with market-wide cost increase scenarios. Next, a description of the methodology and specific metrics used to assess CPT potential are discussed and the results for each sector provided. Finally, conclusions are presented.

From this analysis, EPA concluded that an assumption of zero cost pass-through is appropriate for analyzing the impact of the regulatory analysis options on facilities in the manufacturing industries. Performance of the financial impact analysis under this assumption means that facilities must absorb all compliance-related costs and operating effects (e.g., income loss from facility shutdown during equipment installation) within their baseline cash flow and financial condition. To the extent that facilities would be able to pass on some of the compliance costs to customers through price increases, the analysis overstates the potential impact on complying facilities.

C3A3-1 THE CHOICE OF FIRM-SPECIFIC VERSUS SECTOR-SPECIFIC CPT COEFFICIENTS

One method of examining the ability of a firm to pass-through compliance-related cost increases associated with the Phase III regulation is to review the firm's historical performance in passing on previous cost increases to consumers. For example, Ashenfelter *et al.* (1998) estimate the cost pass-through rate facing an individual firm, and distinguish that rate from the rate at which a firm passes through cost changes common to all firms in an industry, by regressing the price a firm charges on both its costs and the costs of another firm in the industry. The estimated firm-specific CPT rate relates a change in the prices charged by a specific firm to a change in its production costs, assuming no changes in the production cost for rival producers of that product. However, estimating firm specific CPT rates is extremely complex. For example, in order to estimate firm-specific CPT rates for every Phase III manufacturing firm included in the sample of Detailed Industry Questionnaire (DQ) respondents, EPA would require, for each firm, detailed information on the products sold, the markets in which these products are sold, as well as information identifying major competitors in each market. The Detailed

Industry Questionnaire did not obtain this information from surveyed facilities. And even if such information were available, the analysis would remain highly challenging and subject to significant analytic error. As such, it is neither possible nor practical to develop firm-specific CPT coefficients for the sample of Phase III manufacturers.

Moreover, even if the Agency possessed the data necessary to estimate firm-specific CPT rates, it is questionable whether these rates would be the appropriate measure of CPT potential for compliance-related cost increases stemming from the Phase III regulation. The Phase III regulation would force multiple firms in each of the industry sectors considered in this analysis to incur compliance-related cost increases, which implies that for most firms the cost increases would not only apply to them, but also to several of their competitors. Not surprisingly, previous studies have found that the CPT rate for changes to an individual firm's cost differs from the rate at which a firm would pass through cost changes that are common to all, or a substantial fraction of, firms in an industry (Ashenfelter et al., 1998). It can be reasonably expected that the higher the share of firms incurring the cost increase, or more appropriately the higher the share of total output produced by such firms, the greater the ability of those firms to pass on a greater portion of those costs to the consumer.

In cases where an industry-wide cost shock occurs, an industry-wide CPT rate would be an appropriate and practical way of assessing the potential of all firms in that industry to pass through that cost increase to consumers (EPA, 2003). An industry-wide CPT rate provides an estimate of the change in each facility's output prices as a function of the increase in its production costs, assuming that the same cost increase is experienced by all firms in the industry. Such an industry-wide rate is relatively easier to estimate than firm-specific cost pass-through rates if one assumes that perfect competition exists in the industry. Among other things, perfect competition implies the existence of product homogeneity within the industry, homogeneity of production technology among firms in the industry, and homogeneity of production costs among firms (i.e., pricing is at marginal cost). Under these conditions, the price response to a general industry-wide change in production costs is likely to be industry-wide and similar across all firms. For example, in support of the recently promulgated Metal Products &Machinery (MP&M) industry effluent guidelines, EPA's Office of Water (OW) estimated industry-specific CPT rates since a large fraction of establishments in these industries were expected to be subject to the regulation. EPA estimated these CPT rates by regressing annual output price indices on annual input cost indices for the MP&M industry. The estimated CPT coefficients were validated by a market structure analysis that assessed, for each industry, the potential market power enjoyed by firms in the industry and the consequent implications it had on their ability to pass through compliance-related costs.

Industry-wide CPT rates can be estimated for the Phase III manufacturing sectors based on the methodology used for deriving industry-wide CPT rates for industries covered by the MP&M regulation. However, because the regulatory analysis options will affect only those facilities that operate a CWIS to withdraw cooling water from surface water bodies, only a subset of facilities in each industry sector would incur compliance-related cost increases. As the cost increase associated with the regulatory analysis options is not industry-wide, it is questionable whether industry-wide CPT rates are appropriate for estimating the price response of firms in the five industry sectors considered in the analysis of Phase III impacts. If a substantial portion of production in each industry occurs at facilities not subject to the regulation under each analysis option, then the use of industry-wide CPT rates may grossly overestimate the ability of firms in these industries to pass-through compliance-related costs to consumers.

To assess the reasonableness of using industry-wide CPT rates in the analysis of impacts to Phase III manufacturers, EPA estimated the percentage of total production in each of the six Primary Manufacturing Industries sectors that occurs at facilities that are estimated to be subject to the regulatory analysis options. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because value of shipments data were not collected using the DQ, these data were not available for the sample of Phase III manufacturing facilities potentially subject to the regulatory analysis options. As such, total revenue, as reported

on the DQ, was used as a close approximation to value of shipments for these facilities. EPA estimated the total revenue subject to the regulatory options by multiplying the revenue of facilities (in $2004) in the sample of Phase III manufacturers that were determined to be potentially subject to each option by their facility sample weights and summing across all facilities. Total value of shipment estimates for each industry were obtained from the 2004 Annual Survey of Manufacturers. Table C3A3-1 summarizes the findings of this analysis.

Table C3A3-1: Proportion of Value of Shipments Potentially Subject to Compliance-Related Costs Associated with the Phase III Regulation ($2004)

SIC	Industry Sector	Revenue for Facilities Subject to Phase III Regulation (Millions 2004$)	Total Value of Shipments (Millions 2004$)	Proportion of Total Value of Shipments Subject to Regulation		
				50 MGD All	200 MGD All	100 MGD CWB
20	Food and kindred product	4,973	584,908	1%	0%	1%
26	Paper and allied products	19,070	81,988	23%	1%	5%
28	Chemicals and allied products	30,215	357,682	8%	4%	6%
29	Petroleum Refining	25,388	288,084	9%	3%	5%
331	Steel	31,895	92,821	34%	26%	29%
333/35	Aluminum	5,256	18,338	29%	3%	3%

Notes: For the purpose of this analysis, facility revenue was used as an appropriate surrogate in the absence of value of shipments for sample facilities.

Source: Section 316(b) Detailed Industry Questionnaire and 2004 Annual Survey of Manufacturers.

As shown in Table C3A3-1, the proportion of total value of shipments estimated subject to the regulation under the regulatory analysis options ranges from 1 percent to 34 percent depending on the industry and option considered. Given that less than 35 percent of the total value of shipments in each of the six industries considered in this analysis would be subject to regulation induced compliance costs, EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the Phase III impact analysis has not been met. The Agency believes that using industry-wide CPT rates in the analysis of Phase III impacts would overestimate the cost pass-through ability of firms incurring regulation-induced compliance costs, and thus underestimate impacts. At the other end of the spectrum, however, an assumption of zero CPT would provide a conservative estimate, as it would assume that all facilities incur one hundred percent of cost impacts.

Given the inability to estimate firm-specific CPT rates and the finding that the use of industry-wide CPT rates would not be appropriate, EPA next conducted a market structure analysis to investigate the extent to which firms in the six industry sectors enjoy sufficient market power to pass compliance-related costs on to consumers in the form of higher prices.

C3A3-2 MARKET STRUCTURE ANALYSIS

Information on the competitive structure and market characteristics of an industry provide insight into the likely ranges of supply and demand elasticities and the sensitivity of output prices to input costs. For example, when input costs increase, the profit-maximizing firm attempts to maintain its profits by increasing output prices, to the extent permitted by market power. The amount of the cost increase that the firm can pass on as higher prices depends on the relative market power of the firm and its customers. The market structure analysis described in this section attempts to measure the market power enjoyed by firms in each of the six industries. This analysis is

combined with information from industry review documents such as *McGraw Hill's U.S. Industry and Trade Outlook* to reach conclusions regarding the CPT ability of firms in each industry.

The market structure analysis consists of a review of economic data for the following four indicators of market power: industry concentration; import competition; export competition; and long term growth. Each of these indicators is discussed in detail below. EPA notes that the impact of each of these four indicators of market power varies from industry to industry. Furthermore, the results presented for each indicator must be interpreted with caution because even though for a particular industry an indicator may predict high cost pass-through potential, the specific features of the industry may result in the indicator having diminished significance in predicting market power.

C3A3-2.1 Industry Concentration

The extent of concentration among a group of market participants is an important determinant of that group's market power. A group of many small firms typically has less market power than a group of a few large firms, because the latter are in a more advantageous position to collude with each other. All else being equal, highly-concentrated industries are therefore expected to pass-through a higher proportion of the compliance costs that would result from the Phase III regulation.

This analysis uses the Herfindahl-Hirschman Index (HHI) as a measure of market concentration[1]. The HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. For example, for a market consisting of four firms with shares of thirty, thirty, twenty and twenty percent, the HHI is 2600 ($30^2 + 30^2 + 20^2 + 20^2 = 2600$). The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

The accuracy of any analysis of market power originating from industry concentration depends to a large extent on properly defining the relevant market. A well-defined market requires the inclusion of all competitors and the exclusion of all non-competitors. Defining the relevant market too narrowly overstates market power, while defining the market too broadly would underestimate it. The four-digit SIC category, while not a perfect delineation, is most often used by industrial organization economists in their studies because, among publicly available data sources, these industries appear to correspond most closely to economic markets (Waldman & Jensen, 1997). Therefore, in Table C3A3-2 below, industry concentration data is presented for each of the four-digit SIC codes that include at least one potentially regulated Phase III facility for which DQ data are available.

[1] The Herfindahl-Hirschman Index was chosen because it provides a more complete picture of industry concentration compared to other measures such as the four-firm and eight-firm concentration ratios. The HHI uses the market shares of all the firms in the industry, and these market shares are squared in the calculation to place more weight on the larger firms. In contrast, the four- and eight-firm concentration ratios do not use the market share of all firms in the industry, and nor do they provide information about the distribution of firm size. For example, if there were a significant change in the market shares among the firms included in the ratio, the value of the concentration ratio would not change.

Table C3A3-2: Herfindahl-Hirschman Index for Four-Digit SIC

SIC	NAICS[a]	NAICS Description	Industry	HHI[b]
		Unconcentrated Markets (HHI < 1,000)		
20-- (excluding beverage manufacturing)	311	Food Manufacturing	Food and Kindred Products	91
3317	331210	Iron and Steel Pipes and Tubes Mfg From Purchased Steel	Steel	200
3315	331222	Steel Wire Drawing	Steel	223
2869	325199	All Other Basic Organic Chemical Mfg	Chemicals and Allied Products	256
2821	325211	Plastics Material and Resin Mfg	Chemicals and Allied Products	304
2819	325188	All Other Basic Inorganic Chemical Mfg	Chemicals and Allied Products	394
2911	324110	Petroleum Refineries	Petroleum Refining	422
3312	331111	Iron and Steel Mills	Steel	445
2621	32212	Paper (except newsprint) Mills and Newsprint Mills	Paper and Allied Products	467
2631	322130	Paperboard Mills	Paper and Allied Products	485
2082, 2084, 2085, 2086, 2097	3121	Beverage Manufacturing	Food and Kindred Products	532
3316	331221	Cold-Rolled Steel Shape Mfg	Steel	631
		Moderately Concentrated Markets (1,000 < HHI < 1,800)		
2611	322110	Pulp Mills	Paper and Allied Products	1106
2813	325120	Industrial Gas Mfg	Chemicals and Allied Products	1225
3334	331312	Primary Aluminum Production	Aluminum	1231
3353	331315	Aluminum Sheet, Plate and Foil Mfg	Aluminum	1447
2865	325192	Cyclic Crude and Intermediate Mfg	Chemicals and Allied Products	1701
		Concentrated Markets (1,800 < HHI)		
2816	325131	Inorganic Dye and Pigment Mfg	Chemicals and Allied Products	1843
2812	325181	Alkalies and Chlorine Mfg	Chemicals and Allied Products	2870

[a] NAICS code represents largest percentage of facilities and value of shipments within this SIC based on *1997 Bridge Between SIC and NAICS*

[b]The 1997 Census of Manufacturers is the most recent concentration ratio data available.

Source: Census of Manufacturers 1997.

As shown in Table C3A3-2, based on their HHI, 12 four-digit SIC markets can be classified as unconcentrated, 5 can be classified as moderately concentrated, and only 2 can be classified as concentrated. Notably, all 23 of the four-digit SIC categories listed as being concentrated belong to the Chemicals and Allied Products industry. From a market power perspective, Table C3A3-2 seems to suggest that at the four-digit SIC level only two SIC categories are sufficiently concentrated to argue that firms may possess sufficient market power to pass-through a portion of their compliance-related costs assuming that competitor firms in the same industry do not incur similar cost increases.

To further examine the level of concentration in each of the six industry sectors, EPA decided to analyze HHI at the industry level as well. The Industry-level HHI for each sector was calculated as the average of each four-digit SIC HHI belonging to that sector, weighted by the value of shipments for that SIC. EPA notes that aggregating HHI for four-digit SIC categories into industry HHI are likely to yield estimates that in general understate market power. Nonetheless, estimated industry HHI should still provide meaningful insight into market power of firms in the industry because firms in each industry still produce similar or related products (for example, paper products, chemicals, etc.). Estimated Industry HHIs are presented below in Table C3A3-3.

Table C3A3-3: Herfindahl-Hirschman Index by Industry

SIC	Industry	HHI
20	Food and Kindred Products	147
29	Petroleum Refining	422
331	Steel	422
28	Chemicals and Allied Products	496
26	Paper and Allied Products	501
333/5	Aluminum	1380

Source: Census of Manufacturers 1997, and U.S. EPA analysis

Table C3A3-3 reveals that, at the industry level, the estimated HHI for five of the six industries are quite small, implying that they are unconcentrated markets and within these industries individual firms do not enjoy much market power. Notably, the Chemicals and Allied Products industry has a low HHI, which suggests that the 4 four-digit SIC categories that were classified as having concentrated markets in reality make up a very small segment of the Chemicals and Allied Products industry. Thus, from the perspective of the Phase III regulatory analysis, the majority of firms in this industry have small market power. In addition, EPA notes that only 8 percent of production in this is industry would potentially be subject to compliance-related cost increases, which suggests that the cost pass-through potential of firms from this sector incurring such expenses would be severely curtailed.

An important finding in Table C3A3-3 is that the Aluminum industry, which is categorized at the three-digit SIC level, appears to be moderately concentrated. Thus, based solely on an analysis of industry concentration, it would appear that firms in the Aluminum industry might enjoy moderate amounts of market power, which may enable them to pass through costs at a more than negligible rate. However, as cautioned at the beginning of the market structure analysis, an accurate judgment of the market power enjoyed by firms in an industry must be reserved until all indicators have been analyzed.

C3A3-2.2 Import Competition

Theory suggests that imports as a percent of domestic sales are negatively associated with market power because competition from foreign firms limits domestic firms' ability to exercise such power. Firms belonging to sectors in which imports make up a relatively large proportion of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs compared to firms belonging to sectors with lower levels of import penetration, the measure of import competition used in this analysis. Import penetration, the ratio of imports in a sector to the total value of domestic consumption in that sector, is particularly relevant because foreign producers would not incur costs as a result of the Phase III regulation.

In this market structure analysis, EPA assumes that higher import penetration will generally imply that firms are exposed to greater competition from foreign producers and would thus possess less market power to increase prices in response to regulation-induced increases in production costs. EPA estimated import penetration ratios for each industry as total imports in an industry divided by total value of domestic consumption in that industry; where domestic consumption equals domestic production plus imports minus exports. Import penetration ratios estimated using 1998 census data for the six industry sectors considered in this analysis are presented below in Table C3A3-4.

Table C3A3-4: Import Penetration by Industry ($2004)

SIC	Industry	Imports (Millions)	Implied Domestic Consumption (Millions)	Import Penetration
20	Food and Kindred Products	$31,782	$588,644	5.40%
26	Paper and Allied Products	$14,682	$87,280	16.82%
28	Chemicals and Allied Products	$81,491	$373,962	21.79%
29	Petroleum Refining	$33,357	$313,343	10.65%
331	Steel	$16,371	$103,297	15.85%
333/5	Aluminum	$6,032	$22,026	27.39%

Notes: 1. Implied Domestic Consumption = Value of Shipments + Imports - Exports.

2. Most recent available import data comes from 2002 and is denominated in $2004.

Source: 2002 U.S. Bureau of Census data and 2004 Annual Survey of Manufacturers

The estimated import penetration ratios for the six industries range from 5 percent to 27 percent for the year 2004. The estimated import penetration ratio for the entire U.S. manufacturing sector (SIC 20-39) is 25 percent. Considering that the United States is an open economy, EPA believes it is reasonable to assume that in industries with import penetration ratios close to or above 25- percent domestic firms most likely face stiff competition from foreign firms. Such competition is likely to curtail the market power enjoyed by domestic firms and, given the scenario that regulation-induced cost increases are not incurred by foreign producers, would limit the ability of domestic firms to pass-through such costs. Thus, based on the import penetration ratios presented in Table C3A3-4, firms in all of the industries except Aluminum appear to be in a position to pass-through to consumers a significant portion of compliance-related costs associated with the Phase III primary regulatory options. However, given the relatively low HHIs for these industries EPA believes that existing market competition among domestic firms most likely nullifies any favorable influence the lack of foreign competitors would have on increasing the market power of firms in this industry. EPA also highlights the above average import penetration ratio for the Aluminum industry which suggest low market power for firms in this industry. With respect to the Aluminum industry, this fact may offset – from a market power perspective – the finding that the industry was identified above as being moderately concentrated. Thus, even though there are relatively few domestic producers in the U.S. Aluminum industry, the notable presence of foreign producers in U.S. markets is likely to markedly reduce their the market power.

C3A3-2.3 Export Competition

The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. They would therefore have a lower CPT potential, all else being equal.

This analysis uses export dependence, defined as the percentage of shipments from an industry that is exported, to measure the degree to which a sector is exposed to competitive pressures abroad in export sales. Firms in industries with relatively high export dependence are expected to have lesser market power than those in industries with relatively low export dependence due to their relatively larger reliance on sales in export markets. Estimated export dependence ratios for the six industry sectors considered in this analysis are presented below in Table C3A3-5.

Table C3A3-5: Export Dependence by Industry ($2004)

SIC	Industry	Exports (Millions)	Value of Shipments (Millions)	Export Dependence
20	Food and Kindred Products	$28,046	$584,908	4.79%
26	Paper and Allied Products	$9,390	$81,988	11.45%
28	Chemicals and Allied Products	$65,211	$357,682	18.23%
29	Petroleum Refining	$8,098	$288,084	2.81%
331	Steel	$5,895	$92,821	6.35%
333/5	Aluminum	$2,344	$18,338	12.78%

Notes: 1. Most recent available export data comes from 2002 and is denominated in $2004.

Source: 2002 U.S. Bureau of Census data and 2004 Annual Survey of Manufacturers.

The estimated export dependence ratios for the six industries range from 5 percent to 18 percent. The estimated export dependence ratio for the entire U.S. manufacturing sector for the same year is 17 percent. Thus, for all but one industry (Chemicals), the export dependence ratio is below the average for the U.S. manufacturing sector. This finding implies that none of these industries are characterized by strong competitive pressures from foreign firms/markets, and thus market power and CPT potential are not diminished by export dependence. However, it is questionable whether this effect works as strongly in the opposite direction, i.e., firms in an industry will have a comparatively high cost pass-through potential simply because firms in that industry are not active in export markets. From the standpoint of firms gaining market power, EPA believes that the finding of low export dependence diminishes the importance of export competition as an indicator of market power. Thus, the other three indicators must be relied upon to gauge the amount of market power that firms in each industry are expected to hold. For example, even though the Petroleum Refining and Steel industries have extremely low export dependence, the low market concentration in these industries leads EPA to believe that market power held by individual firms is likely to be quite small. In addition, as discussed later in this memo, recent trends in the Steel industry provide good reason to believe that firms in this industry are unlikely to be able to pass through a notable portion of regulation-induced cost increases given the current business environment they face.

C3A3-2.4 Long-Term Industry Growth

An industry's competitiveness and the ability of firms to engage in price competition are likely to differ between declining and growing industries. Most studies have found that recent growth in revenue is positively related to profitability (Waldman & Jensen, 1997), which suggests a greater ability to recover costs fully.

To examine trends in long-term growth for each of the six industry sectors considered in this analysis, EPA estimated the average annual growth rate in the value of shipments between 1989 and 2004 for each industry using data available from the U.S. Bureau of Census[2]. EPA expects firms in sectors with higher growth rates to be better positioned to pass through compliance costs rather than being forced to absorb such cost increases in order to retain market share and revenue. The results of this analysis are presented in Table C3A3-6.

[2] The period from 1989 to 1998 represents the most recent ten-year period that includes data consistent with the survey period for the Detailed Industry Questionnaire (1996-1998).

Table C3A3-6: Average Annual Growth Rates by Industry

SIC	Industry	Average Annual Growth Rate in Value of Shipments (1989 to 2004)
20	Food and Kindred Products	1.0%
26	Paper and Allied Products	-2.0%
28	Chemicals and Allied Products	1.0%
29	Petroleum and Coal Products	3.1%
331	Steel	0.3%
333/5	Aluminum	-2.6%

Source: U.S. Bureau of Census data.

Table C3A3-6 shows that of the six industries specifically considered for this analysis, two industries experienced negative growth over the 1989 to 2004 time period and another experienced only marginal growth. The Petroleum Refining industry experienced the largest growth, displaying an average annual growth rate of 3.1 percent. In the absence of strong growth performance during the analysis period for all six industries, it is unlikely that firms in any of these industries possess significant market power based on growing demand for their products. In effect, the long-term growth performance of all six industries does not support a conclusion that firms in these industries would be in a strong position to pass on a significant portion of their compliance costs.

C3A3-2.5 Conclusions

Given that less than 35 percent of the total value of shipments in each of the six industries considered in this analysis is estimated to be subject to regulation under the regulatory analysis options, and the likelihood that these percentages represent upper bound estimates, the likelihood that firms incurring such costs would be able to pass through to consumers a material portion of 316(b) compliance costs is small. To validate this hypothesis, EPA undertook the market structure analysis presented in the previous section. In general, the weight of evidence from the market structure analysis suggests that firms in all six industries are unlikely to possess significant amounts of market power, thereby lending support to EPA's hypothesis that most firms would not be in a position to pass-through a significant portion of compliance costs.

The analysis of individual indicators under the market structure analysis did reveal a few exceptions to the general finding of low market power in all industries. However, considering the combined impact of all four indicators of market power together with information on recent economic trends in these industries suggests that on the whole, firms in each of the six industries hold relatively low market power and CPT potential. For example, the estimated HHI for the Aluminum industry indicated that this sector is moderately concentrated, which would potentially allow firms in this industry to pass through a significant portion of their compliance-related costs. In contrast, however, the market structure analysis also found that the domestic Aluminum industry witnessed a sustained decline in production during the 1990s and also faces stiff competition from foreign producers in its U.S. markets. As discussed in the profile of this industry, in the early 1990s the domestic Aluminum industry was affected by reduced U.S. demand and the dissolution of the Soviet Union, which resulted in dramatic increases in Russian exports of aluminum. The recovery that followed was subsequently affected by the economic crises in Asian markets in the second-half of the 1990s, which along with growing Russian exports, again resulted in a period of oversupply. Demand for aluminum industry products declined again in 2000 through 2002, reflecting weakness in both the U.S. and world economies, and again resulted in oversupply and declining financial performance. These trends, which are reflected in the negative average annual growth rate and high import penetration for the domestic Aluminum industry, suggest that domestic firms in this industry hold relatively low market power and are not in a position to pass through significant portions of their compliance-related cost increases. Overall, the balance of the argument in favor of and against high cost pass-through in the Aluminum

industry rests with the indicators that argue against it; the lack of domestic competition in the industry is more than offset by the existence of stiff competition from foreign producers and the general decline witnessed by the domestic industry. Similarly, in the case of all other exceptions found in the market structure analysis, the weight of evidence – when all four indicators of market power are considered together – rests with the indicators that suggest low market power and CPT potential.

Based on the findings of the market structure analysis, EPA decided to assume a zero CPT rate for all six industries in the analysis of Phase III impacts. EPA believes that this assumption is reasonable given the results of the market structure analysis and is definitely superior to using industry-wide CPT rates. In addition, EPA notes that by assuming a CPT rate of zero for all industries, the analysis of Phase III impacts is less likely to underestimate facility impacts in that the analysis assumes that facilities would incur one hundred percent of compliance costs. Thus, whereas an overstated CPT rate may erroneously underestimate impacts for facilities incurring compliance-related cost increases, the use of a CPT rate of zero errs on the side of caution, thus potentially overstating impacts to affected facilities.

REFERENCES

Ashenfelter, Orley; David Ashmore; Jonathan B. Baker; and Signe-Mary McKernan. (1998), "Identifying the Firm-Specific Cost Pass-Through Rate," FTC Working Paper No. 217, January.

McGraw-Hill (1999), U.S. Industry and Trade Outlook '99. McGraw-Hill Companies.

Waldman, Don E. and Elizabeth J. Jensen (1997), Industrial Organization: Theory and Practice. Addison-Wesley.

U.S. Department of Commerce (U.S. DOC). 1989, 1992, 1997, and 2002. Bureau of the Census. *Census of Manufactures*.

U.S. Department of Commerce (U.S. DOC). 1988-1991, 1993-1996, 1998, and 2004. Bureau of the Census. *Annual Survey of Manufactures.*

U.S. EPA, Office of Water (2003), Effluent Limitations Guidelines and New Source Performance Standards for the Metal Products and Machinery Point Source Category.

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Appendix C3A4: Adjusting Baseline Facility Cash Flow

INTRODUCTION

This appendix documents EPA's development and analysis of adjustment factors for the 316(b) Phase III manufacturing industries. This analysis presents an updated version of the analysis conducted for the Proposed Section 316(b) Rule for Phase III Facilities. The analysis incorporates two additional years of data, for 2004 and 2005, which reflect the time span between the Proposed and Final Rules. In addition to these extra years of data, EPA also identified and added to the analysis two business sectors – Beverages and Food Processing – that were not previously included in the Primary Manufacturing Industries. Also, the set of firms included in this analysis differs from that used for the Proposed Rule due to business structural changes at the firm level, such as mergers, acquisitions, or bankruptcies, that occurred between the Proposed and Final Rule.

CHAPTER CONTENTS

To support its analysis of the potential economic impact of the 316(b) Phase III regulation, EPA collected economic/ financial data for the three years 1996-1998 from a sample of facilities in the manufacturing industries primarily expected to have been subject to the regulation. These facility economic/financial data are used to gauge the potential economic/financial impact of regulatory compliance: the facilities and their financial data serve as models for testing the financial effect of regulatory alternatives. For this analysis to provide valid insight into the ability of the affected industries to meet regulatory requirements without material adverse impact, the sample facility data should reflect business conditions that might be reasonably anticipated at the time of compliance.

In performing its impact analyses using these data, EPA was concerned in two ways that the facility survey data might yield erroneous conclusions.

- First, knowing that U.S. business conditions during the latter half of the 1990s were cyclically strong, EPA was concerned that business conditions during the 316(b) survey period (1996-1998) might be abnormally favorable for some of the six Primary Manufacturing Industries sectors covered in the Phase III analysis. In this case, the business performance and valuation measures, which are based on survey data, used to assess the burden of regulatory compliance costs might overstate industry's ability to bear these costs and therefore understate the potential impact of the regulatory analysis options considered for the Phase III regulation.
- Second, apart from the issue of short-term deviation from trend caused by a cyclically strong economy, EPA was also aware from its profile analyses that some of the industries might be experiencing a longer-term trend of deteriorating performance. Using sample facility data that don't reflect such possible trends

would again potentially overstate industry's ability to bear compliance costs and therefore understate the potential impact of the regulatory analysis options considered for the Phase III regulation.

Given these concerns, EPA analyzed for the manufacturing industries (1) whether business conditions were "abnormally favorable" during the survey period and (2) whether business performance over a longer term might be following a non-neutral – in particular, negative – trend. This analysis validated EPA's concerns that use of unadjusted survey data might yield erroneous conclusions from the facility impact analysis. From the findings of this analysis, EPA developed a basis for adjusting survey financial data to account for these effects: short-term deviation from trend and non-neutral long-term trend.

C3A4-1 BACKGROUND: REVIEW OF OVERALL BUSINESS CONDITIONS

As background for its analysis, EPA reviewed general economic data over the past several years to assess whether business conditions during the survey data collection period of 1996-1998 might be generally perceived as abnormally favorable for the U.S. economy, as a whole. This review confirmed the concern that business conditions in 1996-1998 were generally more favorable than the average of conditions over a longer time period.

Figure C3A4-1 - Figure C3A4-3 present annual and average values for the period 1985-2005 for three measures of general economic performance:

Figure C3A4-1: Growth in Real Domestic Product, 1985-2005. This exhibit, based on data published by the Department of Commerce, Bureau of Economic Analysis, focuses on the growth trend of the broad economy, including all sectors. Growth stronger than the average trend would indicate a strongly expanding economy and would generally indicate strong business performance.

Figure C3A4-2: Capacity Utilization in Manufacturing Industries, 1985-2005. This exhibit, based on U.S. Federal Reserve Bank data, reports the rate of capital utilization for all manufacturing sectors. All else equal, when the rate of capital utilization is higher than the average trend, demand for manufacturing output is strong and manufacturing business performance would be generally strong.

Figure C3A4-3: Growth in Industrial Production, 1985-2005. Like the preceding exhibit, this exhibit is based on data published by the U.S. Federal Reserve Bank and reports the rate of growth in the Federal Reserve's Industrial Production Index, which is a measure of the real output of the manufacturing industries. Growth stronger than the average trend would indicate a strong expansion in the manufacturing industries and would generally indicate strong manufacturing business performance.

In each case, the annual values in the period 1996-1998 are above the average trend line, indicating stronger overall economic performance in the survey data collection period than for the longer period presented in the charts. The data show a consistent year-by-year pattern over the 1996-1998 period:

- 1996: The values for 1996 are above the longer-term average trend but are the lower than the values for 1997, indicating that manufacturing economy was in an upswing from 1996 to 1997.
- 1997: The values for 1997 are the highest of the values for the three years.
- 1998: The values for 1998 are all lower than the values for 1997 and generally appear to be the beginning of the downswing in economic performance that occurred in the latter part of the 1990s. In the case of *industrial production* and *capacity utilization in manufacturing industries*, 1997 is the peak performance year over the 1990s decade and is followed by a decline in 1998 and subsequent years leading to the recession period in 2001. In the case of *GDP growth*, the fall-off in 1998 (from 1997) is followed by one more year of strong growth in 1999. Afterwards, GDP growth turns sharply lower during 2000, the recession year of 2001, and subsequent years. As is widely acknowledged in general business conditions

analyses, economic weakness during the 2000-2003 period began earlier in the manufacturing industries than in the general economy.

Figure C3A4-1: Growth in Real Domestic Product, 1985-2005

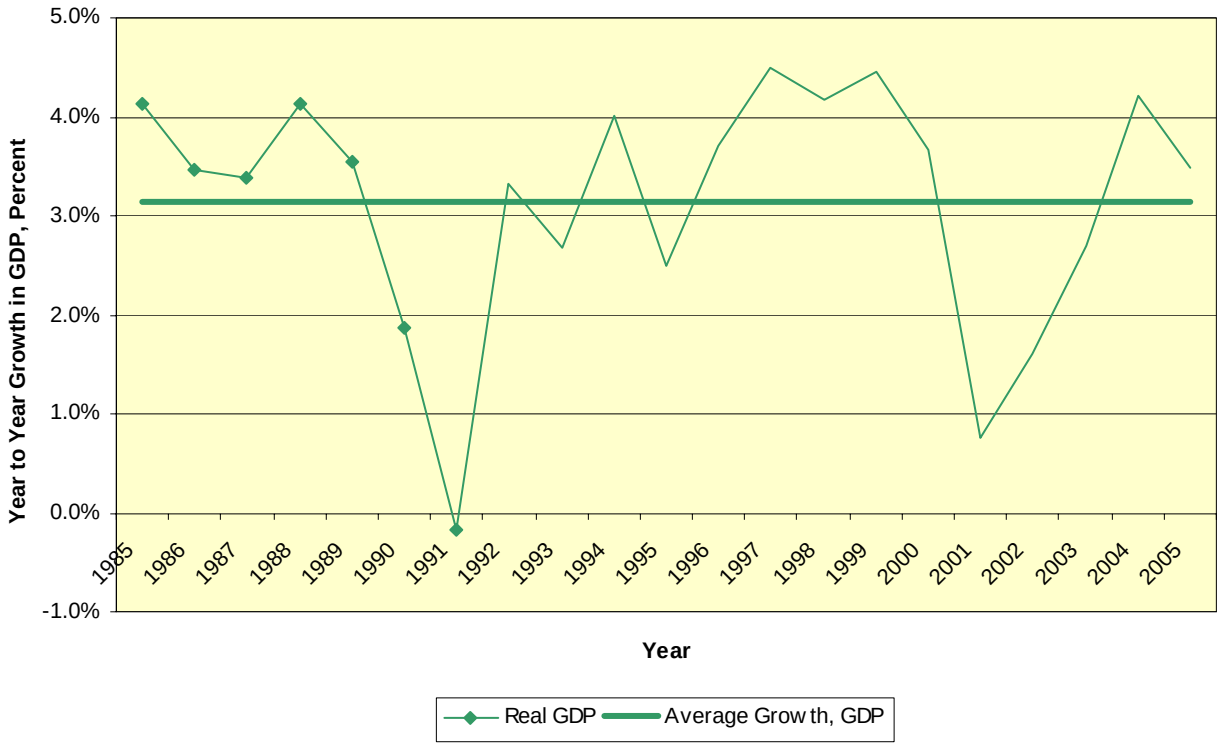


Figure C3A4-2: Capacity Utilization in Manufacturing Industries, 1985-2005

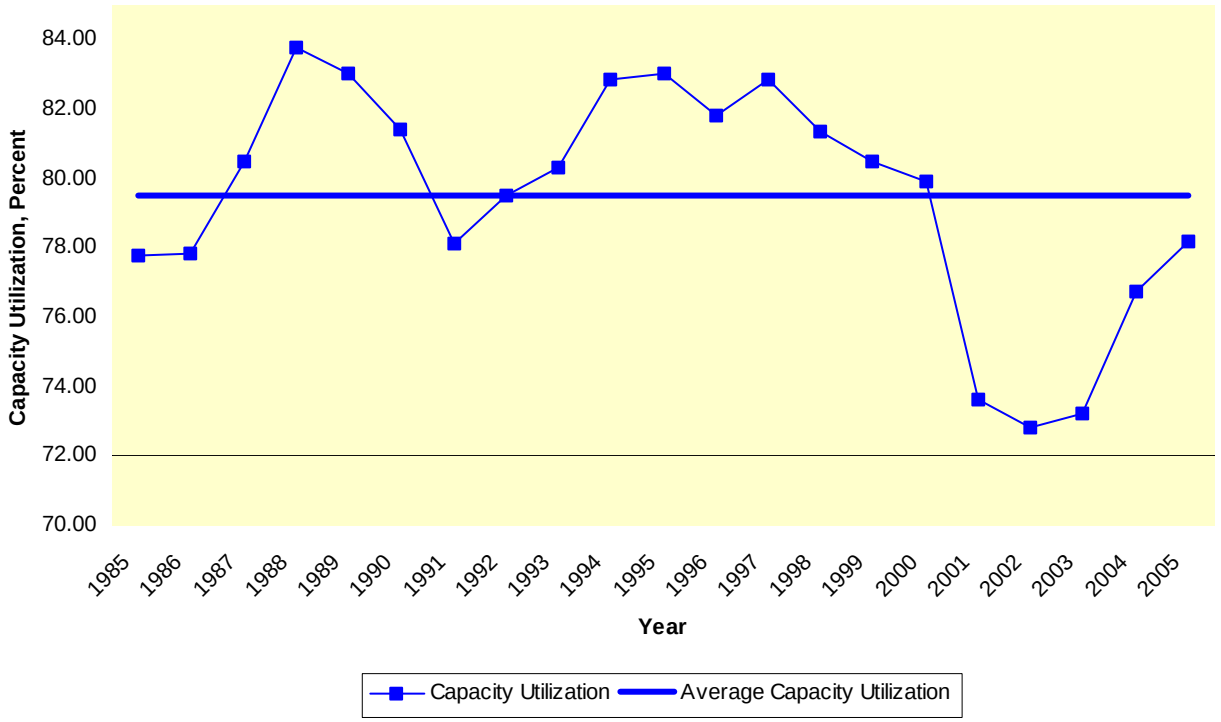
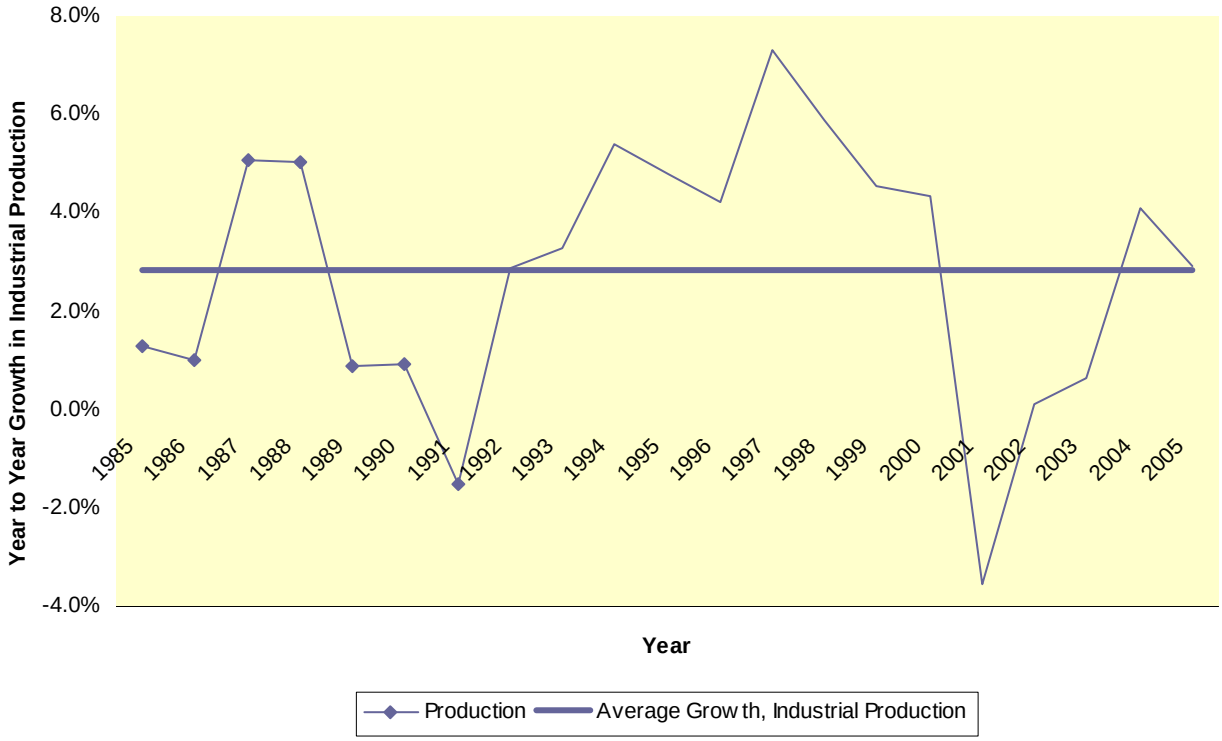


Figure C3A4-3: Growth in Industrial Production, 1985-2005



C3A4-2 FRAMING AND EXECUTING THE ANALYSIS

The objective of this analysis was to understand (1) the extent to which the business conditions and financial performance of the Phase III manufacturing industries reflected cyclically favorable conditions during the 316(b) survey period and (2) whether these industries show a non-neutral longer term trend in economic/financial performance – e.g., deterioration in performance over time independent of cyclical variation. If either or both of these conditions were found, then the data used to test for these conditions would be used to adjust relevant survey data items to a level consistent with normal business conditions and/or the longer term of performance.

To meet these objectives, EPA set, as its overall approach, identification and analysis of a financial performance data series for the 316(b) manufacturing industries. This data series would be used to test whether financial performance at the time of the 316(b) survey differed from the longer term trend. At the outset, EPA recognized that, in all likelihood, such a data series would not report financial performance at the level of the individual facility – which is the unit of analysis for the 316(b) facility impact analysis (see *Chapter C3: Economic Impact Analysis for Manufacturers*) – but would report performance for individual firms or for some industry aggregate. As a result, EPA would need to infer the trend of performance in facility financial performance from firm- or industry-level performance and, in turn, apply adjustments, if needed, to facility financial data based on analysis of the firm- or industry-level performance. Although the use of firm- or industry-level information for adjusting facility data necessarily represents a limitation in this analysis, EPA judges that the effort is warranted given: (1) the potential for the facility impact analysis to yield erroneous findings if it is based on data that reflect cyclically favorable conditions and (2) the absence of facility data to support a more precise analysis.

Key steps in framing and executing the analysis are described below.

C3A4-2.1 Identifying the Financial Data Concept to Be Analyzed

EPA determined that the financial data concept to be analyzed should be equivalent, or close in concept, to the business performance and valuation metrics used in the Phase III impact analysis. For the facility impact analysis, the key financial metric is after-tax, pre-interest cash flow, calculated as income before interest, depreciation and amortization, and adjusted to be on an after-tax basis. In the facility impact analysis, this metric is used to calculate the business value of a sample facility, on both a baseline – i.e., before imposition of compliance costs – and post-compliance basis. Using this, or a closely related, measure in the analysis of financial performance at the time of the facility survey would therefore support a direct test of whether and how the survey financial data – *to be subsequently used in the facility impact analysis* – might reflect cyclically favorable conditions or differ from the longer term trend of financial performance in an analysis. If either or both of these conditions were found, the data would also readily support development of a necessary adjustment to offset these potential biases in the survey data.

EPA recognized that the after-tax, pre-interest cash flow measure used in the facility impact analysis would very likely not be directly available from financial datasets that might be practically used in this analysis. However, reasonable surrogates for this measure that would likely be available include: after-tax cash flow from operations (net income plus depreciation and amortization); earnings before interest, taxes, depreciation and amortization (EBITDA); net income; and earnings before interest and taxes (EBIT).

C3A4-2.2 Selecting Appropriate Data

Other key requirements of the data to be used in the analysis include:

- The financial data need to be a time series, preferably annual, over a sufficiently long period (and including the survey period) to allow testing of (1) whether survey period business conditions were

cyclically favorable; and (2) whether financial performance in the industries exhibits a longer-term, non-neutral trend.

- The data need to be at a sufficient level of industry resolution to account for variations in business conditions and performance not only across the six manufacturing sectors but also within certain sectors, where there may be substantial variation in performance by important segments. Of particular importance is the ability to segment the chemicals sector into its segments such as basic chemicals, plastic materials and resins, and pharmaceuticals.

Based on these requirements, EPA selected the *Value Line Investment Survey* firm financial dataset as the data source for this analysis. The *Value Line* dataset meets analysis requirements as follows:

- The general company dataset of the Value Line Investment Survey (VL) reports summary financial information for nearly all publicly traded companies in the United States for a 14-year period, 1992-2005, which includes the 1996-1998 Phase III survey period.[1] The individual years in this 14-year period may be categorized in three broad categories of economic performance: (1) eight years of "normal" economic performance - 1992-1996, 2000, and 2004-2005; (2) three years of "subnormal" economic performance - 2001-2003; and (3) three years of years of "supra-normal" economic performance - 1997-1999. The 14-year period thus captures reasonable diversity of business conditions before, after, and during the survey period. By including financial results for full-year 2005, the dataset also comes as close as possible to the present (2006) and thus would provide a basis for adjusting facility baseline financial data to essentially current conditions.
- VL identifies and groups companies in a business content classification scheme that approximates 3-digit SIC or 4-digit NAICS classifications. These business classifications support identification of firms within the Phase III manufacturing industries at a level of sector detail sufficient for this analysis. Because (1) the dataset is by company instead of by aggregate groups and (2) the business classifications are defined by practical business content instead of in a rigid SIC or NAICS classification scheme, the VL dataset avoids the challenge confronted elsewhere in the Phase III analysis of the change in economic classification schemes and resulting inconsistency of aggregated data series over the year of the change.[2]
- The VL dataset reports key accounting items that will readily support calculation of a financial metric, after-tax cash flow, that very nearly matches the principal financial metric (after-tax, pre-interest cash flow) underlying the Phase III facility impact analysis.

EPA recognizes that the VL dataset, by definition, excludes firms that are not publicly traded. The studied industries include private, non-publicly traded firms, for which no comparable database of financial information is available. As a result, use of the VL dataset in this analysis could yield findings that are not representative of the overall industry, including the non-publicly traded firms, to the extent that non-public firms in the studied industries faced materially different business conditions or achieved materially different business performance than publicly traded firms in the same industries. Overall, EPA expects that the business conditions faced by, and performance achieved by, non-public firms in the studied industries are not likely to have been materially different from those of the public firms. As a result, EPA judges that use of the VL dataset for this analysis is appropriate and likely to yield reasonably representative findings for to overall industries, including publicly traded and non-traded firms.

[1] At any time, VL reports only 10 years of data for firms in its data serves. The dataset used for this analysis reflects two separate VL datasets that were combined to provide data for the 14 years of analysis.

[2] As described in the industry profiles, the change from SIC-based to NAICS-based reporting of economic data by federal government and other data sources at around 1997/98 created difficulties in aligning and ensuring consistency of time series data that are organized within these frameworks.

In addition to the VL dataset, EPA considered a range of other data sources, including:

- Economic and business performance data published by the Federal Reserve, in particular the *Federal Reserve Economic Data* (*FRED II*) data series compiled by the Federal Reserve Bank of St. Louis.
- The Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (QFR) published by the U.S. Census Bureau.
- Data series from the Bureau of Economic Analysis and data specifically available in *The Survey of Current Business*.

These data sources were each deficient for the analysis in some material way, including:

- Data being too aggregate to provide the industry sector and sub-sector level of resolution needed to assess business conditions and trends within the Phase III manufacturing sectors.
- Data items being descriptive of general economic/financial conditions in an industry but not being sufficiently close to the financial performance concept needed for the analysis.
- Data being reported in inconsistent economic classification frameworks over the desired analysis period. In addition to the problem of the SIC/NAICS break itself, data are sometimes reported at different levels of resolution before and after the SIC/NAICS break – e.g., at a 4-digit or finer level in the NAICS framework but only 2-digit level of resolution in the SIC framework.
- Data not being readily available in an electronic format needed for efficient performance of the analysis.

C3A4-2.3 Selecting Industry Groups and Firms for Use in the Analysis

As discussed above, VL organizes firms by industry groups, which, in most instances, approximate 3-digit SIC or 4-digit NAICS classifications. From review of the VL industry groups and the 316(b) Phase III manufacturing industries, EPA selected 12 VL industry groups and the firms within these industry groups as candidates for this analysis. Following review of the firms within these industry groups, EPA retained 87 firms for use in this analysis. Key considerations in selecting the firms are as follows:

- The selected VL industry groups are those that most closely correspond to the 316(b) Phase III manufacturing industries.
- Within the industry groups, only those firms whose business operations reasonably match the profile of business activities of the 316(b) Phase III manufacturing industries were considered candidates for the analysis. In some industry groups, a substantial number of firms included in the VL industry groups were excluded from the analysis:
  - VL includes Aluminum industry firms in its Metals and Mining industry group. However, most firms in this VL industry group are not involved in the Aluminum industry and thus were excluded from the analysis dataset.
  - In the Paper and Forest Products group, EPA retained only those firms engaged in pulp mill, paper mill and/or paper and paperboard manufacturing operations. Firms engaged only in timber and lumber production were excluded from the analysis.
- EPA retained only those firms that are based in the United States or Canada, and for which financial information is available in U.S. dollars.
- After defining an initial set of firms according to these procedures and criteria, EPA retained only those firms for which a full 14 years of data were available.

- Finally, EPA excluded firms that had undergone a significant restructuring – e.g., a merger or acquisition – which materially disrupted the continuity of financial reporting. Since the analysis to be performed would start from a time series of cash flow, measured in absolute dollars – as opposed, for example, to a time series of profit percentage values – including data from firms whose continuity of financial reporting had been affected by merger or acquisition activity would tend to bias the analysis. In particular, firms engaging in mergers and acquisitions that were accounted for on a purchase-accounting basis instead of a pooling-of-interests basis, would be likely to show sudden jumps in revenue, net income, and cash flow. These sudden jumps would bias the analysis by suggesting greater business growth than could be reasonably be achieved by the firm or facilities within the firm on a simple, organic growth basis. Similarly, large contractions in business volume resulting from divestiture or termination of a line of business would bias the analysis in the downward direction. To apply this restriction, EPA examined the year-to-year revenue profiles for all firms over the 14-year analysis period. EPA researched annual reports and other financial reporting for those firms showing large increases or decreases from year to year and excluded those firms where a material business event was found that would otherwise disrupt the continuity of financial reporting. *EPA followed this rule with only two exceptions. First, EPA kept firms in the analysis when the only business event/disruption of financial reporting occurred in the last year of financial reporting – 2005. EPA kept these firms in the analysis but excluded the final year of data from the analysis. Second, in its research on one firm in the paper industry, EPA found that the firm had recorded an unusual, non-recurring stock gain transaction in 1995 that caused revenue and net income to increase abnormally in that year. Although the VL net income item used in the analysis generally excluded income from unusual, non-recurring events, the VL data series did not exclude income from this transaction. Because EPA had already set aside a substantial number of firms from the paper industry, EPA decided to keep this firm in the analysis but exclude the single year of unusual financial performance from the analysis dataset.*[3] Applying this restriction substantially reduced the number of firms that were included in the analysis dataset. In particular, for the Aluminum industry, all of the firms in the initial VL dataset were found to have some significant discontinuity of financial reporting.[4]

EPA organized the 87 firms selected for the analysis into eight 316(b) Industry Groups. Table C3A4-1, below, lists the VL industry groups, the 316(b) Phase III manufacturing industries and/or industry segments (as discussed in the industry profiles) to which the VL industry groups approximately correspond, the 316(b) Industry Groups for this analysis, and the number of VL firms used in the analysis for each industry group.

[3] EPA considered removing the non-recurring item from the income statement but, because of uncertainty about the correct tax adjustment, rejected this approach.

[4] Because no Aluminum industry firms could be retained in the analysis, EPA was unable to develop an after-tax cash flow adjustment factor for facilities in this industry. EPA considered adjusting the pre-event financial statements for the Aluminum industry firms – in effect, converting the purchase-accounting treatment of transactions to a pooling basis – but rejected this approach as requiring too many judgments. However, EPA assessed the potential effect of applying a cash flow adjustment factor to facilities in this industry by testing hypothetical factor values that substantially exceeded the adjustments – both for decrease and increase – estimated and applied for the facilities in other industries. This analysis found that the facility impact analysis results for the Aluminum industry did not change over this wide range of hypothesized cash flow adjustment factors.

Table C3A4-1: Value Line Industry Groups Selected for Analysis

Value Line Industry Group	316(b) Phase III Manufacturing Industry	316(b) Industry Segment(s) (as relevant)	316(b) Phase III Industry Group for Analysis	Number of Firms Used in Analysis
Metals and Mining	Aluminum		Aluminum	None
Paper and Forest Products	Pulp and Paper Mills		Pulp and Paper Mills	6
Chemical (basic)	Chemicals Industry	Organic Chemicals Inorganic Chemicals	Industrial Chemicals	15
Chemical (diversified)	Chemicals Industry	Organic Chemicals Inorganic Chemicals		
Chemical (specialty)	Chemicals Industry	Plastics Material and Resins	Plastics Material and Resins	15
Biotechnology	Chemicals Industry	Pharmaceuticals	Pharmaceuticals	4
Drug	Chemicals Industry	Pharmaceuticals		
Petroleum (integrated)	Petroleum Refining		Petroleum Refining	6
Steel (General)	Steel		Steel	14
Steel (Integrated)	Steel			
Beverages	Food	Beverages	Beverages	7
Food Processing		Food Processing	Food Processing	20

Source: Value Line Investment Survey, 2005 and U.S. EPA analysis, 2006.

C3A4-2.4 Structuring the Analysis

The general objectives of this analysis were to:

- Test, by 316(b) Industry Group, whether after-tax cash flow performance deviated, during the 316(b) survey data collection years, from *normal* performance over the 14-year analysis period.
- Test, by 316(b) Industry Group, whether after-tax cash flow performance might be following a non-neutral trend over the 14-year analysis period.
- Given a finding that either or both of these conditions are true, to develop an adjustment to baseline after-tax cash flow to account for these effects, and, to yield after-tax cash flow values for the facility impact analysis that more closely reflect *current* financial performance in the 316(b) Phase III industries.

The overall approach to the analysis was to analyze, for each industry group, the trend of financial performance over the 14-year analysis period and to assess where the industry's financial performance lay relative to that trend during the 316(b) survey data collection years of 1996-1998. For each industry group, EPA used as analysis observations an index of constant dollar-adjusted after-tax cash flow for each of the firms in the industry group. To analyze the trend, EPA calculated a simple regression of the index values against time. The estimated regression relationship provided a direct measure of the real (i.e., inflation-adjusted) trend of financial performance for each industry group. The 1996-1998 average of index values for each industry group were then compared with the trend values predicted from the estimated regression coefficients – both for the 1996-1998 years and for the end of the analysis period – to determine the extent to which 1996-1998 survey values should be adjusted to reflect (1) the deviation from trend at 1996-1998 and (2) the trend from 1996-1998 to the end of the analysis period.

Specific steps in this analysis were as follows:

- Calculate After-Tax Cash Flow (ATCF) as Net Profit *plus* Depreciation for each firm by year. As discussed above, EPA sought to analyze ATCF as a close approximation of the key financial metric –

after-tax, pre-interest cash flow – used in the facility impact analysis. EPA calculated ATCF on a year-by-year basis for each firm in the analysis dataset as the sum of the VL data items: Net Profit and Depreciation. In the VL data framework, Net Profit is defined as net income from continuing operations and excluding non-recurring items. Depreciation includes both non-cash items, depreciation and amortization.

- Adjust ATCF to constant dollar values in 2005, using the GDP deflator. To eliminate the effects of inflation in analyzing the trend of financial performance, EPA deflated the ATCF values for all firms to the end of 2005 using the GDP Deflator series published by the Department of Commerce, Bureau of Economic Analysis.
- Calculate an index of each company's ATCF values by year using, as an index numerator, the average ATCF value for the company over the 14-year period. As summarized above, the overall approach of the analysis involved a regression analysis of the trend of ATCF values for the firms in an industry group over the 14-year analysis period. To allow individual firms' ATCF values to be combined in a single regression requires eliminating the scale effect of the different sizes of firms. For this reason, the inflation-adjusted ATCF values for each firm were normalized to an index series by dividing the yearly values by the average of values for each firm over the 14-year period. EPA used the 14-year average of values for this index calculation instead of the value for a single year to prevent anomalously large swings in the index series when the ATCF value for the year selected as the base year for the index calculation was very small relative to other values in the 14-year series. In addition, in calculating the index values for the 14-year series, EPA first removed any negative values from the series for each firm by adding to each value in the firm's 14-year series, the absolute value of the most negative value for the firm plus one. This adjustment has the effect of "vertically" shifting the ATCF values for a firm so that all values are positive while retaining the mathematical "shape" of the series for the trend analysis. This adjustment was necessary to prevent the undesirable inversion of the index trend that would occur if a negative index numerator is combined with a positive series values in calculating the index series.
- Regress ATCF index values against year by industry group to calculate the time trend of constant dollar ATCF over the period 1992-2005. The preceding calculations yield a constant dollar series of ATCF indexed to one and with an average value of one over the 14-year analysis period. To calculate the trend indicated by these index ATCF values, EPA estimated a weighted linear regression of the index ATCF values against year by industry group. These regressions were performed on a revenue-weighted basis – i.e., each ATCF value was weighted by the firm's revenue value for the year – so that each firm's *individual* ATCF trend carries a weight in proportion to its revenue in estimating the trend relationship. As a result, the estimated trend relationship reflects a revenue-weighted average of the ATCF trends of the individual firms, instead of an arithmetic average, which would overweight the presence of smaller firms in estimating the trend relationship. The estimated ATCF index coefficient from the regression for each industry indicates the trend in constant dollar ATCF over the analysis period: a negative coefficient indicates declining constant dollar ATCF over the analysis period; a positive coefficient indicates growing constant dollar ATCF over the analysis period.[5]
- Calculate the predicted trend of ATCF index values for each industry group. Used together, the estimated ATCF index coefficient and regression intercept yield a predicted trend line of ATCF index values for the 14-year period, for each industry group analyzed. The actual ATCF index values for an industry group can then be compared with *predicted* trend line to assess whether the ATCF values during the 1996-1998

[5] In addition to testing a simple linear model of index ATCF against time, EPA also used a logarithm-adjusted series of the ATCF values to test for an exponential trend in ATCF. The log model provided no improvement in the estimated regression relationships. As a result, EPA used the coefficients estimated from the linear model for its analysis of the ATCF trend.

survey data collection period deviate from the trend. The predicted trend line also indicates *where* the ATCF index values would be at the end of the analysis period if the ATCF index values followed the predicted trend.

- Calculate the average of *actual* ATCF index values by industry group for the 1996-1998 period. The average of actual ATCF values for the 1996-1998 period is compared with the predicted trend values to assess the extent to which the actual ATCF index values deviate from trend and to provide a basis for estimating the adjustment needed to bring the ATCF values to the trend, or to the predicted trend value at the end of the analysis period. These values were calculated by, first, averaging ATCF index values over the firms in an industry group using firm revenues as weights, and second, averaging the 1996, 1997, and 1998 ATCF index values for each industry group.

C3A4-3 SUMMARY OF FINDINGS

Table C3A4-2, following page, summarizes key results from the analyses outlined above. Items reported in the table are as follows:

- Estimated Trend: the revenue-weighted average of annual change in ATCF index values for firms in the industry group over the analysis period, 1992-2005. This value is the estimated coefficient of ATCF index against time from the simple linear regression, as described above. Because the trend is estimated from an index series with an average value of one over the analysis period, the estimated trend may also be interpreted as equal approximately to the annual percent change in ATCF index. A negative estimated trend value indicates that ATCF index values decline, on average, over the analysis period; a positive estimated trend value indicates that ATCF index values increase, on average, over the analysis period.
- Average of ATCF Index Values at 1996-1998: the revenue-weighted average of *actual* ATCF index values for firms in the industry analysis set over the 1996-1998 period. The values in this column are compared with values in the next two columns, respectively, to assess (1) the extent to which financial performance during the 1996-1998 survey data period deviated from the analysis period trend *at 1996-1998* and (2) the overall change in financial performance from the 1996-1998 survey data period to the end of the analysis period resulting from the combination of deviation from analysis period trend and the trend, itself (see following paragraphs for further discussion).
- Average of Predicted Trend Values at 1996-1998: the average of *predicted* ATCF index values over the 1996-1998 survey data period *as predicted from the estimated regression terms.* If ATCF performance for an individual firm or industry matched the industry trend over time, the actual ATCF index values at 1996-1998 *would* equal this value. Material deviation of the *actual* ATCF index values from this value suggests, for an industry, that ATCF performance during the 1996-1998 survey data period was: (1) abnormally favorable, if the *actual* ATCF index values exceed the average of predicted values, or (2) abnormally unfavorable, if the *actual* ATCF index values are less than the average of predicted values.
- Predicted Trend Value at 2005: the ATCF index value at the end of the analysis period *as predicted from the estimated regression terms*. This value is the (statistically) expected value of ATCF index at 2005 for a firm or for the industry, based on the estimated trend relationship. Material deviation of this value from the Average of Predicted Trend Values at 1996-1998 indicates a general trend going forward from the 1996-1998 survey data period, which, apart from cyclical deviation, which would further affect ATCF performance for firms in the industry group. For an industry, if this value is *less than* the Average of Predicted Trend Values at 1996-1998, then financial performance, as indicated by ATCF index, generally deteriorated from 1996-1998 forward to 2005, the end of the analysis period. In addition to the cyclical deviation effect, this "trend" effect might also be taken into account in adjusting ATCF data calculated from the 316(b) survey responses. In this case, comparison of the average of *actual* ATCF index values

over the 1996-1998 survey data period with the Predicted Trend Value at 2005, would indicate the total potential adjustment, accounting for both the cyclical deviation and trend effects.

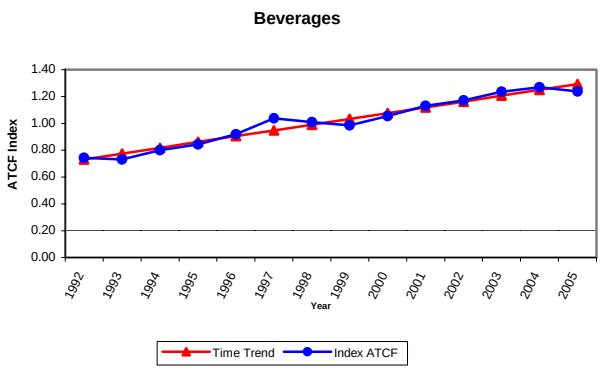
Table C3A4-2: Key Results from Analysis of After-Tax Cash Flow Trends by 316(b) Industry for 1992-2005

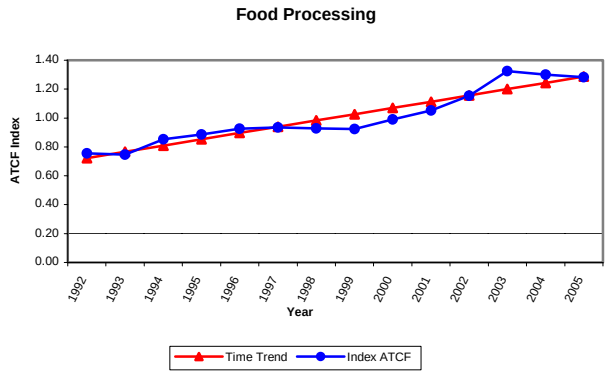
316(b) Phase III Industry Group	Estimated Trend	Average of ATCF Index Values at 1996-1998	Average of Predicted Trend Values at 1996-1998	Predicted Trend Value at 2005
Aluminum	Analysis not undertaken for the Aluminum industry			
Pulp and Paper Mills	0.0003	0.995	1.031	1.033
Industrial Chemicals	0.0282	1.042	0.977	1.203
Plastics Material and Resins	0.0302	1.012	0.968	1.209
Pharmaceuticals	0.0328	1.005	0.996	1.259
Petroleum Refining	0.0428	0.922	1.032	1.374
Steel	0.0112	1.237	1.035	1.125
Beverages	0.0431	0.988	0.947	1.292
Food Processing	0.0433	0.930	0.940	1.286

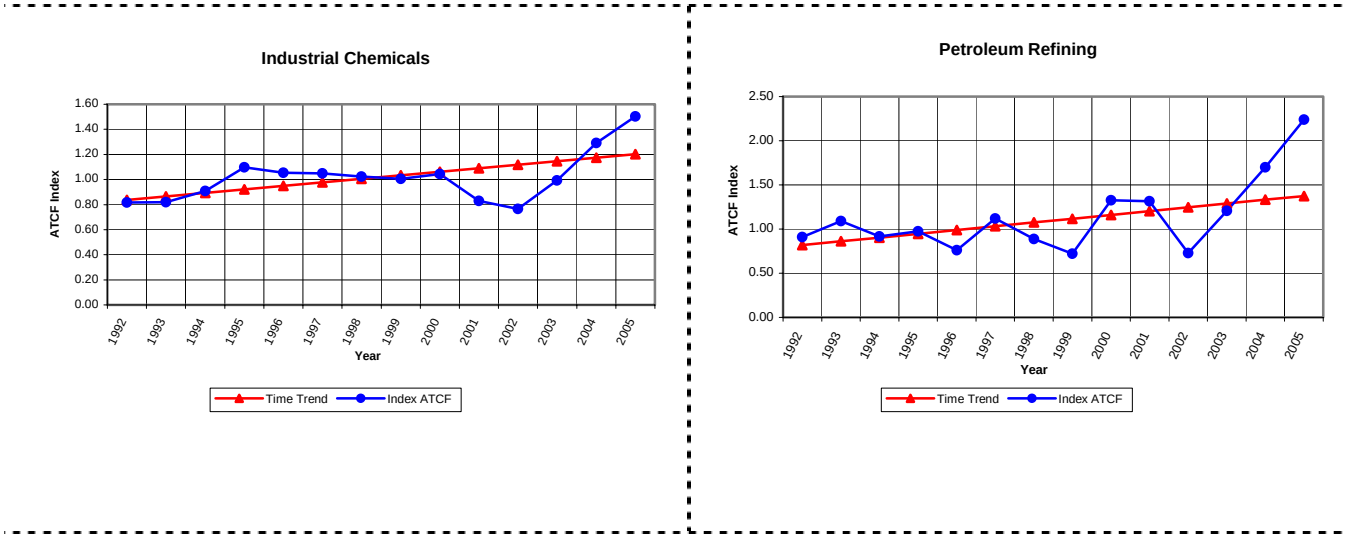
Source: U.S. EPA analysis, 2006.

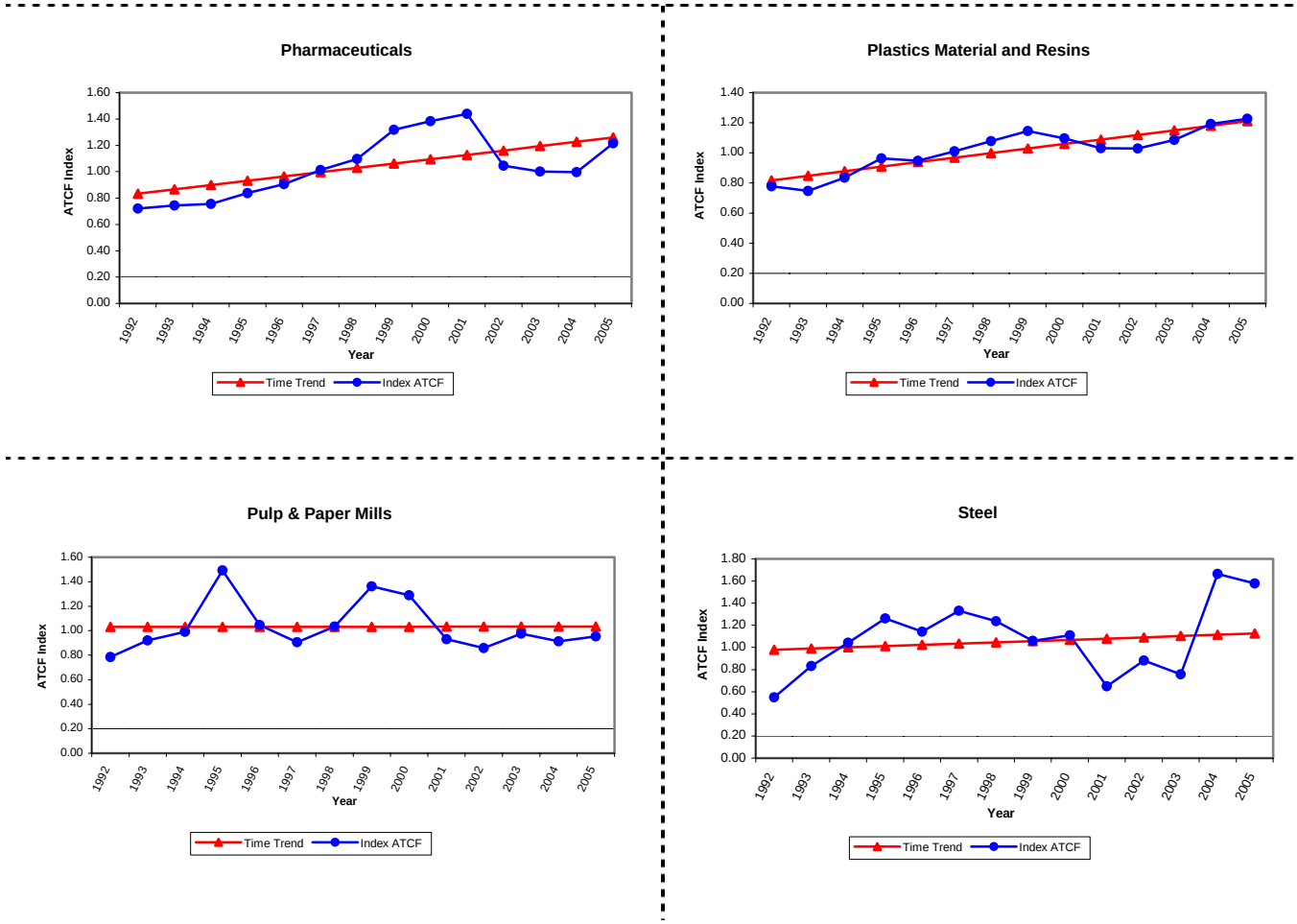
The following pages present charts, by industry group, of the yearly ATCF index values and the estimated predicted trend values over the analysis period.

Figure C3A4-4: ATCF Index vs. Trend






Industrial Chemicals
ATCF Index
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Time Trend
Index ATCF
Petroleum Refining
ATCF Index
2.50
2.00
1.50
1.00
0.50
0.00
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Time Trend
Index ATCF


Pharmaceuticals
ATCF Index
Year
Time Trend
Index ATCF
Plastics Material and Resins
ATCF Index
Year
Time Trend
Index ATCF
Pulp & Paper Mills
ATCF Index
Year
Time Trend
Index ATCF
Steel
ATCF Index
Year
Time Trend
Index ATCF

By industry, these results indicate the following:

- Pulp and Paper Mills. The analysis indicates a very slight annual increase, approximately 0.03 percent, in constant dollar ATCF over the analysis period, meaning financial performance improved slightly over this period. The analysis also indicates that the survey data collection years of 1996-1998 showed weaker performance than the predicted trend performance in those years. Specifically, the average actual ATCF index value at 1996-98 is 3.5 percent below the predicted ACTF trend value for those years. With slight positive growth in ATCF over the analysis period, the predicted ATCF index value at the end of the analysis period, 2005, increases slightly from the 1996-1998 period. As a result, the average actual ATCF index value at 1996-98 is approximately 3.7 percent below the predicted ACTF trend value in 2005.
- Industrial Chemicals. The analysis for the Industrial Chemicals segment of the Chemicals industry shows a moderate increase, approximately 2.8 percent, in constant dollar ATCF over the analysis period, meaning financial performance improved over this period. In contrast to the finding for the Pulp and Paper Mills industry, the analysis indicates that the Industry Chemicals segment achieved higher financial performance during the survey data collection years of 1996-1998 than the predicted trend performance in those years. Specifically, the average actual ATCF index value at 1996-98 is 6.6 percent above the predicted ACTF trend value for those years. However, with relatively strong positive growth in ATCF, the predicted ATCF index value at the end of the analysis period, 2005, increases sufficiently to reverse this relationship. As a result, the average actual ATCF index value at 1996-98 is approximately 13.4 percent *below* the predicted ACTF trend value in 2005.
- Plastics Material and Resins. This segment of the Chemicals industry also shows a moderate increase, 3.0 percent annually, in constant dollar ATCF over the analysis period. Based on this analysis, the Plastic Material and Resins segment, like the Industrial Chemicals segment, also achieved higher financial performance during the survey data collection years of 1996-1998 than the predicted trend performance in those years. Specifically, the average actual ATCF index value at 1996-98 is 4.6 percent above the predicted ACTF trend value for those years. Like the Industrial Chemicals segment, the Plastic Material and Resins segment exhibits relatively strong positive growth in ATCF and the predicted ATCF index value at the end of the analysis period, 2005, increases sufficiently to reverse this relationship. As a result, by 2005, the average actual ATCF index value at 1996-98 is 16.3 percent *below* the predicted ACTF trend value in 2005.
- Pharmaceuticals. This third segment of the Chemicals industry also shows a moderate increase, 3.3 percent annually, in constant dollar ATCF over the analysis period. Financial performance during the survey data collection years very nearly equaled the predicted ATCF index value: the average ATCF index value at 1996-98 is 0.9 percent above the predicted ACTF trend value for those years. Like the other two segments of the Chemicals industry, the Pharmaceuticals segment exhibits relatively strong positive growth in ATCF over the analysis period. As a result, by 2005, the average actual ATCF index value at 1996-98 is substantially *below* (20.2 percent) the predicted ACTF trend value in 2005.
- Petroleum Refining. The analysis indicates a strong increase, 4.3 percent annually, in constant dollar ATCF over the analysis period. The analysis also indicates that the Petroleum Refining industry achieved, on average, much weaker financial performance during the survey data collection years than the predicted trend performance in those years: the average ATCF index value for 1996-1998 is 10.7 percent below the predicted trend value during those years. However, the individual yearly values during 1996-1998 show considerable volatility relative to the trend, suggesting weak confidence in this finding. Like Pharmaceuticals, with strong growth in ATCF over the analysis period, by 2005, the predicted ATCF value is substantially higher than the average ATCF index value at 1996-98: the average ATCF index value at 1996-1998 is 32.9 percent below the predicted trend value at 2005.

- Steel. The analysis indicates a slight increase, 1.1 percent annually, in constant dollar ATCF over the analysis period. The analysis also indicates that financial performance during the survey data collection years substantially exceeded, by 19.5 percent, trend-based predicted performance during those years. With improving trend-based performance through the end of the analysis period, by 2005, the gap between the average ATCF value at 1996-1998 and the predicted trend value at 2005 lessens to 9.9 percent. Steel is the only industry among the analyzed sectors that exhibits higher financial performance than the predicted ATCF index values during the survey data collection years as well as at the end of the analysis period, 2005.
- Beverages. The analysis indicates a strong increase, 4.3 percent annually, in constant dollar ATCF over the analysis period, meaning financial performance improved significantly over this period. The analysis also indicates that the Beverages industry achieved higher financial performance during the survey data collection years of 1996-1998 than the predicted trend performance in those years. Specifically, the average actual ATCF index value at 1996-98 is 4.3 percent above the predicted ACTF trend value for those years. However, with strong positive growth in ATCF, the predicted ATCF index value at the end of the analysis period, 2005, increases sufficiently to reverse this relationship. As a result, the average actual ATCF index value at 1996-98 is approximately 23.5 percent *below* the predicted ACTF trend value in 2005.
- Food Processing. Like the Beverages industry, the analysis of the Food Processing sector indicates a strong increase, 4.3 percent annually, in constant dollar ATCF over the analysis period, meaning financial performance improved significantly over this period. The analysis also indicates that the Food Processing industry achieved, on average, slightly weaker financial performance during the survey data collection years than the predicted trend performance in those years: the average ATCF index value for 1996-1998 is 1.1 percent below the predicted trend value during those years. With strong growth in ATCF over the analysis period, by 2005, the predicted ATCF value is substantially higher than the average ATCF index value at 1996-98: the average ATCF index value at 1996-1998 is 27.7 percent below the predicted trend value at 2005.

Table C3A4-3, below, summarizes these findings.

Table C3A4-3: Estimated Relationship Between Actual ATCF at Survey Period and Trend Predicted Values at Survey Period and End of Analysis Period

316(b) Phase III Industry Group	Percentage Difference in Actual and Predicted ATCF Index Values at 1996-1998	Percentage Difference in Actual ATCF Index Values at 1996-1998 and Trend Predicted Value at 2005
Aluminum	Analysis not undertaken for the Aluminum industry	
Pulp and Paper Mills	-3.5%	-3.7%
Industrial Chemicals	6.6%	-13.4%
Plastics Material and Resins	4.6%	-16.3%
Pharmaceuticals	0.9%	-20.2%
Petroleum Refining	-10.7%	-32.9%
Steel	19.5%	9.9%
Beverages	4.3%	-23.5%
Food Processing	-1.1%	-27.7%

Positive percentage values indicate that the 1996-1998 *Actual* ATCF Index Value *exceeds* the comparison value – i.e., the *Predicted* ATCF Index Value or the Trend Predicted Value at 2005 – and thus suggests that 1996-1998 survey data may overstate industry's ability to withstand compliance burdens as indicated by the comparison data.

Source: U.S. EPA analysis, 2006.

From these results, the industries and/or segments where financial performance during the 1996-1998 survey data collection period exceeds trend-predicted performance and thus for which survey data may overstate the industry's ability to withstand compliance burdens *in comparison to the predicted trend values at 1996-1998* are:

- Industrial Chemicals segment of the Chemicals industry,
- Plastics Material and Resins segment of the Chemicals industry,
- Pharmaceuticals
- Steel industry, and
- Beverages.

Looking to the end of the analysis period, 2005, the Steel Industry is the only industry and/or segment where financial performance during the 1996-1998 survey data collection period exceeds trend-predicted performance at 2005, and thus for which survey data may overstate the industry's ability to withstand compliance burdens at a time closer to the point of regulatory implementation.

C3A4-3.1 Comparison of Findings for Proposed and Final Rule Analysis

The two additional years of data included in the analysis for the final 316(b) rule affected both the estimated trend lines, and the difference in actual ATCF index values during 1996-1998 and predicted ATCF index values at the end of the analysis period. Table C3A4-4, following page, compares the estimated trend and percentage difference in actual ATCF index values during the 1996-1998 period and the predicted ATCF index values at the end of each analysis period: 2003 for the Proposed rule, and 2005 for the potential Final rule for existing Phase III facilities. The values presented in the table below can be found in Table C3A4-2 and Table C3A4-3 of this document and Appendix 4 for the Proposed 316(b) rule (U.S. EPA, November 2004).

Overall, inclusion of the two additional years of data resulted in noticeable improvement of business conditions since 2003 across the analyzed industries. In the same way as indicated by the general measures of economic performance such as growth in real domestic product, capacity of utilization, and growth in industrial production, the individual manufacturing sectors also show generally improving trends during 2003-2005. Specifically, all industries but Pulp and Paper Mills show improvement in business performance during these later analysis years.

As a result of the improved business performance, for all of the analyzed industry sectors, the estimated time trend remains, or becomes, upward sloping. For the two industries – Pulp and Paper Mills and Steel – that showed a negative trend in the analysis for the Proposed Regulation, the estimated analysis period trend reverses to become positive, albeit only slightly so for Pulp and Paper Mills.

One of the largest changes occurred in the Industrial Chemicals sector, where a more distinct positive trend reversed the sign of the percentage difference in actual ATCF index values during the 1996-1998 period and predicted ATCF index values at the end of the analysis period. This trend is also clearly exhibited by the increased percentage difference between actual ATCF index values for 1996-1998 and predicted values at the end of the analysis period for the Plastics Material and Resins, Petroleum Refining, and Steel industries.

Table C3A4-4: Comparison of Key Results from Analyses for the Proposed and Final 316(b) Rule Analysis Periods

316(b) Phase III Industry Group	Estimated Trend		Percentage Difference in Actual ATCF Index Values at 1996-1998 and Trend Predicted Value at the End of Analysis Period	
	Proposed Rule Analysis	Final Rule Analysis	Proposed Rule Analysis	Final Rule Analysis
Aluminum	Analysis not undertaken for the Aluminum industry			
Pulp and Paper Mills	**-0.0004**	**0.0003**	-3.8%	-3.7%
Industrial Chemicals	0.0012	0.0282	**8.4%**	**-13.4%**
Plastics Material and Resins	0.0318	0.0302	-12.3%	-16.3%
Pharmaceuticals	0.0507	0.0328	-24.1%	-20.2%
Petroleum Refining	0.0230	0.0428	-19.9%	-32.9%
Steel	**-0.0042**	**0.0112**	24.1%	9.9%
Beverages	N/A	0.0431	N/A	-23.5%
Food Processing	N/A	0.0433	N/A	-27.7%

Shaded cells indicate a switch in the sign of the observed relationship between the analysis for the Proposed Regulation and the Final Regulation. In each case, the switch in sign reflects improved business conditions as reported in the additional years of data since the time of the Proposed Regulation analysis.

Source: U.S. EPA analysis, 2004, 2006.

C3A4-4 DEVELOPING AN ADJUSTMENT CONCEPT

On the basis of these findings, EPA considered whether and how to adjust after-tax cash flow, as derived from the facility survey responses for use in the facility impact analysis. Given that one industry, was found to have financial performance during the survey data collection period that exceeded the predicted trend financial performance for that period or that exceeded the predicted trend financial performance at the end of the analysis period, EPA concluded that development and application of an adjustment to baseline after-tax cash flow was warranted.

In deciding how to adjust cash flow, EPA considered three primary adjustment concepts:

1. Adjust baseline cash flow to account for deviation from predicted trend at the time of the survey data collection.
2. Adjust baseline cash flow to account for deviation from predicted trend at the end of the analysis period.
3. Adjust baseline cash flow to a future estimated period of compliance based on the estimated trend of change in constant dollar after-tax cash flow over time.

EPA decided to apply the ATCF adjustment according to the second of these three adjustment concepts: adjust baseline cash flow to account for deviation from predicted trend at the end of the analysis period. This adjustment concept addresses both concerns that (1) business performance during the survey data collection period diverged from the predicted trend performance during the survey data collection period, and (2) business performance from the time of survey data collection period followed a non-neutral trend to the present. EPA considered extending the trend projection to the estimated time of compliance (concept 3) but rejected this approach since it was deemed speculative in attempting to forecast business performance into the future. In addition, the greater the number of years over which ATCF results are projected based on historical trend, the less likely that the predicted changes in ATCF reflect the performance of a static set of facilities and instead reflect capital additions, new facilities, facility closures, etc. For these reasons, EPA decided to restrict the adjustment to the end of the ATCF analysis period.

EPA also considered whether to apply the indicated adjustment factors *asymmetrically* – i.e., only to reduce the ATCF values as calculated from facility survey responses – or *symmetrically* – i.e., both to increase or to reduce the ATCF values as calculated from facility survey responses. In the case of asymmetric adjustment, the adjustment would correct for business performance during the survey data collection period that exceeded the predicted trend value – whether for the survey period or some future period – and would thus attempt to avoid overstating the facility's ability to bear the costs of regulation compliance without material financial impact. In the case of a symmetric adjustment, the adjustment would additionally address the potential that business performance during the survey data collection period fell short of the predicted trend value and would thus attempt to avoid understating the ability of an industry or facility to bear the costs of regulatory compliance without material financial impact.

On this question, EPA decided to apply the ATCF adjustment on a symmetric basis, potentially reducing or increasing facility cash flow on the basis of the estimated adjustment factor. EPA based its decision on the principle of avoiding both overstatement and understatement of the ability of facilities in an industry to bear the costs of regulatory compliance without material financial impact.

Based on these decisions, EPA calculated the adjustment factors by dividing the *Predicted Trend Value at 2005* by the *Average of ATCF Index Values at 1996-1998*, as reported in Table C3A4-2, above. In the facility closure analysis, as described in *Chapter C3: Economic Impact Analysis for Manufacturers*, facility after-tax cash flow is simply multiplied by the appropriate adjustment factor based on the industry or industry segment to which a facility is assigned. The resulting adjusted ATCF is carried forward in the baseline and post-compliance closure analyses. Where the *Predicted Trend Value at 2005* is less than *Average of ATCF Index Values at 1996-1998*, the resulting adjustment factor value is less than one and the effect of the ATCF adjustment is to reduce the calculated value of cash flow used in the facility impact analysis. Where the *Predicted Trend Value at 2005* is greater than *Average of ATCF Index Values at 1996-1998*, the resulting adjustment factor value is greater than one and the effect of the ATCF adjustment is to increase the calculated value of cash flow used in the facility impact analysis.

EPA also used the adjustment factors to adjust the numerator values of the measures used in the facility moderate impact analysis: pre-tax return on assets and interest coverage ratio. In both cases, the numerators of the measures are closely related to cash flow, but are calculated on a pre-tax basis. As a result, in this case, the ATCF-based adjustment factor does not match as closely in concept the financial measures to which it is applied as is the case for the ATCF measure used in the facility closure analysis. Nevertheless, use of the adjustment for these measures is appropriate because the pre-tax measures used in the facility moderate impact analysis will still move closely with the after-tax cash flow measure on which the adjustment factor is based. In addition, it is important that EPA recognize the potential effect of change in financial condition since the survey data collection period in the facility moderate impact analysis as well as in the facility closure analysis.

Table C3A4-5, below, summarizes the adjustment factors implemented for each of the industries, and within the chemical industry, for the industry segments. The table also reports the number of baseline and post-compliance closures (under the 50 MGD DIF threshold option, which is the regulatory analysis options with the broadest applicability among the three options considered for Phase III existing facilities) estimated with and without application of the ATCF adjustment factor.

Table C3A4-5: Using After-Tax Cash Flow Adjustment Factors in the Facility Closure Analysis

	Adjustment Factor	Number of Facilities Analyzed	Summary Results from Closure Analysis			
			Using Adjustment Factors		Not Using Factors	
			Baseline Closures	Regulatory Closures	Baseline Closures	Regulatory Closures
Aluminum	1.000	5	0	0	0	0
Pulp and Paper Mills	1.039	41	5	0	5	0
Chemicals Industry						
Industrial Chemicals	1.154	43	4	0	4	0
Plastics Material and Resins	1.195	12	0	0	0	0
Pharmaceuticals	1.253	2	0	0	0	0
Petroleum Refining	1.491	17	**3**	**0**	**4**	**1**
Steel	0.910	27	3	0	3	0
Beverages	1.308	3	0	0	0	0
Food Processing	1.384	6	0	0	0	0
Other Industries	1.000	4	1	0	1	0
Total		159	16	0	17	1

Shaded cells indicate a change in analytic finding as a result of applying the ATCF Adjustment.

Adjustment factors were not developed for the Aluminum industry or Other Industries, so the results with use of adjustment factors are necessarily the same as those without use of the factors.

All results are sample weighted. The reported totals may differ from the apparent sums of individual data items due to rounding.

Source: U.S. EPA analysis, 2006.

As reported in Table C3A4-5, only for the Steel industry is the adjustment factor less than one, at 0.91. For this industry, the effect of the adjustment factor is to reduce the cash flow values calculated from facility survey responses. As described above, EPA did not calculate an adjustment factor for the Aluminum industry due to data limitations; accordingly, this industry's "adjustment factor" is simply 1.000. The adjustment factors for the remaining industries are greater than one, ranging from a value of 1.039 for the Pulp and Paper Mills industry to 1.491 for the Petroleum Refining industry. For these industries, the effect of the adjustment factor is to increase the cash flow values calculated from facility survey responses.

In terms of effect on analytic results, the use of the ATCF adjustment factors caused the number of baseline closures to change in only one 316(b) industry group, the Petroleum Refining industry. For this industry, the increase in cash flow resulting from the adjustment causes 1 less facility to fail the baseline closure analysis.

Under the 50 MGD DIF threshold for existing manufacturing facilities, the use of the ATCF adjustment factors eliminated one regulatory closure, in the Petroleum Refining industry. Because the calculated adjustment factor for this industry is quite large, 1.491, EPA reviewed closely the effect of the adjustment factor on the facility closure calculation. In particular, EPA was concerned that the regulatory closure was being eliminated by application of a large ATCF adjustment. From this review, EPA determined that the single Petroleum Refining industry closure, *without the ATCF adjustment*, is a very marginal closure. Specifically, an ATCF adjustment factor of 1.005 (compared to the calculated 1.491) provides a sufficient increase in baseline cash flow to eliminate the closure under the compliance requirements of the 50 MGD All Option. Another way of understanding the 1.005 adjustment factor is to calculate the annual trend factor (year-to-year change in predicted trend ATCF index) that would yield the 1.005 value. In this case, the year-to-year change required to generate the 1.005 value is 0.006, or an annual change factor that is very close to zero (approximately 0.06 percent annual average change). Given these findings, EPA concludes that the extent of improvement in cash flow needed to eliminate the regulatory closure in the Petroleum Refining industry is very small and is thus quite plausible within the overall improving business performance trend exhibited by the Petroleum Refining industry.

REFERENCES

Board of Governors of the Federal Reserve System. *Release G.17, Industrial Production and Capacity Utilization: Capacity Utilization: Manufacturing (NAICS)* and *Industrial Production Index* quarterly data series. 2005.

U.S. Department of Commerce. Bureau of Economic Analysis. *Table 1.1.6. Real Gross Domestic Product, Chained Dollars.* 2006.

U.S. Environmental Protection Agency (U.S. EPA). 2004. *Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities*. EPA-821-R-04-006. November 2004.

U.S. Environmental Protection Agency (U.S. EPA). 2004. *Information Collection Request for Cooling Water Intake Structures, Phase II Existing Facility Final Rule*. ICR Number 2060.02. February 2004.

Value Line Investment Survey. Value Line Publishing, Inc. 220 East 42nd Street, New York, N.Y. 10017-589. 2006.

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Appendix C3A5: Estimating Capital Outlays for Section 316(b) Phase III Manufacturing Sectors Discounted Cash Flow Analyses

INTRODUCTION

The analysis of economic impacts to Phase III manufacturing facilities associated with the proposed Section 316(b) Regulation involves calculation of the business value of sample facilities on the basis of a discounted cash flow (DCF) analysis of operating cash flow as reported in the detailed industry questionnaires.[1] Business value is calculated on a pre- and post-compliance basis and the change in this value serves as an important factor in estimating regulatory impacts in terms of potential facility closures. To be accurate in concept, the business value calculation should recognize cash outlays for capital acquisition as a component of cash flow. However, the Section 316(b) Detailed Industry Questionnaire did not request information from surveyed facilities on their cash outlays for capital acquisition. Absent this data, EPA developed an estimate of cash outlays for capital acquisition. This appendix describes the methodology EPA used to derive, for each sample facility, an estimate of cash outlays for capital acquisition.

APPENDIX CONTENTS

EPA Office of Water (OW) previously identified that the omission of cash outlays for capital acquisition from DCF analyses may lead to overstatement of the business value of sample facilities and, as a consequence, understatement of regulatory impacts in terms of estimated facility closures (EPA, 2003). In response to this omission, the Office of Management and Budget suggested the adoption of depreciation expense as a surrogate for cash outlays for capital replacement and additions. However, for several reasons EPA believes depreciation is a poor surrogate. First, depreciation is meant to capture the consumption/use of previously acquired assets, *not* the cost of replacing, or adding to, the existing capital base. Therefore, depreciation is fundamentally the wrong concept to use as a surrogate for capital outlays for capital replacement and additions. Second, depreciation is estimated based on the historical asset cost, which may understate or overstate the real replacement cost of assets. Third, both book and tax depreciation schedules generally understate the assets' useful life. Thus, reported depreciation will overstate real depreciation value for recently acquired assets that are still in the depreciable asset base, and conversely, understate the real depreciation value of assets that have expired from the depreciable asset base but still remain in valuable use. Finally, depreciation does not capture the important variations in capital outlays that result from differences in revenue growth and financial performance among firms. Businesses with real growth in revenue will need to expand both their fixed and working capital assets to support business growth, and all else being equal, growing businesses will have higher ongoing outlays for fixed and working capital assets. Similarly, the ability of businesses to renew and expand their asset base depends on the financial productivity of the deployed capital as indicated by measures such as return on assets or return on invested

[1] This analysis is limited to potentially affected facilities in primary SIC codes 26, 28, 29, and 33.

capital. As a result, businesses with "strong" asset productivity will attract capital for renewal and expansion of their asset base, while businesses with "weak" asset productivity will have difficulty attracting the capital for renewal and expansion of the business' asset base. All else being equal, businesses with strong asset productivity will have higher ongoing outlays for capital assets; businesses with weak asset productivity will have lower ongoing outlays for capital assets.

As an approach to addressing the absence of capital acquisition cash outlay data to support the Phase III DCF analysis, EPA estimated a regression model of capital outlays using reported capital expenditures and relevant explanatory financial and business environment information for public-reporting firms in the original, primary Phase III manufacturing sectors. The resulting estimated model is used to estimate capital outlays for facilities in the Phase III sample dataset. The estimated capital outlay values were then used in the DCF analyses to calculate business value of sample facilities and estimate regulatory impacts in terms of facility closures.

The approach and regression model described above are based largely on the approach and regression model developed in support of the analysis of economic impacts for the Metal Products and Machinery Regulation (MP&M), which provides a recent example of the need to address the omission of capital acquisition cash outlay data from a DCF analysis. EPA notes that the facilities/industry sectors examined in the Section 316(b) Phase III analysis are similar to those analyzed in the MP&M analysis: both analyses estimate impacts to facilities in manufacturing industries only and facilities in SIC 33 are covered under both regulations. In addition, the Section 316(b) Detailed Industry Questionnaire and the MP&M survey instruments are similar; therefore, similar data are available for Phase III and MP&M survey facilities. As such, EPA relied heavily on prior experience from the MP&M final regulation in estimating the regression model used to estimate of capital outlays for facilities in the Phase III sample dataset.

This appendix reports the results of the effort to estimate capital outlays for Phase III manufacturing facilities, including: an overview of the analytic concepts underlying the analysis of capital outlays; specific variables included in the regression analysis; summary of data selection and preparation; general specification of regression models to be tested; and the findings from the regression analyses. The model estimation does not include sector information for the Food and Kindred Products industry, which was subsequently added as a primary industry in the Section 316(b) Phase III analysis.[2]

C3A5-1 ANALYTIC CONCEPTS UNDERLYING ANALYSIS OF CAPITAL OUTLAYS

On the basis of general economic and financial concepts of investment behavior, EPA began its analysis by outlining a framework relating the level of a firm's capital outlays to explanatory factors that:

- can be observed for public-reporting firms – either as firm-specific information or general business environment information – and thus be included in a regression analysis; and
- for firm-specific information, are also available from the Phase III sample facility dataset.

To aid in identifying the explanatory concepts and variables that might be used in the analysis and as well in specifying the models for analysis, EPA reviewed recent studies of the determinants of capital outlays. EPA's

[2] Since the estimated regression model for the Phase III facilities is based on an earlier model developed for the MP&M final regulation, much of the underlying research involved in the analytic development of the model had been previously completed and was not required to be redone. Nonetheless, in order to present a lucid discussion of the analytic concepts underlying the model and the rationale behind specifying variables for the analysis and specification of the regression model, a complete discussion of how the regression model was developed is presented. During the course of the discussion, instances where prior experience gained during estimating the regression model for the MP&M final regulation had a significant influence in the development of the current model are clearly highlighted.

review of this literature generally confirmed the overall approach in seeking to estimate capital outlays and helped to identify additional specific variables that other analysts found to contribute important information in the analysis of capital outlays (e.g., the decision to test capacity utilization as an explanatory variable, see below, resulted from the literature review). Articles reviewed are listed in Attachment C3A5.A to this Appendix C3A5.

Table Appendix C3A5-1, beginning below and continuing on the subsequent page, summarizes the conceptual relationships between a firm's capital outlays and explanatory factors that EPA sought to capture in this analysis. In the table, EPA outlines the concept of influence on capital outlays, the general explanatory variable(s) that EPA identified to capture the concept in a regression analysis, and the hypothesized mathematical relationship (sign of estimated coefficients) between the concept and capital outlays. Table Appendix C3A5-2identifies the specific variables included in the analysis, including any needed manipulations and the correspondence of the variables to Phase III survey information.

Table Appendix C3A5-1: Summary of Factors Influencing Capital Outlays

Explanatory Factor/Concept To Be Captured in Analysis	Translation of Concept to Explanatory Variable(s)	Expected Relationship
Availability of attractive opportunities for additional capital investment. A firm's owners, or management acting on behalf of owners, should expend cash for capital outlays only to the extent that the expected return on the capital outlays – whether for replacement of, or additions to, existing capital stock – are sufficient to compensate providers of capital for the expected return on alternative, competing investment opportunities, taking into account the risk of investment opportunities.	Historical ***Return On Assets*** of establishment as a indicator of investment opportunities and management effectiveness, and, hence, of desirability to expand capital stock and ability to attract capital investment. Use of a historical variable implicitly assumes past performance is indicative of future expectations.	Positive
Business growth and outlook as a determinant of need for capital expansion and attractiveness of investment opportunities. All else equal, a firm is more likely to have attractive investment opportunities and need to expand its capital base if the business is growing and the outlook for business performance is favorable.	***Revenue Growth***, from the prior time period(s) to the present, provides a *historical* measure of business growth and is a potential indicator of need for capital expansion. Use of a historical variable implicitly assumes past performance is indicative of future expectations.	Positive
	Clearly, the theoretical preference is for a forward-looking indicator of business growth and need for capital expansion. Options EPA identified include ***Index of Leading Indicators*** and current ***Capacity Utilization***, by industry. Higher current *Capacity Utilization* may presage need for capital expansion.	Positive
Importance of capital in business production. All else equal, the more capital intensive the production activities of a business, the greater will be the need for capital outlay to replenish, and add to, the existing capital stock. More capital intensive businesses will spend more in capital outlays to sustain a given level of revenue over time.	The ***Capital Intensity*** of production as measured by the production capital required to produce a dollar of revenue provides an indicator of the level of capital outlay needed to sustain and grow production. As an alternative to a firm-specific concept such as Capital Intensity of production, differences in business characteristics might be captured by an ***Industry Classification*** variable.	Positive

Table Appendix C3A5-1: Summary of Factors Influencing Capital Outlays

Explanatory Factor/Concept To Be Captured in Analysis	Translation of Concept to Explanatory Variable(s)	Expected Relationship
Life of capital equipment in the business. All else equal, the shorter the useful life of the capital equipment in a business, the greater will be the need for capital outlay to replenish, and add to, the existing capital stock.	No information is available on the actual useful life of capital equipment by business or industry classification. However, the ***Capital Turnover Rate***, as calculated by the ratio of book depreciation to net capital assets, provides an indicator of the rate at which capital is depleted, according to book accounting principles: the higher the turnover rate, the shorter the life of the capital equipment. However, the measure is imperfect for reasons of both the inaccuracies of book reporting as a measure of useful life, and as well the confounding effects of growth in the asset base due to business expansion – which will tend to lower the indicated turnover rate, all else equal, without a real reduction in life of capital equipment. As above, an alternative to a firm-specific concept, differences in business characteristics might be captured by an ***Industry Classification*** variable.	Positive, generally, but with recognition of the potential for counter-trend effects
The cost of financial capital. The cost at which capital – both debt and equity – is made available to a firm will determine which investment opportunities can be expected to generate sufficient return to warrant use of the financial capital for equipment purchases. All else equal, the higher the cost of financial capital, the fewer the investment/capital outlay opportunities that would be expected to be profitable and the lower the level of outlays for replacement of, or additions to, capital stock.	Preferably, measures of cost-of-capital would be developed separately for debt and equity. The ***Cost of Debt Capital***, as measured by an appropriate benchmark interest rate, provides an indication of the terms of debt availability and how those terms are changing over time. Preferably, the debt cost/terms would reflect the credit condition of the firm, which could be based on a credit safety rating (e.g., S&P Debt Rating).	Negative
	The cost of equity capital is more problematic than the cost of debt capital since it is not directly observable for either public-reporting firms or, in particular, private firms in the Phase III dataset. However, a readily available surrogate such as ***Market-to-Book Ratio*** provides insight into the terms at which capital markets are providing equity capital to *public-reporting firms*: the higher the Market-to-Book Ratio, the more favorable the terms of equity availability.	Negative
The price of capital equipment. The price of capital equipment – in particular, how capital equipment prices are changing over time – will influence the expected return from capital outlays. All else equal, when capital equipment prices are increasing, the expected return from incremental capital outlays will decline and vice versa. However, although the generally expected effect of higher capital equipment prices is to remove certain investment opportunities from consideration, the potential effect on *total capital outlay* may be mixed. If expected returns are such that the demand to invest in capital projects is relatively inelastic, the effect of higher prices for capital equipment may be to raise, instead of lower, the total capital outlay for a firm.	Index provides an indicator of the change in capital equipment prices.	Negative, generally, but with recognition of the potential for counter-trend effects

Source: U.S. EPA analysis, 2004.

C3A5-2 SPECIFYING VARIABLES FOR THE ANALYSIS

Working from the general concepts of explanatory variables outlined above, EPA defined the specific explanatory variables to be included in the analysis. A key requirement of the regression analysis is that the firm-specific explanatory variables included in the regression analysis later be able to be used as the basis for estimating capital

expenditures for facilities in the Phase III dataset. As a result, in defining the firm-specific variables, it was necessary to ensure that the definition of variables selected for the regression analysis using data on public-reporting firms be consistent with the data items available for facilities in the Phase III dataset.

Also, EPA's selection of firm-specific variables was further constrained by the decision to use the Value Line Investment Survey (VL) as the source of firm-specific information for the regression analysis. The decision to use VL as the source of firm-specific data for the analysis was driven by several considerations:

- *Reasonable breadth of public-reporting firm coverage.* The VL dataset includes 8,500 firms.
- *Reasonable breadth of temporal coverage.* VL provides data for the most recent 11 years – i.e., 1992-2002. Although ideally EPA would have preferred a longer time series to include more years not in the "boom" business investment period of the mid- to late-1990s.
- *Reasonable coverage of concepts/data needed for analysis.* The VL data includes a wide range of financial data that are applicable to the analysis (VL provides 37 data items over the 11 reporting years; see Attachment DB). However, because of the pre-packaged nature of the VL data, it was not possible to customize any data items to support more precise definition of variables in the analysis. In particular, EPA found that certain balance sheet items were not reported to the level of specificity preferred for the analysis. Overall, though, EPA expects the consequence of using more aggregate, less-refined concepts should be minor.

The decision to use VL data for the analysis constrained, in some instances, EPA's choice of variables for the analysis.

Table Appendix C3A5-2Table Appendix C3A5-1 reports the specific definitions of variables included in the analysis (both the dependent variable and explanatory variables), including any needed manipulations, the data source, the Phase III estimation analysis equivalent (either the corresponding variable(s) in the Section 316(b) Phase III Detailed Industry Questionnaire or other source outside the questionnaire), and any issues in variable definition.

Table Appendix C3A5-2: Variables For Capital Expenditure Modeling Analysis

Variables for Regression Analysis			Phase III Analysis Equivalent	Comment / Issue
Variable	**Source**	**Calculation**		
Dependent Variable				
Gross expenditures on fixed assets: CAPEX, includes outlays to replace, and add to, existing capital stock	Value Line	Obtained from VL as Capital Spending per Share. CAPEX calculated by multiplying by Average Shares Outstanding.	None: to be estimated based on estimated coefficients.	*This value and all other dollar values in the regression analysis were deflated to 2002 using 2-digit SIC PPI values.*
Explanatory Variables				
Firm-Specific Variables				
Return On Assets: ROA	Value Line	ROA = Operating Income / Total Assets. Both Operating Income, defined as Revenue less Operating Expenses (CoGS+SG&A), and Total Assets were obtained directly from VL.	From Survey: Revenue *less* Total Operating Expenses (Material & Product Costs + Production Labor + Cost of Contract Work + Fixed Overhead + R&D + Other Costs & Expenses)	Would have preferred an after-tax concept in numerator *and* a deployed production capital concept in denominator. However, VL provides no tax value *per se* and would require calculation of tax using an estimated tax rate, which could introduce error. Also neither VL nor Phase III survey data provide sufficient information to get at deployed production capital.
Revenue: REV	Value Line	REV = Revenues. Revenues directly available from VL.	From Survey: Revenue	In the log-linear formulation this variable captures percent change/growth in revenues. However, the use of the log-linear formulation, eliminates the potential to set the growth term to zero in estimating baseline capital outlays for Phase III facilities. During the specification of the regression model for the MP&M final regulation, Total Assets was also tested as a scale variable. Since it provided a good, but not as strong, an explanation, as REV it was not included in the final specification. Based on this previous finding, Total Assets was not considered while specifying the Phase III regression model.
Capital Turnover Rate: CAPT	Value Line	CAPT = Depreciation / Total Assets. Depreciation and Total Assets directly available from VL.	From Survey: Depreciation / Total Assets	Would have preferred denominator of *net fixed assets* instead of *total assets*. However, VL provides detailed balance sheet information for only the four most recent years. Not possible to separate current assets and intangibles from total assets.
Capital Intensity: CAPI	Value Line	CAPI = Total Assets / Revenue. Total Assets and Revenue directly available from VL	From Survey: Total Assets / Revenue	As above, would have preferred *net fixed assets* instead of *total assets*, but needed data are not available from VL for the full analysis period.

Table Appendix C3A5-2: Variables For Capital Expenditure Modeling Analysis

Variables for Regression Analysis			Phase III Analysis Equivalent	Comment / Issue
Variable	**Source**	**Calculation**		
Market-to-Book Ratio: MV/B	Value Line	MV/B = average market price of common equity (Price) divided by book value of common equity (Book Value per Share). Price and Book Value per Share directly available from VL.	N/A (see Comment/Issue)	During specification of the MP&M regression model, MV/B was found to highly correlated with other, more important explanatory variables, which makes sense, given that equity terms would be derived from more fundamental factors, such as ROA. Thus, MV/B was omitted from the MP&M regression model. As a result, MV/B was not considered during the specification of the Phase III regression model which eliminated the need to define an approach to use this variable with Phase III survey data.
General Business Environment Variables				
Interest on 10-year, A-rated industrial debt: DEBTCST	*Moody's Investor Services*	*DEBTCST = annual average of rates for each data year*	*Use average of DEBTCST rates at time of Phase III survey.*	*10-year maturity, industry debt selected as reasonable benchmark for industry debt costs. 10 years became "standard" maturity for industrial debt during 1990s.*
Index of Leading Indicators: ILI	*Conference Board*	*Monthly index series available from Conference Board. ILI = geometric mean of current year values.*	*Use average of ILI values at time of Phase III survey.*	*During specification of the MP&M regression model, EPA found that ILI and the CAPPRC (see below) are highly correlated. Thus, ILI was omitted from the MP&M regression model. As a result, ILI was not considered during the specification of the Phase III regression model.*
Capacity Utilization by Industry: CAPUTIL	*Federal Reserve Board (Dallas Federal Reserve)*	*Monthly index series available from Federal Reserve. CAPUTIL = current year average value.*	*Use average of CAPUTIL values at time of Phase III survey.*	
Producer Price Index series for capital equipment: CAPPRC	*Bureau of Labor Statistics (BLS)*	*Annual average values available from BLS. CAPPRC = current year average value as reported by BLS.*	*Use average of CAPPRC values at time of Phase III survey.*	*BLS reports PPI series for capital equipment based on "consumption bundles" defined for manufacturing and non-manufacturing industries. For this analysis, EPA used the PPI series based on the manufacturing industry bundle.*

Source: U.S. EPA analysis, 2004.

C3A5-3 SELECTING THE REGRESSION ANALYSIS DATASET

In addition to specifying the variables to be used in the regression analysis, EPA also needed to select the public firm dataset on which the analysis would be performed.

As noted above, EPA used the Value Line Investment Survey as the source for public firm data. VL includes over 8,500 publicly traded firms and identifies firms' principal business both by a broad industry classification (e.g., Paper/Forest) and by an SIC code assignment. Value Line's SIC code definitions do not match the U.S.

Census Bureau's SIC code definitions; however, in most instances a Value Line SIC code can be reasonably matched to one or several U.S. Census Bureau defined SIC codes. To build the public firm dataset corresponding to the original Phase III sectors (SIC 26: Paper and allied products, SIC 28: Chemicals and allied products, SIC 29: Petroleum and coal products, and SIC 33 Primary metal industries), EPA initially selected all firms included in the Value Line SIC code families:

- 2600: Paper/forest products,
- 2640: Packaging and container,
- 2810: Chemical (basic),
- 2813: Chemical (diversified),
- 2820: Chemical (speciality),
- 2830: Biotechnology,
- 2834: Drug,
- 2840: Household products,
- 2844: Toiletries/cosmetics,
- 2900: Petroleum (integrated),
- 3311: Steel (general), and
- 3312: Steel (integrated).

This is the same set of data used for analysis of the Proposed rule. Although the Food and Kindred Products sector was ultimately included as a primary sector within the Section 316(b) Phase III analysis, it was not necessary to re-estimate the model with this additional industry data because the estimated model coefficients do not vary by industry in a statistically significant way. The current model's applicability across industries is detailed further in the next section of this appendix.

In order to derive a dataset of firms whose business activities closely match the activities of firms included in the Phase III sample survey EPA made or attempted to make the following revisions to the initial dataset:

- EPA found that the VL SIC code definition does not include categories that match SIC 331 and SIC 335 (combined together to form the aluminum sector in the Phase III analysis). Since U.S. aluminum companies are generally vertically integrated (S&P, 2001), most aluminum companies own large bauxite reserves and mine bauxite ore. As such, these firms are classified in VL under SIC 1000: Metals and mining. EPA reviewed the business activities of firms listed in SIC 1000: Metals and mining, and included only those firms described as aluminum companies in the regression analysis dataset.
- EPA reviewed the business activities of firms listed in SIC 3400: Metal fabricating, however, no firms whose activities matched those described within the profiles of the Phase III Manufacturing Sectors were found.[3]
- EPA reviewed the business activities of firms listed in SIC 2840: Household products and SIC 2844: Toiletries/cosmetics, and retained only those firms in the dataset whose activities matched those described within the profiles of the Phase III Manufacturing Sectors (see footnote 4).

[3] The profiles only focus on 4-digit SIC categories represented in the sample of facilities which received the Section 316(b) detailed industry questionnaire.

- EPA deleted firms within SIC 2600: Paper/forest products whose business activities are solely limited to timber/lumber production. These facilities are unlikely to use cooling water intake structures and therefore fall outside the Phase III Manufacturing Sectors.
- EPA reviewed the business activities of firms listed in SIC 2830: Biotechnology and SIC 2834: Drug in order to exclude firms that are exclusively research and development (R&D) firms and are unlikely to use cooling water intake structures. However, based on the information provided by Value Line EPA was unable to segregate R&D firms from the rest of the firms listed in these SIC codes.
- EPA only retained firms in the VL dataset if they are situated in the U.S. or Canada, and for whom financial information is available in U.S. dollars.

On inspection, EPA found that a substantial number of firms did not have data for the full 11 years of the analysis period. The general reason for the omission of some years of data is that the firms did not become publicly listed in their current operating structure – whether through an initial public offering, spin-off, divestiture of business assets, or other significant corporate restructuring that renders earlier year data inconsistent with more recent data – until after the beginning of the 11-year data period.[4] As a result, the omission of observation years for a firm always starts at the beginning of the data analysis period. This systematic front-end truncation of firm observations in the dataset could be expected to bias the analysis in favor of the capital expenditure behavior nearer the end of the 1990s decade. To avoid this problem, EPA removed all firm observations that have fewer than 11 years of data. As a result, the dataset used in the analysis has a total of 2,244 yearly data observations and represents 204 firms.

Table Appendix C3A5-3presents the number of firms by industry classifications.

Table Appendix C3A5-3: Number of Firms by Industry Classifications

SIC Industry Classification	Number of Firms
26: Paper and allied products	24
28: Chemicals and allied products	136
29: Petroleum and coal products	20
33: Primary metal industries	24

U.S. EPA Analysis, 2004

C3A5-4 SPECIFICATION OF MODELS TO BE TESTED

On the basis of the variables listed above and their hypothesized relationship to capital outlays, EPA specified a time-series, cross sectional model to be tested in the regression analysis. EPA's dataset consisted of 204 cross sections observed at 11 years (1992 through 2002). The general structure of this model was as follows:

$$CAPEX_{i,t} = f(ROA_{i,t}, REV_{i,t}, CAPT_{i,t}, CAPI_{i,t}, DEBTCST_{i,t}, CAPPRC_{t}, CAPUTIL_{j,t}) \quad \text{Appendix C3A5-1}$$

Where:

$CAPEX_{i,t}$ = capital expenditures of firm *i*, in time period *t*;[5]

[4] When VL adds a firm to its dataset, it fills in the public-reported data history for the firm for the lesser of 11 years or the length of time that the firm has been publicly listed and thus subject to SEC public reporting requirements.

[5] All dollar values were deflated to 2002 using 2-digit PPI values.

t	=	year (year = 1992, . . . , 2002);
i	=	firm i (i = 1, . . . , 204);
j	=	industry classification j
$ROA_{i,t}$	=	return on total assets for firm i in year t;
$REV_{i,t}$	=	revenue ($ millions) for firm i in year t;
$CAPT_{i,t}$	=	capital turnover rate for firm i in year t;
$CAPI_{i,t}$	=	capital intensity for firm i in year t;
$DEBTCST_t$	=	financial cost of capital in year t;
$CAPPRC_t$	=	price of capital goods in year t;
$CAPUTIL_{j,t}$	=	the Federal Reserve Board's Index of Capacity utilization for a given industry j in year t.

EPA only tested log-linear model specifications for this analysis.[6] The main advantage of the log-linear model is that it incorporates directly the concept of percent change in the explanatory variables. Specifying the key regression variables as logarithms permitted EPA to estimate directly as the coefficients of the model, the elasticities of capital expenditures with respect to firm financial characteristics and general business environment factors. The following paragraphs briefly discuss testing of the log-linear forms of the model. Parameter estimates are presented for the final log-linear model only.

EPA specified a log-linear model, as follows:

$$\ln(CAPEX_{i,t}) = \alpha + \Sigma[\beta_x \ln(X_{i,t})] + \Sigma[\gamma_y \ln(Y_t)] + \varepsilon$$ Appendix C3A5-2

Where:

$CAPEX_{i,t}$	=	capital expenditures of firm i, year t;
β_x	=	elasticity of capital expenditures with respect to firm characteristic X;
$X_{i,t}$,	=	a vector of financial characteristics of firm i, year t;
γ_y	=	elasticity of capital expenditures with respect to economic indicator Y;
Y_t	=	a vector of economic indicators, year t; for CAPUTIL, Y is also differentiated by industry classification
ε	=	an error term; and
$\ln(x)$	=	natural log of x

Based on this model, the elasticity of capital expenditures with respect to an explanatory variable, for example, return on assets is calculated as follows:

$$E(CAPEX) = \frac{d\ln(CAPEX)}{d\ln(ROA)} = \frac{d(CAPEX)/CAPEX}{d(ROA)/ROA}$$ Appendix C3A5-3

[6] While specifying the MP&M regression model, EPA tested both linear and log-linear model specifications. The pattern of coefficient significance was found to be better in the log-linear model. In addition, the log-linear model offered advantages in terms of retention of early time period observations (by eliminating the need to use percent change variables) and variable specifications, and helped to reduce outlier effects in the model. As a result, EPA selected a log-linear specification as the final regression model for the MP&M final regulation. Based on these reasons and the similarity of industry sectors analyzed for the two regulations, EPA decided to test only log-linear model specifications for the Phase III regression model.

Since logarithmic transformation is not feasible for negative and zero values, such values in the VL public firm dataset required linear transformation to be included in the analysis. The following variables in the sample required transformation:

- CAPEX: Eighteen firms in the sample reported zero capital expenditures at least in one time period. EPA set these expenditures to $1.
- REVENUE: Seven firms reported negative revenues in at least one time period. Because these are likely due to accounting adjustments from prior period reporting, EPA set negative revenues for these firms to $1.
- ROA: the values for return on assets in the public firm sample range from -2.9 to 0.7. Approximately 34 percent of the firms in the dataset reported negative ROAs in at least one year. To address this issue while reducing potential effects of data transformation on the modeling results, EPA used the following data transformation approach:[7]

  EPA excluded 27 firms with *any* annual ROA values below the 95th percentile of the ROA distribution (i.e., ROA # - 0.51).

  EPA used an additive data transformation to ensure that remaining negative ROA values were positive in the logarithm transformation. The additive transformation was performed by adding 0.51 to all ROA values.

As a result of the data transformation procedures outlined above, the VL public firm dataset on which the regression model is based was reduced to 177 firms (204 - 27 firms) and 1,947 yearly data observations.

The analysis tested several specifications of a log-linear model, including models with the intercept and slope dummies for different industrial sectors and models with the intercept suppressed.[8] Slope dummies were used to test the influence of industry classification on the elasticity of capital expenditures with respect to an explanatory variable: e.g., using the product of an industry classification dummy variable and CAPPRC to test whether certain industries responded differently to change in price of capital equipment over time. Following review of the different models tested, EPA concluded that the estimated coefficients did not vary, significantly, by industry and thus selected the simple log-linear model, with the intercept and no slope dummies as the basis for the 316(b) Phase III capital expenditures analysis. The results for this model are summarized below.

Cross-sectional, time-series datasets typically exhibit both autocorrelation and group-wise heteroscedasticity characteristics. Autocorrelation is frequently present in economic time series data as the data display a "memory" with the variation not being independent from one period to the next. Heteroscedasticity usually occurs in cross-sectional data where the scale of the dependent variable and the explanatory power of the model vary across observations. Not surprisingly, the dataset used in this analysis had both characteristics. Therefore, EPA

[7] While specifying the MP&M regression model EPA conducted a sensitivity analysis to examine the degree to which the estimated model was affected by this data transformation. Results of this analysis showed that the data transformation produces results that are compatible with a model considering only positive ROA values and a model considering all ROA values. As a result, the Phase III regression model utilized the same data transformation procedure.

[8] While specifying the MP&M regression model, EPA also tested specifications that included the following structural modifications: (1) testing contemporary vs. lagged specification of certain explanatory variables: e.g., using prior, instead of current period revenue, REV, as an explanatory variable; (2) testing scale-normalized specification of the dependent variable: e.g., using CAPEX/REV as the dependent variable instead of simple CAPEX; (3) testing flexible functional forms that included quadratic terms; and (4) testing additional explanatory variables including the index of 10 leading economic indicators (ILI) and market-to-book ratio (MV/B). Because EPA found that these structural modifications either did not improve the fit of the MP&M regression model or resulted in the introduction of multicollinearity among variables, these structural modifications were not tested while specifying the Phase III regression model.

estimated the specified model using the generalized least squares procedure. This procedure involves the following two steps:

- First, EPA estimated the model using simple OLS, ignoring autocorrelation for the purpose of obtaining a consistent estimator of the autocorrelation coefficient (ρ);
- Second, EPA used the generalized least squares procedure, where the analysis is applied to transformed data. The resulting autocorrelation adjustment is as follows:

$$Z_{i,t} = Z_{i,t} - \rho Z_{i,t-1}$$ Appendix C3A5-4

where Z_{it} is either dependent or independent variables.

EPA was unable to correct the estimated model for group-wise heteroscedasticity due to computational difficulties. The statistical software used in the analysis (LIMDEP) failed to correct the covariance matrix due to the very large number of groups (i.e., 177 firms) included in the dataset. Application of other techniques to correct for group-wise heteroscedasticity was not feasible due to time constraints. The estimated coefficients remain unbiased; however, they are not minimum variance estimators. Regression results reveal strong systematic elements influencing capital expenditures: the analysis finds both statistically significant and intuitive patterns that influence firm's investment behavior. We find a strong systematic element of capital expenditures variation that allows forecasting of capital expenditures based on firm and business environment characteristics.

Table Appendix C3A5-1 presents model results. The model has a fairly good fit, with adjusted R^2 of 0.81. All coefficients have the expected sign and all but one variable (cost of debt capital) are significantly different from zero at the 95th percentile.

Table Appendix C3A5-4: Time Series, Cross-Sectional Model Results

Variable	Coefficient	t-Statistics
Constant	21.880	2.618
Ln(ROA)	0.526	3.964
Ln(REV)	1.129	58.450
Ln(CAPT)	0.687	11.085
Ln(CAPI)	1.078	18.491
Ln(DEBTCST)	-0.789	-1.605
Ln(CAPPRC)	-5.957	-4.369
Ln(CAPUTIL)	1.716	2.842
Autocorrelation Coefficient		
r	0.385	18.402

Source: U.S. EPA Analysis

The empirical results show that among the firm-specific variables, the output variable (REV) is a dominant determinant of firms' investment spending. A positive coefficient on this variable means that larger firms invest more, all else equal, which is clearly a simple expected result. In addition, as expected, firms with higher financial performance and better investment opportunities (ROA) invest more, all else equal: for each one percent increase in ROA, a firm is expected to increase its capital outlays by 0.53 percent. Other firm-specific characteristics were also found important and will aid in differentiating the expected capital outlay for Phase III facilities according to firm-specific characteristics. Firms that require more capital to produce a given level of business activity (i.e., firms that have high capital intensity, CAPI) tend to invest more: a one percent increase in

capital intensity leads to a 1.08 percent increase in capital spending. Higher capital turnover/shorter capital life (CAPT) also has a positive effect on investment decisions: a one percent increase in capital turnover rate translates to a 0.69 percent increase in capital outlays.

The model also shows that current business environment conditions play an important role in firms' decision to invest. Negative signs on the capital price (CAPPRC) and debt cost (DEBTCST) variables match expectations, indicating that falling (either relatively or absolutely) capital equipment prices and less costly credit are likely to have a positive effect on firms' capital expenditures. The most influential factor is capital equipment prices for manufacturing facilities. A one percent increase in the capital price index (CAPPRC) leads to a 5.96 percent decrease in capital investment. Capacity utilization is also an influential factor: a one percent increase in the Federal Reserve Index of Capacity Utilization for the relevant industrial sector (CAPUTIL) leads to a 1.7 percent increase in capital investments. The fact that these systematic variables are significant in the regression analysis means that EPA will be able to control for economy- and industry-wide conditions in estimating capital outlays for Phase III facilities.

C3A5-5 MODEL VALIDATION

To validate the results of the regression analysis, EPA used the estimated regression equation to calculate capital expenditures and then compared the resulting estimate of capital expenditures with actual data. EPA used two methods to validate its results:

- EPA used median values for explanatory variables from the Value Line data as inputs to estimate capital expenditures and then compared the estimated value to the median reported capital expenditures, and
- EPA used Phase III survey data to estimate capital expenditures and then compared the estimated values to depreciation reported in the survey.

First, EPA estimated capital expenditures for a hypothetical firm based on the median values of the four dependent variables from the Value Line data and the relevant values of the three economic indicators. The estimated capital expenditures for this hypothetical firm are $43 million. EPA then compared this estimate to the median value of capital expenditures from the Value Line data. The median capital expenditure value in the dataset is $36 million, which provides a close match to the estimated value. This is not surprising since the same dataset was used to estimate the regression model and to calculate the median values used in this analysis.

EPA also used Phase III survey data to confirm that the estimated capital expenditures seem reasonable. Because the Phase III survey does not provide information on capital expenditures, EPA compared the capital expenditure estimates to the depreciation values reported in the survey. Depreciation had been proposed as a possible surrogate for cash outlays for capital replacements and additions. However, depreciation does not capture important variations in capital outlays that result from differences in firms' financial performance.

For this analysis, EPA chose a representative facility from each of the Phase III primary manufacturing sectors for model validation. The selected facility for each sector corresponds as closely as possible to the hypothetical median facility in the sector based on the distribution of facility revenues and facility return on assets. For each of the facilities, EPA estimated capital expenditures using the estimated regression equation and facility financial data. Table Appendix C3A5-5 shows the estimated regression coefficients, financial averages for the primary Phase III sectors, estimated facility capital expenditures, reported facility depreciation, and the comparison of capital expenditures and depreciation.

As shown in Table Appendix C3A5-5, the estimated model provides reasonable estimates of capital expenditures.

Table Appendix C3A5-5: Estimation of Capital Outlays for Phase III Sample Facilities: Median Facilities Selected by Revenue and ROA Percentiles

Sectors	Pre-Tax Return on Assets (ROA)	Revenue ($2004, millions)	Capital Turnover Rate	Capital Intensity	Cost of Debt	Price of Capital Goods	Capacity Utilization	Estimated Capital Expenditures ($2004, millions)	Depreciation ($2004, millions)	Difference between Depreciation and Capital Expenditures ($2004, millions)
Coefficient Intercept (21.88)	0.53	1.13	0.69	1.08	-0.79	-5.96	1.72			
Paper and allied products	0.16	252.00	0.09	0.89	7.71	137.60	86.24	$19.54	$16.73	($2.80)
Chemicals and allied products	0.27	244.59	0.06	1.14	7.71	137.60	79.36	$15.73	$14.69	($1.04)
Petroleum and coal products	0.22	1516.01	0.05	0.59	7.71	137.60	91.88	$47.03	$66.95	$19.93
Primary metals industries	0.09	458.46	0.04	0.93	7.71	137.60	88.77	$16.07	$19.21	$3.14
Food and kindred products	0.37	292.56	0.06	0.29	7.71	137.60	80.46	$4.82	$4.52	($0.30)

Source: U.S. EPA analysis, 2004.

One of the possible implications of the hypothesized relationships and estimated coefficient values from the prior analysis is that a facility's predicted capital expenditures might be expected to increase relative to the facility's actual depreciation as the facility's ROA increases. An extension of this hypothesis is that, at lower ROA values, predicted capital expenditures would be less than the depreciation but that at higher ROA values, predicted capital expenditures exceed depreciation. These hypotheses are consistent with the expectation that businesses with higher financial performance will have relatively more attractive investment opportunities and are more likely to attract the capital to undertake those investments. EPA examined whether these relationships occur in the 316(b) sample facilities. Specifically, EPA calculated the predicted capital expenditure for each facility and compared these values to the facilities' reported depreciation values. To remove the scale effect of revenue, EPA normalized both the predicted capital expenditure and reported depreciation values by dividing by the three-year average of revenue for each facility. EPA then estimated the simple linear relationship of the resulting revenue-normalized capital expenditure and deprecation values against facility ROA. The five graphs on the following pages present, for each of the five primary two-digit SIC code sectors, the normalized capital expenditure and deprecation values, and the estimated trend lines for each sector's depreciation and capital expenditures with respect to ROA.[9] The graphs indicate the following:

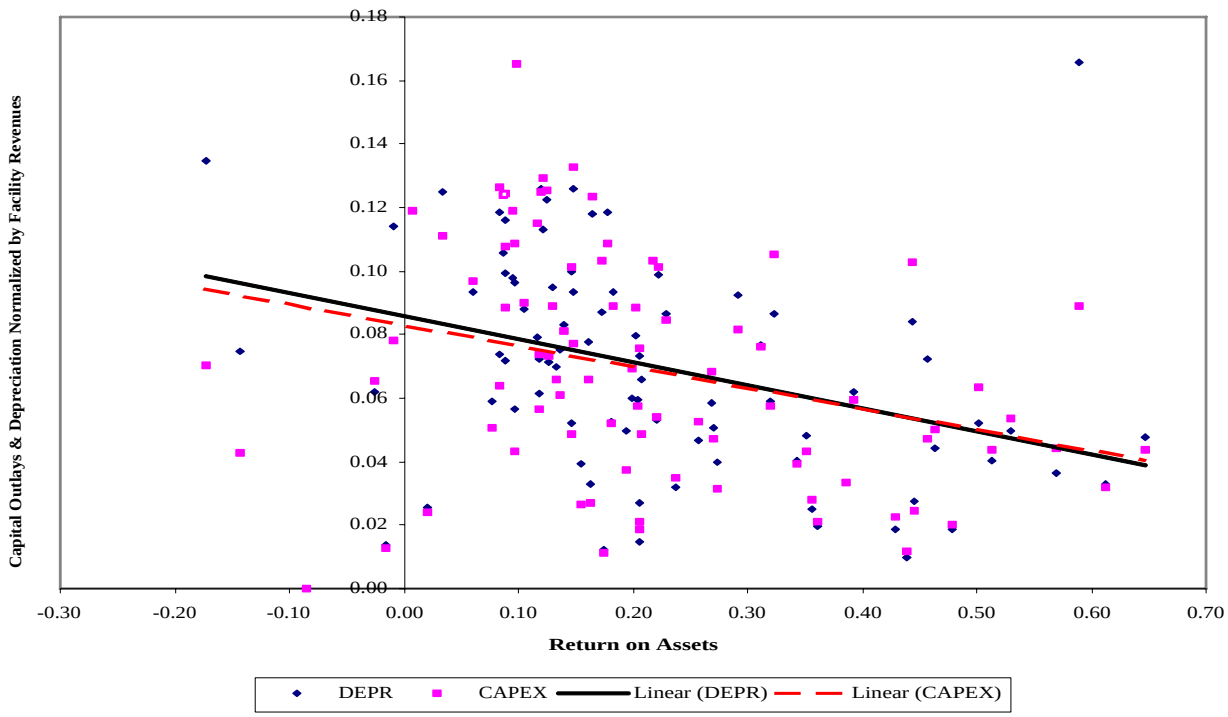
- The Paper and Allied Products (SIC 26) graph shows depreciation exceeding predicted capital expenditure at low ROA values but this relationship reverses with predicted capital expenditure exceeding depreciation as ROA increases. Thus, the calculations for these facilities match the hypothesized relationship.

[9] For presentation purposes, two outlier facilities were excluded from the graph for SIC 28: Chemicals and allied products, and one outlier facility was excluded from the graph for SIC 26: Paper and allied products.

- The Chemicals and Allied Products (SIC 28) graph also shows depreciation exceeding predicted capital expenditure at low ROA values, but again the relationship reverses with predicted capital expenditure exceeding depreciation as ROA increases. This predicted relationship is observed more strongly for facilities in the Chemicals and Allied Products industry than in the Paper and Allied Products industry.
- The Petroleum and Coal Products (SIC 29) graph shows predicted capital expenditures exceeding depreciation over the ROA range analyzed. However, the extent of difference does not materially change as ROA increases.
- The Primary Metal Industries (SIC 33) graph also shows predicted capital expenditures exceeding depreciation over the ROA range analyzed. However, unlike for the Petroleum and Coal Products facilities, the amount by which predicted capital expenditures exceeds depreciation increases as ROA increases, thus matching the hypothesized relationship.
- The Food and Kindred Products (SIC 20) graph also shows that calculations for these facilities match the hypothesized relationship, where predicted capital expenditures exceed depreciation over the ROA range analyzed. The consistency of this result, as well as the CAPEX estimation in Table Appendix C3A5-5 above, is notable to the extent that it demonstrates the model's overall applicability across industries, as facility data from SIC 20 were not used for model specification.

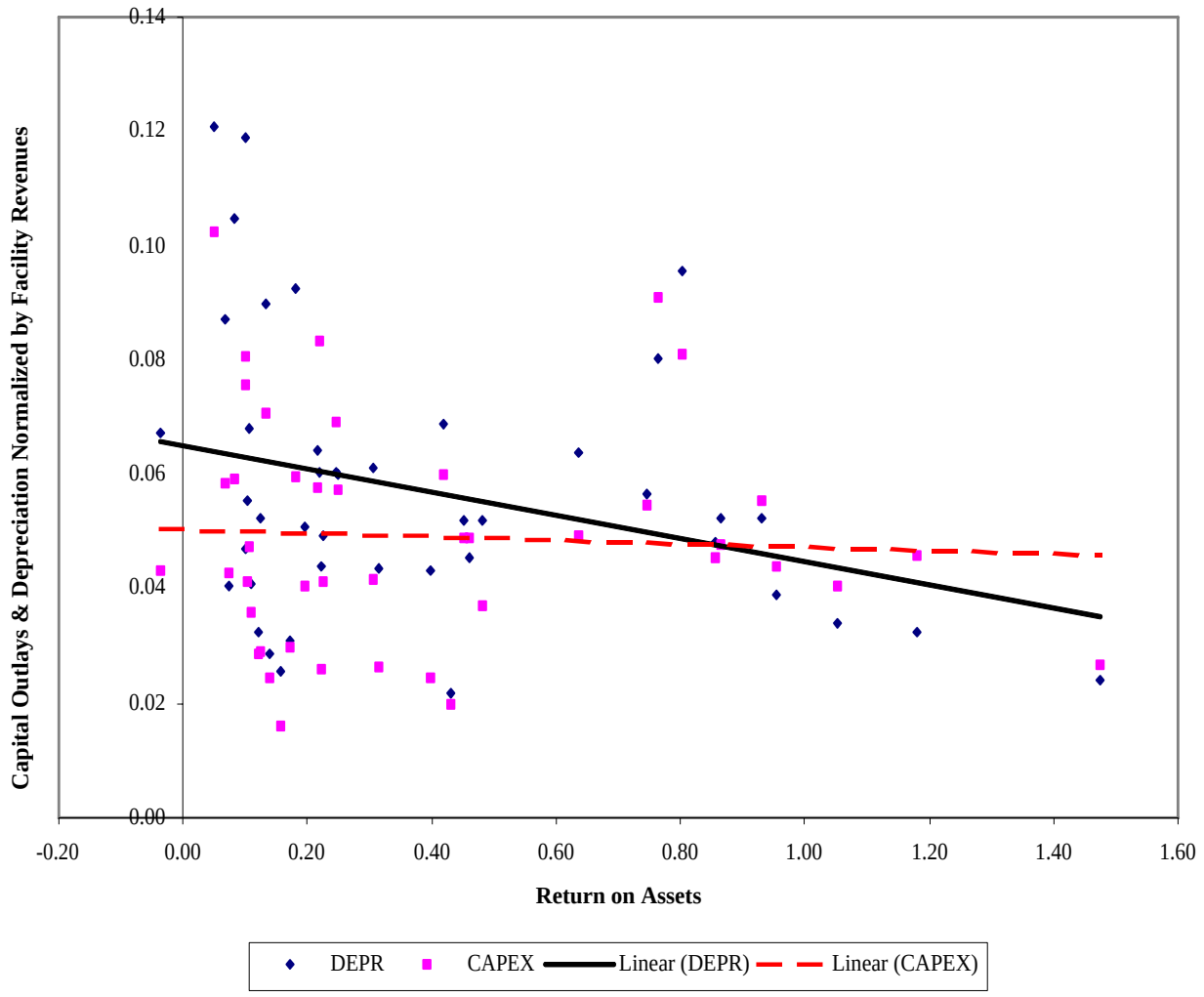
In summary, with the exception of facilities in the Petroleum and Coal Products industry, the estimated model produces capital expenditure values that increase relative to reported depreciation with increasing ROA, which matches the hypothesized relationship.

Figure Appendix C3A5-1: Comparison of Estimated Capital Outlays to Reported Depreciation for Phase III Survey Facilities in the Paper and Allied Products Sector



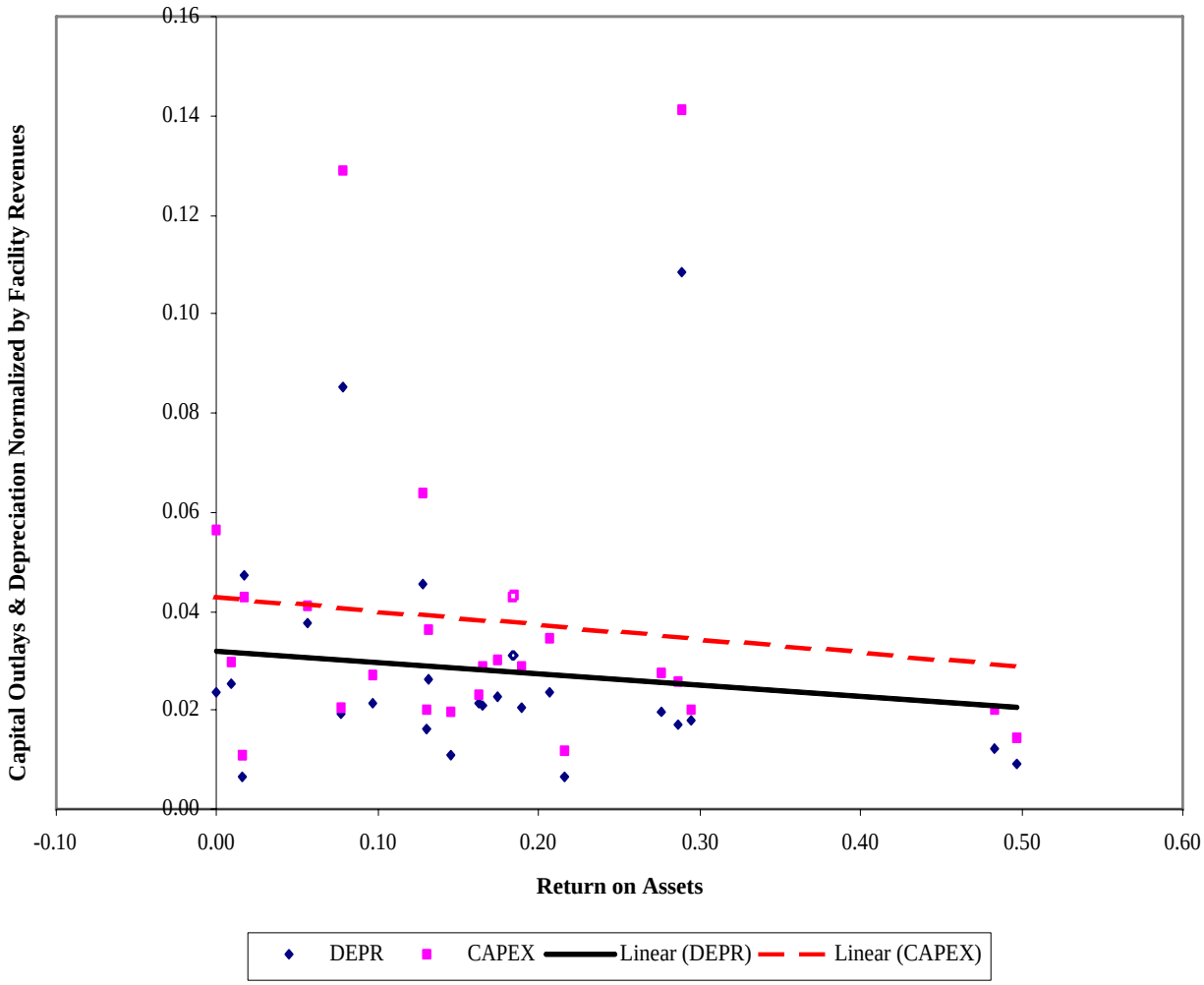
Source: U.S. EPA analysis, 2004.

Figure Appendix C3A5-2: Comparison of Estimated Capital Outlays to Reported Depreciation for Phase III Survey Facilities in the Chemicals and Allied Products Sector



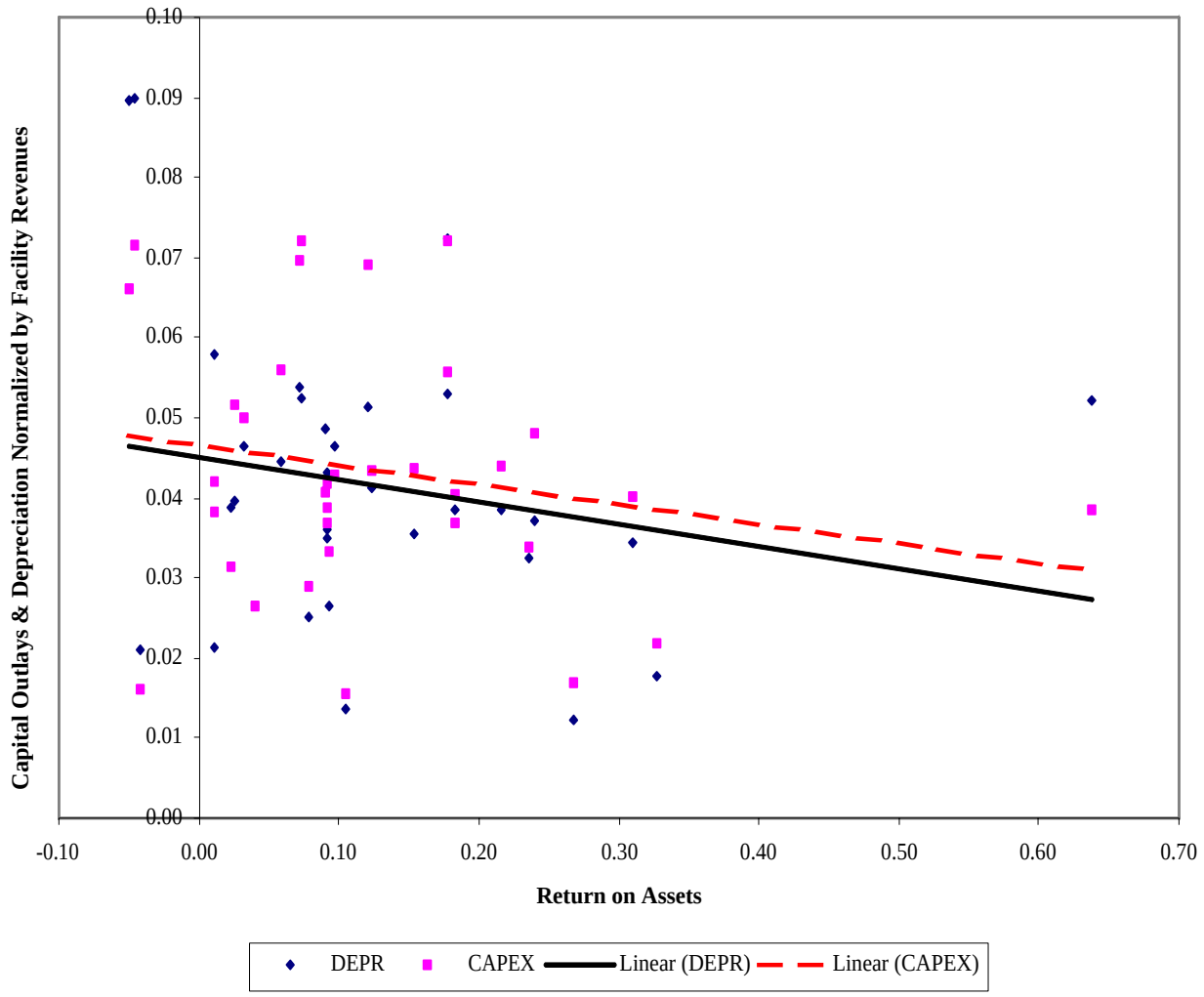
Source: U.S. EPA analysis, 2004.

Figure Appendix C3A5-3: Comparison of Estimated Capital Outlays to Reported Depreciation for Phase III Survey Facilities in the Petroleum and Coal Products Sector



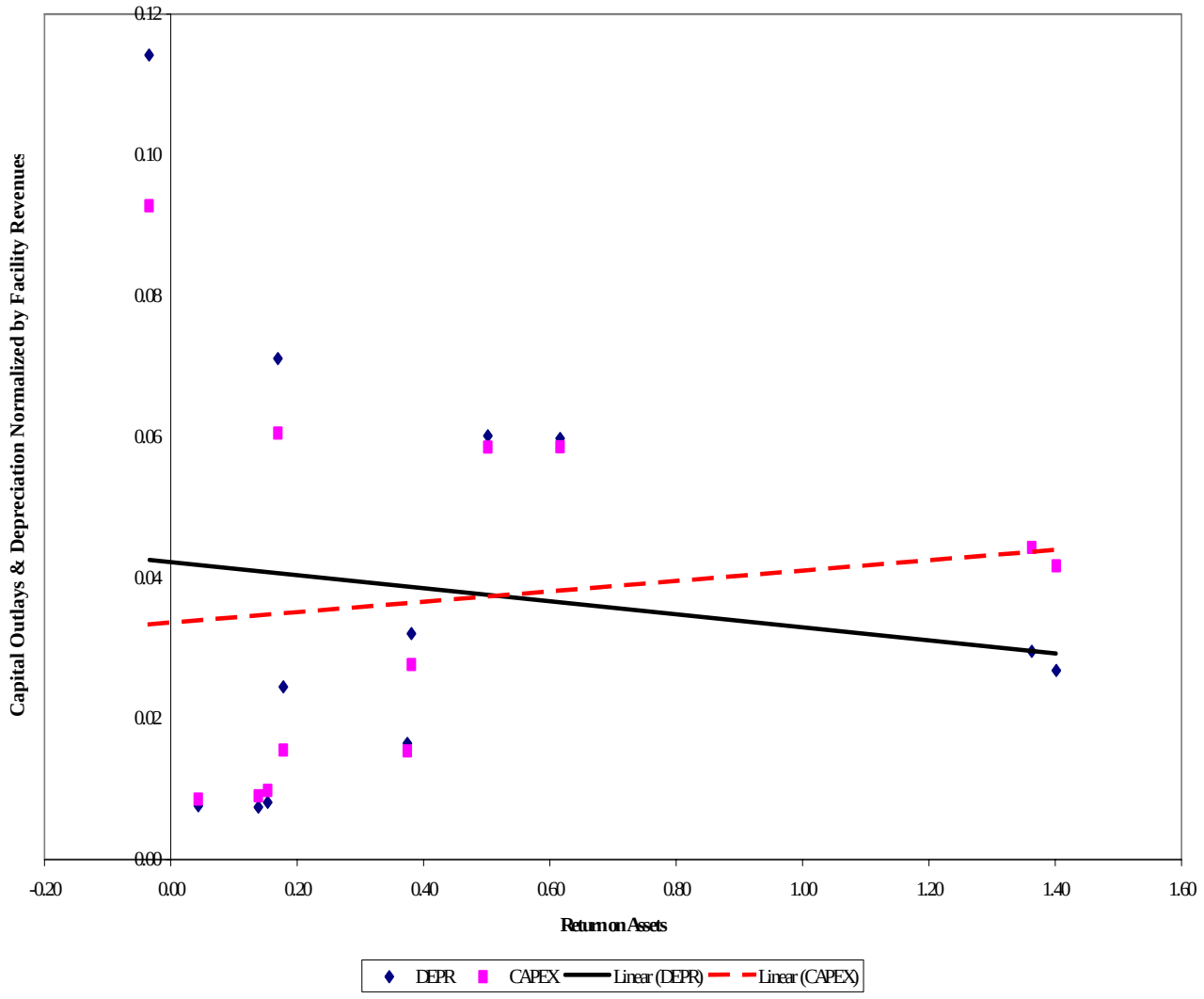
Source: U.S. EPA analysis, 2004.

Figure Appendix C3A5-4: Comparison of Estimated Capital Outlays to Reported Depreciation for Phase III Survey Facilities in the Primary Metal Industries Sector



Source: U.S. EPA analysis, 2004.

Figure Appendix C3A5-5: Comparison of Estimated Capital Outlays to Reported Depreciation for Phase III Survey Facilities in the Food and Kindred Products Sector



Source: U.S. EPA analysis, 2004.

ATTACHMENT C3A5.A: BIBLIOGRAPHY OF LITERATURE REVIEWED FOR THIS ANALYSIS

As noted above, EPA relied on previous studies of investment behavior to select critical determinants of firms' capital expenditures. Empirical results from these studies suggest that investment is most sensitive to quantity variables (output or sales), return-over-cost, and capital utilization (R. Chirinko). Empirical results from more recent studies further found that increasing depreciation rates and capital equipment prices were of first-order importance in the equipment investment behavior in the 1990 (T. Tevlin, K. Whelan). Specifically, declining prices of micro-processor based equipment played a crucial role in the investment boom in the 1990.

Chirinko, Robert S. 1993. "Business Fixed Investment Spending: A Critical Survey of Modeling Strategies, Empirical Results and Policy Implications." *Journal of Economic Literature* 31, no. 4: 1875-1911.

Goolsbee, Austan. 1997. "The Business Cycle, Financial Performance, and the Retirement of Capital Goods." University of Chicago, Graduate School of Business Working Paper.

Greenspan, Alan. 2001. "Economic Developments." Remarks before the Economic Club of New York, New York, May 24.

Kiyotaki, Nobuhiro and Kenneth D. West. 1996. "Business Fixed Investment And The Recent Business Cycle In Japan." National Bureau of Economic Research Working Paper 5546.

McCarthy, Jonathan. 2001. "Equipment Expenditures since 1995: The Boom and the Bust." *Current Issues In Economics And Finance* 7, no. 9: 1-6.

Opler, Tim and Lee Pinkowitz, Rene Stulz and Rohan Williamson. 1997. "The Determinants and Implications of Corporate Cash Holdings." Working paper, Ohio State University College of Business.

Tevlin, Stacey and Karl Whelan. 2000. "Explaining the Investment Boom of the 1990s." Board of Governors of the Federal Reserve System Finance and Economics Discussion Paper no. 2000-11

Uchitelle, Louis. 2001. "Wary Spending by Companies Cools Economy." *New York Times*, May 14, p. A1.

ATTACHMENT C3A5.B: HISTORICAL VARIABLES CONTAINED IN THE VALUE LINE INVESTMENT SURVEY DATASET

All variables are provided for 10 years (except where a firm has been publicly listed for less than 10 years):

- Price of Common Stock
- Revenues
- Operating Income
- Operating Margin
- Net Profit Margin
- Depreciation
- Working Capital
- Cash Flow per share
- Dividends Declared per share
- Capital Spending per share
- Revenues per share
- Average Annual Price-Earnings Ratio
- Relative Price-Earnings Ratio
- Average Annual Dividend
- Return Total Capital
- Return Shareholders Equity
- Retained To Common Equity
- All Dividends To Net Worth
- Employees
- Net Profit
- Income Tax Rate
- Earnings Before Extras
- Earnings per share
- Long Term Debt
- Total Loans
- Total Assets
- Preferred Dividends
- Common Dividends
- Book Value
- Book Value per share
- Shareholder Equity
- Preferred Equity
- Common Shares Outstanding
- Average Shares Outstanding
- Beta
- Alpha
- Standard Deviation

Appendix C3A6: Summary of Moderate Impact Threshold Values by Industry

APPENDIX CONTENTS

INTRODUCTION

Facilities subject to *moderate impacts* from the regulation under the regulatory analysis options are expected to experience financial stress short of closure. This analysis uses two financial indicators – (1) Pre-Tax Return on Assets (PTRA) and (2) Interest Coverage Ratio (ICR) – to test whether facilities might experience such stress. These threshold values were calculated at the industry-level and compared to pre- and post-compliance PTRA and ICR values for sample facilities 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 six industries considered in this analysis are: Paper, Chemicals, Petroleum, Steel, Aluminum, Food (the "Primary Manufacturing Industries"), and Other Industries. The remainder of this appendix describes the sources and methodology used to derive industry-specific moderate impact threshold values.

EPA calculated the thresholds using income and financial structure information by 4-digit SIC code from the Risk Management Association (RMA) *Annual Statement Studies* for eight years 1994-2001 (RMA, 2002; RMA, 2001; RMA, 1998)[1]. This source provides quartile values derived from statements of commercial bank borrowers and loan applicants for firms having less than $250 million in total assets. These criteria may introduce 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 RMA data offers the advantage of being available by 4-digit SIC codes and for quartile ranges.

RMA did not provide data for all 4-digit SIC codes associated with an in-scope Section 316(b) facility. In particular, RMA had no years of data available for SIC codes associated with sample facilities in the Aluminum and Food industries. For the Aluminum industry, EPA applied a combined Steel/Aluminum industry value to facilities in those industries. For the Food industry, EPA applied values calculated using RMA data for SIC 20 (Twenty-two 4-digit SIC codes).

The 4-digit SIC code data were consolidated into weighted industry averages, weighted by 1997 value of shipments from the Economic Censuses (U.S. DOC, 1997). For each industry and impact measure, a separate threshold was calculated. The use of the RMA data for calculating the threshold values for pre-tax return on assets and interest coverage ratio is outlined below.

[1] Thresholds for the Food industry were calculated using five years of data – 1997-2001 – because older data for this industry are unavailable from RMA.

C3A6-1 DEVELOPING THRESHOLD VALUES FOR PRE-TAX RETURN ON ASSETS (PTRA)

Pre-tax return on total assets measures management's effectiveness in employing the capital resources of the business to produce income. A low ratio may indicate that a borrower would have difficulty financing treatment investments and continuing to attract investment.

The following data from Risk Management Association *Annual Statement Studies* were used to calculate PTRA:

- *% Profit Before Taxes / Total Assets$_{25th}$* Ratio of profit before taxes divided by total assets and multiplied by 100 for the lowest quartile of values in each 4-digit SIC code.
- *Operating Profit* Gross profit minus operating expenses.
- *Profit Before Taxes* Operating profit minus all other expenses (net).

RMA provides a measure of pre-tax return on assets that approximates the measure EPA defined for the moderate impact analysis. As defined by RMA, this measure is the ratio of pre-tax *income* to assets, designated ROA_{RMA}:

$$ROA_{RMA} = \text{Pre-Tax Income (EBT)} / ASSETS_{25th}$$

However, as defined by EPA for its analysis, the numerator of the PTRA measure requires the use of earnings before interest and taxes (EBIT) instead of pre-tax income (EBT). Defined as EBIT, the PTRA numerator will capture all return from assets, whether going to debt or equity. To derive a pre-tax, total return value, EPA adjusted RMA's measure of PTRA using the median percentage values of EBIT and EBT available from RMA. This adjustment yields the PTRA measure that EPA used in the moderate impact analysis, designated $ROA_{316(b)}$:

$$ROA_{316(b)} = ROA_{RMA} * EBIT / EBT$$

Negative values are included in the weighted-industry PTRA averages but a different method is used to adjust the ROA values reported in RMA to the value used in the moderate impact analysis. Specifically, using only those observations (i.e., 4-digit SIC code and year combinations) with positive values for % Profit Before Taxes / Total Assets, Operating Profit, and Profit Before Taxes, EPA calculated an adjustment factor by subtracting the difference between $ROA_{316(b)}$ and ROA_{RMA} as follows:

$$ROA_{316(b)} - ROA_{RMA} = \text{adjustment factor.}$$

Those values were consolidated into industry-specific adjustment factors, weighted by 1997 value of shipments from the Economic Censuses (U.S. DOC, 1997). Each negative PTRA observation from RMA was adjusted by its industry specific adjustment factor to approximate the measure used in the moderate impact analysis:

$$ROA_{RMA} + \text{industry specific adjustment factor} = ROA_{316(b)}$$

The industry specific adjustment factors average 0.41 and range from 0.12 for Paper to 0.55 for the combined Steel/Aluminum industry.

C3A6-2 DEVELOPING THRESHOLD VALUES FOR INTEREST COVERAGE RATIO (ICR)

Interest coverage ratio measures a business' ability to meet current interest payments and, on a pro-forma basis, to meet the additional interest payments for new debt. A high ratio may indicate that a borrower would have little difficulty in meeting the interest obligations of a loan. This ratio serves as an indicator of a firm's capacity to take on additional debt, as might be required to finance installation of compliance technology.

The following data from Risk Management Association *Annual Statement Studies* were used to calculate ICR:

- *EBIT/Interest$_{25th}$* — Ratio of earnings (profit) before annual interest expense and taxes (EBIT) divided by annual interest expense for the lowest quartile of values in each 4-digit SIC code.
- *% Depr., Dep., Amort./Sales$_{med}$* — Median ratio of annual depreciation, amortization and depletion expenses divided by net sales and multiplied by 100.
- *Operating Profit* — Gross profit minus operating expenses.

RMA provides a measure of interest coverage that approximates the measure that EPA defined for the moderate impact analysis. As defined by RMA, this measure is the ratio of earnings before interest and taxes to interest, designated ICR_{RMA}:

$$ICR_{RMA} = EBIT / INTEREST_{25th}$$

However, as defined by EPA for its analysis, the numerator of the ICR measure requires the use of earnings before interest, taxes, depreciation, and amortization (EBITDA) instead of earnings before interest and taxes (EBIT). Defined this way, the ICR numerator will include all operating cash flow that could be used for interest payments. To derive the desired ICR value (designated $ICR_{316(b)}$), EPA adjusted the RMA value as outlined below:

$$ICR_{316(b)} = EBITDA / INTEREST$$

Therefore, $ICR_{316(b)} = ICR_{RMA} * (EBIT + DA) / EBIT$

or $ICR_{316(b)} = ICR_{RMA} * \{1+ [(DA / SALES) / (EBIT / SALES)]\}$

For consistency of calculation, EPA used the median values available from RMA for the adjusting both the numerator (DA / SALES) and denominator (EBIT / SALES) terms.[2]

EPA used the same method as described above to adjust the negative ICR values reported in RMA to the value used in the moderate impact analysis. Including only those observations with positive values for EBIT/Interest, % Depr., Dep., Amort./Sales, and Operating Profit, an adjustment factor was calculated by subtracting the difference between $ICR_{316(b)}$ and ICR_{RMA} as follows:

$$ICR_{316(b)} - ICR_{RMA} = \text{adjustment factor.}$$

An industry specific adjustment factor was calculated for ICR values similar to the PTRA. Each negative ICR observation from RMA was adjusted by its industry specific adjustment factor to approximate the measure used in the moderate impact analysis:

$$ICR_{RMA} + \text{industry specific adjustment factor} = ICR_{316(b)}$$

The industry specific adjustment factors average 0.66 and range from 0.55 for Petroleum to 0.70 for Paper and the combined Steel/Aluminum industry.

C3A6-3 SUMMARY OF RESULTS

Table C3A6-1 reports the resulting threshold values for PTRA and ICR by industry. The PTRA values range from 1.6 percent for Food industries to 2.9 percent for Chemicals. The ICR values range from 2.0 for Food industries to 2.4 for Chemicals.

[2] Numerator (% Depr., Dep., Amort./Sales) is available for quartile values; denominator (Operating Profit) only for median values.

Table C3A6-1: Summary of Moderate Impact Thresholds by Industry
based on 25th percentile value of firms reporting data to RMA

Industry	Pre-Tax Return on Assets (PTRA)	Interest Coverage Ratio (ICR)
Paper	2.1%	2.2
Chemicals	2.9%	2.4
Petroleum	2.1%	2.2
Steel/Aluminum	2.0%	2.1
Food & Beverage	1.6%	2.0
Other Industries	1.8%	2.0

Source: RMA, 1998; RMA, 2001; RMA, 2002; U.S. Economics Census, 1997; U.S. EPA Analysis, 2006.

REFERENCES

U.S. Department of Commerce. 1997. Bureau of the Census. *Census of Manufacturers, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries.*

Risk Management Association (RMA). 2002. *Annual Statement Studies 2001-2002.*

Risk Management Association (RMA). 2001. *Annual Statement Studies 2000-2001.*

Risk Management Association (RMA). 1998. *Annual Statement Studies 1997-1998.*

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Appendix C3A7: Analysis of Baseline Closure Rates

INTRODUCTION

This appendix presents information on the closure of establishments in the Primary Manufacturing Industries.

APPENDIX CONTENTS

C3A7-1 ANNUAL ESTABLISHMENT CLOSURES

EPA used *dynamic data* from the U.S. Small Business Administration (SBA) to estimate the rate at which facilities in the Primary Manufacturing Industries leave their industry each year. The SBA data report numbers of establishments starting up, closing, expanding employment and contracting employment each year from 1989 through 2002 (the latest year currently available).

EPA compared the percent of facilities predicted to close in the baseline closure analysis to typical closure rates in the six Primary Manufacturing Industries. The SBA data are organized by 3-digit SIC code for years 1990 through 1998, and 4-digit NAICS code for years 1999 through 2002. As a result, it is not possible to compile a series of data consistently aligned with the industries profiled. Nevertheless, EPA believes the SBA data can provide a general measure of establishment closures for comparison for the broad industry segments.

Table C3A7-1 shows the percentage of facilities potentially subject to the regulatory analysis options assessed as baseline closures, i.e. the facilities were found to be in severe financial distress absent any regulatory compliance costs and were likely to close. The table also presents the range and average of closure rates for each of the six Primary Manufacturing Industries. As reported in the table, between 1.4 percent and 14.4 percent of all facilities in these industries close annually. The estimated baseline closure rates for facilities in the Paper and Petroleum industries are higher than the observed closure rates in these industries, as reported in SBA data. However, EPA's baseline closure rates are estimated from sample survey data and are thus subject to the statistical uncertainty of the sample survey. EPA judges that the individual sample facility analyses accurately represent the baseline financial condition of the facilities, based on the data provided by facilities in their detailed facility questionnaires.

Table C3A7-1: Predicted Baseline Closures and Annual Percentage of Closures for Primary Manufacturing Industries (1990-2002)

Sector	Percent of 316(b) Facilities Assessed as Baseline Closures	Percent of Establishments Closing	
		Range	Average
Paper	11.1%	1.4% - 9.8%	5.4%
Chemicals	7.8%	2.3% - 11.0%	6.6%
Petroleum	18.7%	3.3% - 10.6%	6.6%
Steel	9.2%	4.6% - 14.4%	6.8%
Aluminum	0.0%	2.3% - 12.5%	6.8%
Food	0.0%	3.6% - 13.3%	8.1%
Total Primary Manufacturing Industries	**9.4%**	**1.4% - 14.4%**	**6.7%**

Source: U.S. SBA, 2006.

REFERENCES

U.S. Department of Commerce (U.S. DOC). 1997. Bureau of the Census. *1997 Economic Census Bridge Between NAICS and SIC.* Available at: http://www.census.gov/epcd/ec97brdg/.

U.S. Small Business Administration (SBA). 2006. *Firm Size Data*. Dynamic data, by births, deaths, growth, and decline (text files). Downloaded March 22, 2006. Available at: http://www.sba.gov/advo/research/data.html.

Appendix C3A8: Analysis of Other Regulations

APPENDIX CONTENTS

INTRODUCTION

Public comments on the proposed Phase III regulation argued that the manufacturers analysis should account for other environmental regulations that were recently or will soon be promulgated, potentially imposing additional costs beyond those reflected in the survey financial statements. The after-tax cash flow (ATCF) adjustment analysis, which EPA undertook to bring the estimates of cash flow forward from the time of the survey (1996-1998) to the time of the regulatory analysis (2005), accounts implicitly for additional regulatory costs incurred through 2005. However, it does not capture the impact of new regulations that came into effect during this period and for which costs had not yet been incurred, or fully incurred, by 2005.

To account for potential costs that had not been fully incurred by 2005, EPA researched additional regulatory requirements that might apply to facilities in the Primary Manufacturing Industries or the Food and Kindred Products industry (i.e., the "316(b) Manufacturing Industries"), whose costs were not likely to have been captured in the ATCF adjustment analysis. This research identified 13 regulations that apply to the 316(b) Manufacturing Industries and could result in additional costs to 316(b) manufacturing facilities.[1]

Table C3A8-1 below summarizes these regulations (referred to hereafter as "other regulations"). The following discussion uses both the regulation number presented in the first column and the abbreviated regulation name, bolded in the second column.

[1] The methodology used to identify the 13 other regulations is discussed in detail in a memorandum to the record, *Identifying Additional EPA Regulations That May Affect 316(b) Facilities.*

Table C3A8-1: Regulations Potentially Affecting 316(b) Manufacturers

No.	Regulation	Effective Date	Summary	316(b) Industries Affected	Compliance Date
1	National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional **Boilers and Process Heaters**; Final Rule	11/04	Sets emission limits for several hazardous air pollutants (HAPs) for boilers and process heaters	Pulp and paper mills, petroleum refineries, chemical manufacturers, and steel works (blast furnaces); potentially others	Not later than 9/07
2	National Emission Standards for Hazardous Air Pollutants: **Miscellaneous Organic Chemical Manufacturing**; Final Rule	11/03	Sets emission limits for several HAPs for miscellaneous organic chemical manufacturers	Chemical manufacturers	Not later than 11/06
3	National Emission Standards for Hazardous Air Pollutants for **Petroleum Refineries**: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units; Final Rule	04/02	Sets emission limits for several HAPs for catalytic cracking units, catalytic reforming units, and sulfur recovery limits, as well as associated by-pass lines	Petroleum refineries	Not later than 4/07; 12/09 for some refineries that meet certain requirements
4	National Emission Standards for Hazardous Air Pollutants: **Organic Liquids Distribution** (Non-Gasoline); Final Rule	02/04	Sets emission limits for several HAPs for new and existing organic liquids distribution operations	Chemical manufacturers, petroleum refineries; potentially others	Not later than 02/07; 02/14 for some roof storage tanks
5	National Emission Standards for Hazardous Air Pollutants for **Coke Ovens**: Pushing, Quenching, and Battery Stacks; Final Rule	04/03	Sets emission limits for several HAPs for coke ovens	Integrated steel mills	Not later than 04/06
6	National Emission Standards for Hazardous Air Pollutants: **Integrated Iron and Steel Manufacturing**; Final Rule	05/03	Sets emission limits for several HAPs for integrated iron and steel manufacturing facilities	Integrated steel mills	Not later than 05/06
7	National Emission Standards for Hazardous Air Pollutants: **Generic Maximum Achievable Control Technology**; Final Rules and Proposed Rule	07/02	Sets emission limits for four source categories: Cyanide Chemicals Manufacturing, Carbon Black Production, Ethylene Production, and Spandex Production.	Chemical manufacturers, certain segments	Not later than 07/05
8	Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the **Iron and Steel Manufacturing** Point Source Category; Final Rule	11/02	Revises CWA effluent limitations guidelines and standards for wastewater discharges from the iron and steel manufacturing industry	Steel manufacturers	Not later than 10/05
9	National Emission Standards for Hazardous Air Pollutants: **Cellulose Products Manufacturing**; Final Rule	06/02	Sets emission limits for HAPs for cellulose products manufacturing	Chemical manufacturers	Not later than 06/05; except 06/10 for rayon operations
10	National Emission Standards for Hazardous Air Pollutants: **Site Remediation**; Final Rule	10/03	Sets emission limits for several HAPs from site remediation	Chemical manufacturers, primary aluminum; potentially others	Not later than 10/06
11	National Emission Standards for Hazardous Air Pollutants: **Hydrochloric Acid Production**; Final Rule	04/03	Sets emission limits for HAPs for hydrochloric acid production facilities	Chemical manufacturers	Not later than 04/06
12	National Emission Standards for Hazardous Air Pollutants: Mercury Emissions from **Mercury Cell Chlor-Alkali Plants**; Final Rule	12/03	Sets emission limits for mercury for mercury cell chlor-alkali plants	Chemical manufacturers	Not later than 12/06
13	Control of Emissions of Air Pollution From **Nonroad Diesel Engines and Fuel**; Final Rule	08/04	Sets new emission standards for nonroad diesel engines and reduces sulfur content of nonroad diesel fuel.	Petroleum refineries (for production of lower sulfur content diesel fuel)	2007-2014, with staged reduction in sulfur content

Source: Rule preambles and supporting materials. See reference section.

To account for potential impacts of these other regulations on 316(b) manufacturing facilities, EPA determined to which 316(b) industry sectors, based on SIC code, each regulation applies and extracted the estimated per facility costs for facilities in the identified sectors. These costs were added to the free cash flow analysis for each 316(b) facility that is likely to be regulated by one of the 13 regulations (see also Chapter C3, Section 2.2). EPA then determined if the potential costs associated with these regulations would affect either the baseline or the post-compliance determination of impact for each facility. The remainder of this appendix discusses the methodology used for this analysis and the findings.

C3A8-1 METHODOLOGY

❖ ***Determination of applicability to 316(b) manufacturing facilities***

EPA first identified which of the in-scope manufacturing facilities would potentially incur costs as a result of each of the 13 other regulations. This determination was based on the SIC codes or NAICS codes specified in either the preamble or the supporting documents of each regulation. When a rule only specified NAICS codes, EPA identified all SIC codes associated with each NAICS code. All 316(b) manufacturing facilities in each 4-digit SIC sector subject to a given regulation are assumed to incur costs under that regulation. For three of the 13 other regulations (No. 5, 6, and 7), the supporting documents identified specific facilities that are regulated under the rule. For these three rules, EPA assumed that only those 316(b) manufacturing facility identified by the rule would incur compliance costs.

EPA's assumption about the applicability of the 10 regulations that did not identify specific facilities covered by the rule – i.e., that a 316(b) facility will incur costs under the regulation, if it belongs to an SIC code that is subject to that regulation – is likely to overstate the additional cost burden as a result of these regulations. Rules often only affect a specific part of an industry sector, depending, for example, on specific emission or discharge characteristics, or existing pollution control technology. It is therefore likely that not all 316(b) facilities in a given SIC code subject to a rule would actually incur costs under that rule. However, little information is available on those technical characteristics of 316(b) manufacturing facilities that would determine the applicability of the regulations to these facilities. EPA therefore made the conservative assumption that all 316(b) manufacturing facilities in the SIC codes covered by the other regulations would incur costs under those rules.

❖ ***Extraction of facility-level costs***

EPA considered several analytic approaches of applying the costs of the 13 other regulations to 316(b) manufacturing facilities that might be affected by them. Considered approaches included application of costs based on (1) model facilities, (2) average per facility cost, and (3) maximum per facility cost, if a range was provided. These costs might be based on the overall cost of a regulation or might be broken out by SIC code or another definition of industry sector. In addition, different concepts of cost were considered, including industry compliance costs and changes in producer surplus.

Ultimately, the cost application approach selected for each regulation depended on the level of detail that was available in the regulatory materials; however, EPA always used the method that would result in the most precise application of costs. In general, the model facility approach proved not feasible since insufficient information was available on how to map 316(b) facilities to specific models used in a regulation. EPA also decided not to apply a maximum per facility cost, if a range of per facility costs was provided. This approach would yield an upper-bound estimate but would, in most cases, significantly overstate the actual cost likely borne by each facility and would therefore not provide a good indication of the additional burden. EPA therefore calculated the average cost per facility for each regulation. This average cost was either calculated for each affected SIC code, if possible, or for the rule as a whole. Finally, EPA used the average loss in producer surplus, if available. Change in producer surplus is the best indicator of burden on complying facilities since it takes into account the ability of

passing-through compliance costs to customers and any resulting changes in prices and quantities sold. If changes in producer surplus were not available, EPA used industry pre-tax, annualized compliance costs.

Table C3A8-2 summarizes the cost application method that was used for each of the 13 other regulations and the resulting per facility costs that were applied to 316(b) manufacturing facilities in the relevant sectors.

Table C3A8-2: Per Facility Cost of Regulations that Affect 316(b) Industries[a]

No.	Regulation	Affected 316(b) SIC Codes	Cost Application Method	Per Facility Cost (Pre-Tax; $2004)
1	Boilers and Process Heaters NESHAP	1011, 2046, 2085, 2611, 2621, 2631, 2676, 2812, 2813, 2819, 2821, 2823, 2833, 2865, 2869, 2911, 3312, 3313, 3315, 3317, 3334, 3353, 3421, 3724	➢ Average cost per facility ➢ By 2-digit SIC code ➢ Change in producer surplus	SIC 10 – $364,600 SIC 20 – $221,400 SIC 26 – $210,300 SIC 28 – $166,600 SIC 29 – $32,600 SIC 33 – $396,800 SIC 34 – $161,900 SIC 37 – $219,400
2	Miscellaneous Organic Chemical Manufacturing NESHAP	2812, 2813, 2819, 2821, 2823, 2833, 2865, 2869	➢ Average cost per facility ➢ Total rule ➢ Industry compliance costs	$372,000
3	Petroleum Refineries NESHAP	2911	➢ The analysis predicted a gain in producer surplus as a result of the rule.	$0
4	Organic Liquids Distribution NESHAP	2821, 2865, 2869, 2911	➢ Average cost per facility ➢ By 2-digit SIC code ➢ Industry compliance costs	SIC 28 – $63,625 SIC 29 – $21,036
5	Coke Ovens NESHAP	3312 (specific facilities are identified)	➢ Average cost per facility ➢ By 4-digit SIC code ➢ Change in producer surplus	$2,646,700
6	Integrated Iron and Steel Manufacturing NESHAP	3312 (specific facilities are identified)	➢ Average cost per facility ➢ By 4-digit SIC code ➢ Change in producer surplus	$708,400
7	Generic Maximum Achievable Control Technology NESHAP	2819, 2869 (specific facilities are identified)	➢ 2819: average cost per facility ➢ 2869: maximum cost per facility ➢ By 2-digit SIC code ➢ Industry compliance costs	SIC 2819 – $193,700 SIC 2869 – $1,662,400
8	Iron and Steel Manufacturing ELG	3312	➢ Average cost per facility ➢ Total rule ➢ Industry compliance costs	$50,300
9	Cellulose Products Manufacturing NESHAP	2821, 2823, 2869	➢ Average cost per facility ➢ Total rule ➢ Industry compliance costs	$521,400
10	Site Remediation NESHAP	2819, 2821, 2865, 2869, 2911	➢ Average cost per facility ➢ Total rule ➢ Industry compliance costs	$569,000
11	Hydrochloric Acid Production NESHAP	2819, 2821, 2869	➢ Average cost per facility ➢ Total rule ➢ Industry compliance costs	$101,100
12	Mercury Cell Chlor-Alkali Plants NESHAP	2812	➢ Average cost per facility ➢ By 4-digit SIC code ➢ Industry compliance costs	$209,200
13	Nonroad Diesel Engines and Fuel Emissions Standards	2911	➢ Average cost per facility ➢ By 4-digit SIC code ➢ Change in producer surplus	$124,535

Source: EPA analysis of rule preambles and supporting materials. See reference section.

The per facility costs identified in Table C3A8-2 were then aggregated for each 316(b) manufacturing facility (based on SIC code or individual facility identification), converted to a post-tax value, and subtracted from baseline adjusted after-tax cash flow (see discussion of the impact analysis method in *Chapter C3: Economic Impact Analysis for Manufacturers*). For all 316(b) facilities that were operational in the baseline under each primary analysis option, EPA determined if the addition of the cost of complying with the 13 other regulations would cause the facility to (1) fail the baseline test and become a "baseline closure" or (2) fail the post-compliance impact test and be considered a "severe impact" of the analysis option.

C3A8-2 RESULTS

❖ ***Baseline analysis***

Of the 70 sample manufacturing facilities[2] that are operational in the baseline and have a design intake flow of at least 50 MGD, the smallest DIF applicability threshold of all three regulatory analysis options, only one facility would experience financial difficulty in the baseline (i.e., before incurring Phase III compliance costs) if it incurred the additional costs of the other regulations. This facility is a petroleum refinery with very low baseline profitability. EPA estimates that this facility might be subject to regulations #1, 3, 4, 10, and 13 and incur a total cost of $447,000 (post-tax) as a result of these regulations.

None of the other sample facilities would be affected in the baseline as a result of complying with the other regulations.

❖ ***Post-compliance analysis***

The post-compliance analysis sets aside facilities considered baseline closures. Of the 69 remaining sample manufacturing facilities (i.e., those that are not considered a baseline closure after applying the costs of the other regulations), no facility would experience a severe impact as a result of incurring both Phase III compliance costs and the costs of the other regulations.

This analysis shows that consideration of other regulations that might affect 316(b) manufacturing facilities would have a minimal effect on the results of EPA's facility impact analysis conducted in support of the Phase III rule.

[2] This analysis excludes one facility with zero revenues in the baseline.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 2006. Memorandum to the record: *Identifying Additional EPA Regulations That May Affect 316(b) Facilities*. June 1, 2006.

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters; Final Rule. 69 FR 55218. September 13, 2004. (Rule #1)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of the Industrial Boilers and Process Heaters NESHAP. EPA-452/R-04-011. February 2004. (Rule #1)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing; Final Rule. 68 FR 63857. November 10, 2003. (Rule #2)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking, Catalytic Performing, and Sulfur Plant Units; Final Rule. 67 FR 17762. April 11, 2002. (Rule #3)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis for the Petroleum Refineries (Catalytic Cracking, Catalytic Performing, and Sulfur Plant Units) NESHAP. A-97-36. December 1997. (Rule #3)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline); Final Rule. 69 FR 5038. February 3, 2004. (Rule #4)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of Air Pollution Regulations: NESHAP for Organic Liquids Distribution. EPA-452/R-02-017. August 2003. (Rule #4)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants for Coke Ovens: Pushing, Quenching, and Battery Stacks; Final Rule. 68 FR 18008. April 14, 2003. (Rule #5)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of Final Coke Ovens NESHAP. EPA 452/R-02-008. September 2002. (Rule #5)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Integrated Iron and Steel Manufacturing; Final Rule. 68 FR 27646. May 20, 2003. (Rule #6)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of Final Integrated Iron & Steel NESHAP. EPA 452/R-02-009. September 2002. (Rule #6)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Generic Maximum Achievable Control Technology; Final Rules and Proposed Rule. 67 FR 46259. July 12, 2002. (Rule #7)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis for the Proposed Cyanide Manufacturing NESHAP. EPA-452/D-00-004. May 2000. (Rule #7)

U.S. Environmental Protection Agency (U.S. EPA). Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the Iron and Steel Manufacturing Point Source Category; Final Rule. 67 FR 64216. October 17, 2002. (Rule #8)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of the Final Effluent Guidelines and Standards for the Iron & Steel Manufacturing Point Source Category. EPA-821-R-02-006. April 2002. (Rule #8)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Cellulose Products Manufacturing; Final Rule. 67 FR 40044. June 11, 2002. (Rule #9)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Site Remediation; Final Rule. 68 FR 58172. October 8, 2003. (Rule #10)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Site Remediation. EPA-452/R-03-016. August 2003. (Rule #10)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Hydrochloric Acid Production; Final Rule. 68 FR 19076. April 17, 2003. (Rule #11)

U.S. Environmental Protection Agency (U.S. EPA). Economic Impact Analysis of the Hydrochloric Acid (HCl) Production NESHAP – Final Report. EPA 453/R-03-001. February 2003. (Rule #11)

U.S. Environmental Protection Agency (U.S. EPA). National Emission Standards for Hazardous Air Pollutants: Mercury Emissions from Mercury Cell Chlor-Alkali Plants; Final Rule. 68 FR 70904. December 19, 2003. (Rule #12)

U.S. Environmental Protection Agency (U.S. EPA). Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule. 69 FR 38958. June 29, 2004. (Rule #13)

U.S. Environmental Protection Agency (U.S. EPA). Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines. EPA 420-R-04-007. May 2004. (Rule #13)

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Chapter D1: Regulatory Flexibility Analysis

INTRODUCTION

The Regulatory Flexibility Act (RFA) requires EPA to consider the economic impact a proposed rule would have on small entities. The RFA requires an agency to prepare a regulatory flexibility analysis for any notice-and-comment rule it promulgates, unless the Agency certifies that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities" (The Regulatory Flexibility Act, 5 U.S.C. § 605(b)).

Small entities include small businesses, small organizations, and small governmental jurisdictions. For assessing the impacts of the proposed regulation proposal on small entities, a small entity is defined as: (1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

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To evaluate the potential impact of this rule on small entities, EPA identified the domestic parent entity of each facility potentially subject to Phase III regulation, and determined its size. EPA then used a "sales test" to assess the potential severity of economic impact on small entities. The test compares annualized compliance cost to total entity sales revenues. This analysis uses three cost-to-revenue ranges to report the estimated number and percentage of small entities incurring compliance costs: less than 1%; at least 1% but less than 3%; and at least 3%. EPA assumed that small entities with costs of 3% of revenues or more might be significantly impacted as a result of the proposed rule.

In this chapter, EPA presents findings for the regulatory analysis options considered for existing facilities: the "50 MGD All Waterbodies option," the "200 MGD All Waterbodies option," and the "100 MGD for Certain Waterbodies option." These options all require the same reduction in impingement and entrainment (I&E), and differ only by design intake flow (DIF) applicability threshold and waterbody type. As a result, the number of facilities that would be required to meet the national categorical requirements varies among the three options: the 50 MGD All option has the broadest applicability, and would apply national categorical requirements to 144 facilities. The 200 MGD All option would apply national categorical requirements to 30 facilities, while the 100 MGD CWB option would apply national categorical requirements to 24 facilities. In addition to the analyses for these regulatory analysis options, EPA evaluated eight other supplementary options. Results for these supplementary analyses are presented in Appendix 1 to this chapter.

Although EPA has decided to retain permitting authorities' best professional judgment for Phase III existing facilities, EPA is promulgating section 316(b) requirements for Phase III new offshore oil and gas extraction facilities (also abbreviated as "new OOGE facilities"). These final requirements are based on a 2 MGD DIF applicability threshold and would apply to an estimated 124 new offshore oil and gas extraction facilities.

EPA's analysis found that the final rule would not have a significant economic impact on a substantial number of small entities. This determination is based on the finding that this rule would apply national categorical requirements to only one small entity in the new offshore oil and gas extraction industry segment. EPA estimates that this entity would incur annualized after-tax compliance costs of less than 0.1% of annual sales revenues. The sections that follow detail this analysis for new offshore oil and gas facilities as well as the existing manufacturing facilities considered in development of the final Phase III Section 316(b) rule.

D1-1 ANALYSIS OF NEW OFFSHORE OIL AND GAS EXTRACTION FACILITIES

This section discusses EPA's analysis of potential small entity impacts of the final regulation on the new offshore oil and gas extraction industry segment. The final Phase III regulation for new offshore oil and gas extraction facilities is based on a 2 MGD DIF applicability threshold and would regulate an estimated 124 new offshore oil and gas extraction facilities.

D1-1.1 Small Entity Determination

EPA used the information on existing small entities in the offshore oil and gas extraction industry to estimate the number of small entities associated with new facilities. EPA identified only 25 small entities currently operating mobile offshore drilling units or platforms in 2006 that could potentially be regulated by the final option for new facilities, should they construct new MODUs or platforms similar to those currently in operation.

D1-1.1.1 Mobile Offshore Drilling Units (MODUs)

EPA first identified the operating companies of existing MODUs operating in the Gulf of Mexico and the number of rigs owned by each company. EPA then linked these operating companies to their domestic parent companies. EPA identified 24 parent firms potentially affected by the final rule for new facilities (see Table B2-2 in *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*). These affiliations were determined primarily on the basis of Security and Exchange Commission (SEC) data using the *FreeEdgar* database, on which all filings of publicly held firms are available (SEC, 2006). The 10-K reports were the primary sources used to collect this information. The 10-K annual reports generally list significant subsidiaries of the parent company and are the source of income statement and balance sheet information used for characterizing financial conditions at a firm. The subsidiary lists were used to confirm ownership relationships.

EPA identified the NAICS code for each of the domestic parent companies currently operating a MODU in the Gulf of Mexico and the SBA size standard for each code. Table D1-1 shows that of the 24 parent entities operating MODUs in the Gulf of Mexico, none could be clearly identified as small. Only one of three firms presumed small currently operate MODUs of the type identified as likely to have DIFs of 2 MGD or more. EPA noted at proposal that only large firms are building new MODUs. Current data also indicate that only large firms are building new MODUs. EPA received no comments indicating that small businesses in this segment of the oil and gas industry will be affected by the final rule.

Table D1-1: NAICS Classification of MODU Parent Companies

SIC code	NAICS code	NAICS Description	SBA Definition of Small	Total Number of Firms[a]	
				Small	Large
1311	211111	Crude Petroleum and Natural Gas Extraction	500 employees	0	1
2911	324110	Petroleum Refineries	1,500	0	1
2810	325110	Industrial Chemical Mfgs.	1,000[b]	0	1
1381	213111	Drilling Oil and Gas Wells	500 employees	0	11
1389	213112	Support Activities for Oil and Gas Operations	$6.5 million in revenues	0	1
6799	Several NAICS	Various, related to misc. investment firms	$6.5 million in revenues[c]	0	1

[a] Does not include five foreign firms and three potentially small, unknown firm for which NAICS or SIC codes could not be located in publicly available data.

[b] Specific NAICS not listed in SBA definitions; largest employment definition from NAICS 325 used here.

[c] All three NAICS matched to SIC 6799 are listed $6.5 million in revenues.

Source: SEC, 2006; 13 CFR Part 121, Census, 2006

EPA estimates that 80 jack-up MODUs, 20 semi-submersible MODU, and three drillships will be built during the entire 20-year period of analysis, for a total of 103 new sources (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry* for a detailed discussion of the estimated number of new MODUs). EPA estimates that no small entities will be building new MODUs potentially subject to Phase III regulation.

D1-1.1.2 Platforms

❖ ***Gulf of Mexico***

At proposal, EPA determined, based on data from the Bureau of Land Management's Minerals Management Service (MMS), that, on average, one potentially regulated structure is built per year in the deepwater portion of the Gulf of Mexico. EPA therefore estimates that 20 structures will be constructed over the time frame of the analysis. With the exception of a few sub-sea completions, which do not operate potentially regulated CWIS; only large firms have built structures in the deepwater Gulf of Mexico. EPA reviewed the current status of deepwater structures (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry).* The structures built between 2003 and 2006 were all constructed by large firms. This trend is likely to continue, given the resources required to construct deep-sea structures, which sometimes exceed $1 billion dollars (EPA 821-B-00-012). Therefore, all of these structures are assumed to be constructed by large firms. EPA determined that it was unlikely that any platforms with DIFs of 2 MGD or more would be constructed outside of the deepwater Gulf and has not changed the count of small businesses operating within the shallow water Gulf of Mexico from proposal. EPA received no comments indicating that small businesses in this segment of the oil and gas industry will be affected by the final rule.

❖ ***California***

At proposal, EPA did not project any platforms off the California coast to be constructed during the time period of evaluation. Therefore, no small entities owning platforms in this area would be affected by this rule. EPA has not changed this assessment. EPA received no comments indicating small businesses in this segment of the oil and gas industry will be affected by the final rule.

❖ ***Alaska***

In Cook Inlet, Alaska, only one new platform has been constructed in the last 16 years. Most new exploration and development in this region takes place from existing infrastructure or from onshore locations. No definitive plans appear to be in place for any new platforms in State waters. In Federal waters, lower Cook Inlet is a source of potential activity, since MMS completed a lease bid in April 2004. No activity in this region was noted since that time, however. Given the long lead times between lease bid to operation, it may be unlikely that this lease bid will result in new platforms during the time frame of the analysis. To be conservative, however, EPA assumes that one such platform might be constructed in either Federal or State waters and begin operation in 2014. In other Federal areas in the Alaska region, little new activity is underway. BP has dropped plans for its Liberty project in the Beaufort Sea area. The only other activity that has taken place in recent years in Federal waters is an exploratory well drilled in the Beaufort Sea in 2003. No further activity has been noted since that time. MMS has completed lease sales in the Beaufort Sea in 2003 and 2005; however, the time frame for development, if any is undertaken, is likely to be beyond the time frame of this analysis. Because the most recently installed platform in Cook Inlet was built by a small entity, EPA projects that one small entity in Alaska would potentially be affected by the rule. This platform is estimated to have a DIF of greater than 2 MGD.

In summary, EPA projects that 20 new deepwater platforms in the Gulf of Mexico and one new platform in Cook Inlet would be potentially regulated under the final rule. All new platforms expected to be built in the Gulf of Mexico are assumed to be owned by large entities. The one new platform expected to be built in Cook Inlet is assumed to be owned by a small entity. For more information on oil and gas platforms, including profiles and projections for the number and type of new facilities estimated to begin operation, see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry.*

D1-1.2 Percentage of Small Entities Regulated

Due to the capital requirements for constructing a new MODU or platform with a DIF of 2 MGD or more, very few small businesses are expected to be affected by the final rule. For existing offshore oil and gas extraction facilities, EPA identified three (presumed) small businesses operating MODUs, 21 small businesses operating platforms in the shallow Federal Gulf of Mexico waters, and one small business operating a platform in Cook Inlet, Alaska for a total of 25 small businesses. EPA estimates one small entity would potentially be subject to the final rule for new offshore oil and gas extraction facilities. Therefore, one of 25 identified small entities in the offshore oil and gas extraction industry (4%) is estimated to be subject to Phase III regulation.

D1-1.3 Sales Test for Small Entities

There are no small entities projected to build new MODUs or deepwater platforms in the Gulf of Mexico that are potentially subject to the final rule. In Alaska, Forest Oil is considered the likeliest type of firm to build an Alaska platform during the time frame of the analysis. Forest Oil, which has had employment hovering near 500 employees, (458 at the end of 2003 and 506 at the end of 2004; currently the company reports fewer than 500 employees) is considered, for the sake of modeling purposes, a small business that might be large enough to construct a platform in Alaska. The SBA definition of a small entity in the Crude Petroleum and Natural Gas Extraction industry is less than 500 employees. In 2004, Forest Oil reported revenues of $913 million. The annualized pre-tax costs of compliance applied to all known affected or potentially affected structures owned by Forest Oil are $0.3 million and the annualized after-tax costs are $0.2 million. The cost-to-revenue ratio for the one small entity projected to be in scope of the final rule is therefore approximately 0.032% pre-tax or 0.021% after-tax.

D1-2 ANALYSIS OF MANUFACTURERS

EPA's 2000 Section 316(b) *Detailed Industry Questionnaire* (U.S. EPA, 2000) identified sample facilities in the six Primary Manufacturing Industries – Paper, Chemicals, Petroleum, Aluminum, Steel, and Food – estimated to be subject to regulation for Phase III existing facilities under the three regulatory analysis options. This section considers the effect of these options on facilities in the six Primary Manufacturing Industries, as well as facilities in Other Industries that are potentially subject to regulation under the analysis options. EPA excluded baseline closure facilities from this analysis (see *Chapter C3: Economic Impact Analysis for Manufacturers* for more information).

Although EPA's sample-based data for the Primary Manufacturing Industries support specific estimates of the number of small entity-owned facilities, these data do not support a specific estimate of the number of small entities that own these facilities. As a result, EPA estimated the number of small entities owning facilities in the Primary Manufacturing Industries as a range, based on alternative assumptions about the ownership of regulated manufacturing facilities by small entities.

D1-2.1 Small Entity Determination

The small entity determination for Manufacturers facilities was conducted in two steps:

1. For each analysis option, identify the domestic parent entity of the sample facilities in the Primary Manufacturing Industries and the additional known facilities in Other Industries.
2. For each analysis option, determine the size of the entities owning the sample facilities in the Primary Manufacturing Industries and the additional known facilities in Other Industries.

D1-2.1.1 Identification of Domestic Parent Entities

The RFA analysis is conducted at the highest level of domestic ownership, referred to as the "domestic parent entity" or "domestic parent firm." EPA gathered information on the domestic parent firm in the *Detailed Industry Questionnaire*. In instances where a response was not provided, EPA used several other data sources to determine the domestic parent firm including the *Screener Questionnaire*, corporate websites, and Dun & Bradstreet data (D&B, 2003).

D1-2.1.2 Size Determination of Domestic Parent Entities

EPA identified the size of each entity owning a potentially regulated Manufacturers facility using Small Business Administration (SBA) size threshold guidelines.[1] These thresholds define the minimum firm-level employment or revenue size, by industry (by 6-digit NAICS code), below which a business qualifies as a small business under SBA guidelines. To determine the entity size, EPA used data from the *Detailed Industry Questionnaire*, as well as the *Screener Questionnaire*, corporate websites, the U.S. Securities and Exchange Commission's (SEC) *FreeEdgar* database, corporate websites, and Dun & Bradstreet data (SEC, 2004; D&B, 2003).

EPA started with the unique firm-level, 4-digit SIC codes for firms that own existing facilities potentially subject to Phase III regulation under the regulatory analysis options (see Table D1-2). EPA used information from the Economic Census, *1997 Economic Census: Bridge Between NAICS and SIC*, to determine 1997 NAICS Codes classifications for these firms. EPA also used an additional Economic Census publication/dataset, *1997 NAICS Matched to 2002 NAICS*, to bring the data forward to NAICS 2002 so that the most current small business thresholds could be used (Census, 2003).

[1] The SBA website provides the most recent size thresholds at http://www.sba.gov/size/sizetable2002.html.

The SBA small business size standards changed from a SIC code-based system to a NAICS code-based system on October 1, 2000. However, because EPA structured its data collection effort for existing facilities before these changes, its survey data collection was based on the SIC code framework. In addition, as part of the data collection, EPA confirmed the SIC code assignment of the survey facilities but did not request the NAICS classification of the facilities. In its analysis for the proposed Phase III regulation, EPA therefore used the SIC-based size criteria for determining whether a firm owning a 316(b) facility would be classified as small or large. For this small entity analysis, however, EPA revised its approach to use the NAICS code-based size criteria for determining whether a firm owning a 316(b) facility would be classified as small or large. In many instances, substituting the NAICS-based criterion was straightforward: the SIC either mapped to a single NAICS code or the SIC code mapped to more than one NAICS code and the multiple NAICS codes all have the same size criterion. Some of the 316(b) facility SIC codes, though, map to more than one NAICS code and the size criteria for these multiple NAICS code varies. In these instances, the determination of an appropriate NAICS code and the associated small entity size criterion is ambiguous. To be conservative in its analysis, in these ambiguous instances – i.e., a single SIC code maps to more than one NAICS code and the size criteria for the NAICS codes vary – EPA used the higher/highest of the NAICS-based size thresholds for the small entity size determination. Using the higher/highest of the NAICS-based size thresholds for the comparison provides a more conservative test of the chance that a firm would be classified as *small*. As a result, the analysis may overstate the presence of small entity-owned facilities among the set of facilities potentially subject to the Phase III regulation under each analysis option.

Table D1-2, following page, presents the unique firm-level 4-digit SIC codes and corresponding SBA size standards used to determine the size of entities that own Manufacturers facilities determined to be potentially subject to Phase III regulation.

Table D1-2: Unique 4-Digit Firm-Level SIC Codes and SBA Size Standards for Manufacturers [a]

SIC Code	SIC Description	SBA Size Standard
1011	Iron Ores	500 Employees
1311	Crude Petroleum and Natural Gas	500 Employees
2011	Meat Packing Plants	500 Employees
2046	Wet Corn Milling	750 Employees
2061	Cane Sugar, Except Refining	500 Employees
2062	Cane Sugar Refining	750 Employees
2063	Beet Sugar	750 Employees
2075	Soybean Oil Mills	1,000 Employees
2211	Broadwoven Fabric Mills, Cotton	1,000 Employees
2421	Sawmills and Planing Mills, General	500 Employees
2611	Pulp Mills	750 Employees
2621	Paper Mills	750 Employees
2631	Paperboard Mills	750 Employees
2653	Corrugated and Solid Fiber Boxes	500 Employees
2673	Plastics, Foil, and Coated Paper Bags	500 Employees
2679	Converted Paper and Paperboard Products, NEC	500 Employees
2711	Newspapers: Publishing, or Publishing and Printing	500 Employees
2812	Alkalies and Chlorine	1,000 Employees
2813	Industrial Gases	1,000 Employees
2819	Industrial Inorganic Chemicals, NEC	1,000 Employees
2821	Plastics Material and Synthetic Resins, and Nonvulcanizable Elastomers	750 Employees
2824	Manmade Organic Fibers, Except Cellulosic	1,000 Employees
2833	Medicinal Chemicals and Botanical Products	750 Employees
2834	Pharmaceutical Preparations	750 Employees
2851	Paints, Varnishes, Lacquers, Enamels, and Allied Products	500 Employees
2869	Industrial Organic Chemicals, NEC	1,000 Employees
2873	Nitrogenous Fertilizers	1,000 Employees
2874	Phosphatic Fertilizers	500 Employees
2891	Adhesives and Sealants	500 Employees
2899	Chemicals and Chemical Preparations, NEC	1000 Employees
2911	Petroleum Refining	1,500 Employees
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	1,000 Employees
3313	Electrometallurgical Products, Except Steel	750 Employees
3315	Steel Wiredrawing and Steel Nails and Spikes	1,000 Employees
3316	Cold-Rolled Steel Sheet, Strip, and Bars	1,000 Employees
3317	Steel Pipe and Tubes	1,000 Employees
3334	Primary Production of Aluminum	1,000 Employees
3353	Aluminum Sheet, Plate, and Foil	750 Employees
3421	Cutlery	500 Employees
3714	Motor Vehicle Parts and Accessories	1,000 Employees
3728	Aircraft Parts and Auxiliary Equipment, NEC	1,000 Employees
3999	Manufacturing Industries, NEC	500 Employees
5153	Grain and Field Beans	500 Employees
5171	Petroleum Bulk Stations and Terminals	$11.5 Million
6141	Personal Credit Institutions	$165.0 Million (Assets)
6719	Offices of Holding Companies, NEC	$6.5 Million

NAICS-based size criteria were assigned to SIC codes as described in accompanying text.

Source: U.S. EPA Analysis, 2006; U.S. SBA, 2006.

As discussed in Chapter C3, EPA estimated the number of small entities owning facilities in the manufacturing industries as a range, based on alternative assumptions about the possible ownership of potentially regulated manufacturing facilities by small entities. EPA considered two cases based on the sample weights developed from the facility survey. These cases provide a range of estimates for (1) the number of firms incurring compliance costs and (2) the costs incurred by any firm owning a regulated facility. *Chapter C3: Economic Impact Analysis for Manufacturers* provides a more detailed description of these cases.

Case 1: Upper bound estimate of number of firms owning facilities that face requirements under each primary analysis option; lower bound estimate of total compliance costs that a firm may incur.

For this case, EPA assumed (1) that a firm owns only the regulated sample facility(ies) that it is known to own from the sample analysis and (2) that this pattern of ownership, observed for sampled facilities and their owning firms, extends over the facility population represented by the sample facilities. This case minimizes the possibility of multi-facility ownership by a single firm and thus maximizes the count of affected firms, but also minimizes the potential cost burden to any single firm.

Case 2: Lower bound estimate of number of firms owning facilities that face requirements under each primary analysis option; upper bound estimate of total compliance costs that a firm may incur.

For this case, EPA inverted the prior assumption and assumed that any firm owning a regulated sample facility(ies) owns the known sample facility(ies) and all of the sample weight associated with the sample facility(ies). This case minimizes the count of affected firms, while tending to maximize the potential cost burden to any single firm.

Data in the rest of this section are presented by the industry sector of the firm. EPA determined firm sector based on the sample facilities owned by the firm. If all of the sampled facilities owned by the firm are in the same industry sector, then that industry sector was assigned to the firm. If sample facilities owned by the firm are in more than one industry sector, then the firm was assigned to the "multiple industries" firm sector. One known facility in the Other Industries group was found to be owned by a firm that owns facilities in the Primary Manufacturing Industries. This firm is included in the data reported for multiple industries. The remaining entities that were found to own facilities in Other Industries are presented separately.

The number of entities in Primary Manufacturing Industries that would be required to meet the national categorical requirements set by the regulatory analysis options varies by option based on the DIF applicability threshold and waterbody type specified in the option. Under the 50 MGD All option, between 50 (Case 2 estimate) and 116 (Case 1 estimate) Primary Manufacturing Industries firms would potentially be subject to Phase III regulation. Under the 200 MGD All option, the number of firms potentially regulated is between 17 (Case 2) and 29 (Case 1). Finally, the 100 MGD CWB option would potentially regulate between 14 (Case 2) and 25 (Case 1) entities. EPA determined that no firms owning potentially regulated 316(b) manufacturing facilities would be small.

Table D1-3 on the following page presents the total number of firms with facilities potentially subject to the national categorical requirements, as well as the number and percentage of those firms determined to be small. The data are shown for the three regulatory analysis options under the two ownership cases described above.

Table D1-3: Number of Firms by Firm Sector and Size (assuming two different ownership cases)

Firm Sector	Case 1: Upper bound estimate of number of firms owning facilities that face requirements under the regulatory analysis			Case 2: Lower bound estimate of number of firms owning facilities that face requirements under the regulatory analysis		
	Total Number of Firms	Number of Small Firms	Percentage of Firms that are Small	Total Number of Firms	Number of Small Firms	Percentage of Firms that are Small
50 MGD All option						
Paper	26	0	0%	13	0	0%
Chemicals	42	0	0%	12	0	0%
Petroleum	12	0	0%	10	0	0%
Steel	19	0	0%	8	0	0%
Aluminum	3	0	0%	1	0	0%
Food	6	0	0%	2	0	0%
Multiple Industries	8	0	0%	4	0	0%
Firms that own facilities in Primary Manufacturing Industries[a,b]	116	0	0%	50	0	0%
Additional firms that own known facilities in Other Industries[a]	2	0	0%	2	0	0%
200 MGD All option						
Paper	3	0	0%	2	0	0%
Chemicals	4	0	0%	3	0	0%
Petroleum	4	0	0%	4	0	0%
Steel	10	0	0%	3	0	0%
Aluminum	0	0	0%	0	0	0%
Food	3	0	0%	1	0	0%
Multiple Industries	5	0	0%	4	0	0%
Firms that own facilities in Primary Manufacturing Industries[a,b]	29	0	0%	17	0	0%
Additional firms that own known facilities in Other Industries[a]	0	0	0%	0	0	0%
100 MGD CWB option						
Paper	2	0	0%	1	0	0%
Chemicals	9	0	0%	4	0	0%
Petroleum	5	0	0%	4	0	0%
Steel	7	0	0%	2	0	0%
Aluminum	0	0	0%	0	0	0%
Food	0	0	0%	0	0	0%
Multiple Industries	4	0	0%	3	0	0%
Firms that own facilities in Primary Manufacturing Industries[a,b]	25	0	0%	14	0	0%
Additional firms that own known facilities in Other Industries[a]	1	0	0%	1	0	0%

[a] Excludes firms whose only sample facilities close in the baseline.

[b] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

D1-2.2 Percentage of Small Entities Under the Regulatory Analysis Options

As part of its assessment of the small entity impact of the regulatory analysis options on Manufacturers, EPA estimated the percentage of all small entities in the Primary Manufacturing Industries that would be expected to be subject to the national requirements for the three regulatory analysis options. Because the analysis of facilities in Other Industries is not based on a statistically valid sample, EPA could not estimate the number of entities in Other Industries that would be subject to the regulatory requirements of the regulatory analysis options, nor the percentage that are small entities. From its prior analysis of the use of cooling water in industries other than the electric power industry, EPA judges the overall effect and coverage of Phase III regulation in the Other Industries to be minor in relation to the effect and coverage in the six Primary Manufacturing Industries.

EPA used the Statistics of U.S. Businesses (SUSB) published by the Small Business Administration to estimate the total number of manufacturing establishments owned by small firms in each of the six Primary Manufacturing Industries. EPA included all of the SIC industry groups with a sample facility in the six Primary Manufacturing Industries. Based on the SUSB reporting framework, EPA considered all establishments owned by a firm with 500 or fewer employees to be a small entity-owned establishment. This assumption will tend to underestimate the number of small entity-owned establishments in these industry groups because the SBA small entity size criterion is greater than 500 employees for some SIC codes. Underestimating the total number of small entities would result in an overestimate of the percentage of small entities in these industries that are potentially subject to Phase III regulation under each option.

EPA estimated that 31,963 entities within the six Primary Manufacturing Industries are small. However, since no small entity is expected to be subject to national requirements under the three regulatory analysis options, the percentage of all small entities subject to Phase III regulation is zero.

D1-2.3 Sales Test for Small Entities

In addition to considering the fraction of small entities in each of the affected Manufacturers industries that would be potentially subject to Phase III regulation, EPA also assessed the extent of economic/financial impact on small entities by comparing estimated compliance costs to estimated entity revenue (also referred to as the "sales test"). The analysis is based on the ratio of estimated annualized after-tax compliance costs to annual revenue of the entity. For this analysis, EPA judges that entities for which annualized compliance costs equal or exceed 3% of revenue, might experience a significant economic/financial impact as a result of the regulatory requirements under the three regulatory analysis options.

EPA included the following compliance cost categories in this analysis: pilot study capital costs; one-time technology costs of complying with the regulatory requirements; one-time costs of installation downtime; annual operating and maintenance costs; and permitting costs (initial permit costs, annual monitoring costs, and permit re-issuance costs). A detailed summary of how these costs were developed is presented in *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* and *Chapter C3: Economic Impact Analysis for Manufacturers*. EPA collected revenue data for the small entities in EPA's *Detailed Industry Questionnaire*.

In the Manufacturers segment, EPA determined that no small entities would face regulatory requirements under any of the three regulatory analysis options; therefore, no small entities would incur compliance costs or significant economic impact under these options.

D1-3 SUMMARY OF REGULATORY FLEXIBILITY ANALYSIS

The RFA analysis, conducted in examining regulatory options for existing facilities, is summarized in Table D1-4. Only one small entity would be subject to the national categorical requirements for new offshore oil and gas extraction facilities under the final rule. This small entity is estimated to incur compliance costs of less than

0.1% of annual revenues. Although EPA is not promulgating a rule for Phase III existing facilities, this analysis shows that no small entity would have been impacted by any of the three regulatory analysis options considered for existing facilities. As a result of this analysis, EPA concluded that the final rule for new offshore oil and gas extraction facilities will not have a significant economic impact on a substantial number of small entities

Table D1-4: Summary of Small Entity Impact Ratio Ranges by Sector

Industry	Total Number of Small Entities	Number of Small Entities Owning Facilities Potentially Subject to Regulation	Percentage of Small Entities Subject to Regulation	Compliance Cost/Annual Revenues		
				0-1%	1-3%	>3%
New OOGE Facilities	25	1	4.2%	1	-	-
Manufacturers	31,963	-	0.0%	-	-	-

Source: U.S. EPA Analysis, 2006.

REFERENCES

Dun and Bradstreet (D&B). 2003. Data extracted from D&B Webspectrum over 2002 and 2003.

Regulatory Flexibility Act. Pub. L. 96-354, Sept. 19, 1980, 94 Stat. 1164 (Title 5, Sec. 601 et seq.).

U.S. Census Bureau (Census). 2003. *1997 NAICS Matched to 2002 NAICS.* May 2003. Available at: http://www.census.gov/epcd/naics02/NAICS97toNAICS02.xls.

U.S. Environmental Protection Agency (U.S. EPA). 2000. *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures*.

U.S. Environmental Protection Agency (U.S. EPA). 1999a. *Information Collection Request (ICR), Detailed Industry Questionnaires: Phase II Cooling Water Intake Structures & Watershed Case Study Short Questionnaire.* August 1999.

U.S. Environmental Protection Agency (U.S. EPA). 1999b. *Revised Interim Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act.* March 29, 1999.

U.S. Securities and Exchange Commission (SEC). 2004. FreeEdgar Database. Accessed between 1999 and 2004. Available at: www.freeedgar.com.

U.S. Small Business Administration (U.S. SBA). 2006. *Small Business Size Standards matched to North American Industry Classification System.* Available at: http://www.sba.gov/size/sizetable2002.html

Appendix D1A: Summary of Results for Supplemental Options

INTRODUCTION

APPENDIX CONTENTS

This appendix presents the results of the RFA analysis for the supplemental options evaluated in development of the final rule. For all options, facility counts and other results only include those Phase III existing facilities that are (1) non-baseline closures and (2) estimated to be within the regulatory scope of the evaluated option. See *Chapter C3: Economic Impact Analysis for Manufacturers* for more information on baseline closures and counts of facilities subject to national categorical requirements under each option. See the main body of this chapter for a description of data sources and methodologies used in these analyses.

D1A-1 SUMMARY OF RESULTS

In Table D1A-1, following page, the evaluated supplemental options for existing facilities are presented in order of increasing stringency (e.g., the most stringent supplemental option evaluated being I&E requirements on all waterbodies). As discussed in the main chapter, the estimates of the total number of regulated small entities and the percentage of all small entities subject to Phase III regulation *exclude* consideration of entities in Other Industries within the Manufacturers segment (see section D1-1.2). However, the estimated number of small entities incurring costs in the three cost-to-revenue ranges *includes* the known number of small entities owning known facilities in Other Industries. As this analysis is conducted at the firm level, not the facility level, and a single firm may own multiple facilities with varying DIFs, results for manufacturers are not broken out by the 2-50 MGD and 50+ flow ranges.

Table D1A-1: Summary of Small Entity Impact Ratio Ranges for Existing Facilities by Regulatory Segment (Facilities with DIF of at least 2 MGD)

Industry	Total Number of Small Entities	Number of Small Entities Owning Facilities Subject to Regulation	Percentage of Small Entities Subject to Regulation	Compliance Cost/Annual Revenues		
				0-1%	1-3%	>3%
I-only Everywhere Option						
Manufacturers[a,b]	31,963	13	< 0.001%	13	0	0
Electric Generators	543 - 1,295	13	1.0% - 2.4%	9	4	0
Total[c]	32,506 – 33,258	26	<0.001%	22	4	0
I&E Like Phase II Option						
Manufacturers[a,b]	31,963	13	< 0.001%	13	0	0
Electric Generators	543 - 1,295	13	1.0% - 2.4%	7	5	1
Total[c]	32,506 – 33,258	26	<0.001%	20	5	1
I&E Everywhere Options						
Manufacturers[a,b]	31,963	13	< 0.001%	13	0	0
Electric Generators	543 - 1,295	13	1.0% - 2.4%	6	4	3
Total[c]	32,506 – 33,258	26	<0.001%	19	4	3

[a] For Manufacturers, the more conservative cost analysis (Case 2 estimate) is presented, which is likely to overstate the compliance costs that would be incurred by any single small entity but may understate the number of small entities incurring compliance costs.

[b] For Manufacturers, the "Total Number of Small Entities" and the "Number of Small Entities Owning Facilities Potentially Subject to Regulation" *exclude* entities in Other Industries; the numbers presented in the cost-to-revenue ranges *include* known entities in Other Industries.

[c] Individual numbers may not sum to reported totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Chapter D2: UMRA Analysis

INTRODUCTION

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Title II of the Unfunded Mandates Reform Act of 1995, Pub. L. 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under UMRA section 202, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that might result in expenditures by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year.

Before promulgating a regulation for which a written statement is needed, UMRA section 205 generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that might significantly or uniquely affect small governments, including Tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant intergovernmental mandates, and informing, educating, and advising small governments on compliance with regulatory requirements.

Today's final rule applies Section 316(b) requirements to new offshore oil and gas extraction facilities (also abbreviated as "new OOGE facilities") in Phase III. These requirements are based on a 2 MGD DIF applicability threshold and will apply to an estimated 124 new offshore oil and gas extraction facilities. Under today's regulation, none of the potential Phase III existing facilities will be subject to national categorical requirements. EPA has decided that Phase III existing facilities should continue to be permitted on a case-by-case best professional judgment basis.

In addition to presenting findings for the Final Regulation described above, this chapter also presents findings for the three regulatory analysis options for existing facilities that were co-proposed with the Final Regulation: the "50 MGD for All Waterbodies" option (the "50 MGD All" option), the "200 MGD for All Waterbodies" option (the "200 MGD All" option), and the "100 MGD for Certain Waterbodies" option (the "100 MGD CWB" option). These regulatory analysis options all require the same reduction in impingement and entrainment (I&E), and differ only by applicability criteria defined on the basis of design intake flow (DIF) and waterbody type. All of these options would also apply 316(b) requirements to new offshore oil and gas extraction facilities based on a 2 MGD applicability threshold. Throughout this UMRA analysis, EPA presents cost estimates for the final rule promulgated today, as well as for the three regulatory options considered in preparation for this rule.

- ***Final Regulation:*** EPA estimates the total annualized after-tax costs of compliance for the Final Regulation to be $1.9 million ($2004) for the estimated 124 new offshore oil and gas extraction facilities. All of these direct facility costs are incurred by the private sector. No facility owned by State and local governments is subject to the national requirements under the final rule. Additionally, State and local permitting authorities will not incur costs to administer the rule for new offshore oil and gas extraction facilities because these facilities are under Federal jurisdiction not under State jurisdiction. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $1.5 million in 2013.
- ***50 MGD for All Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for the final rule to be $32.8 million ($2004). All of these direct facility costs are incurred by the private sector (including 146 Manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is expected to be subject to the national requirements under the final rule. Additionally, State and local permitting authorities are estimated to incur $0.6 million annually to administer the rule, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $132.1 million in 2011.
- ***200 MGD for All Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for this option to be $17.9 million ($2004). All of these direct facility costs are incurred by the private sector (including 31 manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is expected to be subject to the national requirements under this evaluated option. Additionally, State and local permitting authorities are estimated to incur $0.2 million annually to administer this option, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $78 million in 2010.
- ***100 MGD for Certain Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for this option to be $13.0 million ($2004). All of these direct facility costs are incurred by the private sector (including 23 manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is expected to be subject to the national requirements under this evaluated option. Additionally, State and local permitting authorities are estimated to incur $0.2 million annually to administer this option, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $79 million in 2011.

Given these findings, EPA has determined that this rule does not contain a Federal mandate that may result in expenditures of $100 million or more in any one year, for State, local, and Tribal governments, in the aggregate, or the private sector. This chapter contains information on compliance and administrative costs, and on impacts on small governments. In addition, the appendix to this chapter presents summary results for the supplemental regulatory options considered during the development of the proposed regulation and the final Phase III regulation.

D2-1 ANALYSIS OF IMPACTS ON GOVERNMENT ENTITIES

Governments may incur two types of costs as a result of this final rule:

1. Direct costs to comply with the rule for facilities owned by government entities, and

2. Administrative costs to implement the rule.

Both types of costs are discussed on the following pages.

D2-1.1 Compliance Costs for Government-Owned Facilities

The Electric Generating Industry is the only industry segment potentially subject to Phase III regulation with government-owned facilities. None of the facilities in the manufacturers or new offshore oil and gas extraction facility segment are owned by a government. Therefore, no government-owned facility would incur compliance costs under the Final Regulation or the regulatory analysis options.

D2-1.2 Administrative Costs for New Offshore Oil and Gas Extraction Facilities

For new facilities in the offshore oil and gas extraction industry, NPDES permitting is consolidated under General Permits, which are administered by EPA Regional offices. No States are involved in these permitting activities. Thus, States would incur no costs for new facility permitting. Three EPA Regions (Region 6, Region 4, and Region 10) are expected to be the only entities responsible for permitting. Because States are not involved in the section 316(b) permitting for new offshore oil and gas extraction facilities, the Federal government would incur no costs for State oversight. The affected EPA Regions would incur three types of costs for implementing the final rule: (1) start-up activities, (2) activities associated with the initial General Permit containing the new section 316(b) requirements and subsequent permit renewals, and (3) annual activities. These activities and their timing assumptions are discussed below. The timing of these costs and how they are discounted and annualized are documented in the Oil and Gas 316(b) Compliance Cost Model (see DCN 7-4018). For more information on the methods used for discounting and cost annualization, see *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities*.

It should be noted that costs incurred by the Federal government are not part of the UMRA analysis, but are part of the social cost analysis presented in *Chapter E1: Summary of Social Costs* and *Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry* of this EA.

D2-1.2.1 Start-Up Activities

Start-up activities are not considered incremental to existing Regional permitting activities (U.S. EPA, 2004).

D2-1.2.2 Initial Post-Promulgation Permitting and Repermitting Activities

Initial permitting and repermitting activities relate to the review of data collected for the regional studies and the individual data submitted by facilities that plan to be permitted (or re-permitted) under the General Permits in the three EPA Regions. Table D2-1and Table D2-2present the individual activities and their costs for Regions 4, 6, and 10. These costs are on a per facility basis, i.e., the regions incur these costs for each facility that is permitted under their general permits (see DCN 7-4018, which illustrates how these costs are aggregated and assigned to the regions).

Table D2-1 presents the permit issuance activities and their related costs. The per facility initial permitting cost of approximately $12,600 would be incurred in 2012 for facilities brought on-line or launched between 2007 and 2012 (Region 6) and in 2014 for facilities brought on-line or launched between 2007 and 2014 (Region 4 and 10). In later years, these costs are assumed to be incurred in the year of compliance of each new facility. The burden of repermitting is expected to be smaller than the burden of initial permitting, approximately $3,300 per facility, because the permitting authority is already familiar with the facility's case and the type of information the facility would provide. Repermitting costs are incurred in 5-year intervals after the initial post-promulgation permit.

Table D2-1: Federal Government Costs for Permit Issuance Activities (Per Facility Permitted under General Permits; $2004)

Activity	First Post-Promulgation Permit	Repermitting
Review Source Water Physical Data	$297	$116
Review CWIS Data	$893	$266
Review Source Water Body Flow Information	$297	$116
Review CWIS Velocity Information	$1,335	$417
Review Design and Construction Technology Plan	$1,480	$420
Review Regional Monitoring Study Design and Sampling Plans	$1,480	-
Review Regional Monitoring Study	$2,848	-
Review Source Water Baseline Biological Characterization Study	$1,335	$870
Determine Monitoring Frequency	$297	$116
Determine Record Keeping and Reporting Frequency	$297	$116
Consider Public Comments	$1,335	$417
Issue Permit	$272	$66
Permit Record Keeping	$133	$25
ODCs Lump Sum	$318	$318
Total[a]	$12,620	$3,264

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2006.

D2-1.2.3 Annual Activities

Annual costs are associated with the activities that must be undertaken by the regions each year for each active facility operating under the applicable General Permit. These activities also include a one-time cost for determining monitoring frequency reduction. This cost is assigned only to facilities operating at the time the decision about monitoring frequency reduction is made (assumed to occur at the end of the initial two years of monitoring, which is 2013 for the Region 6 permit and 2015 for the Region 4 and Region 10 permits). Table D2-2 outlines these activities and their associated costs.

Table D2-2: Federal Government Costs for Annual Activities (Per Facility Permitted under General Permits; $2004)

Activity	Annual Costs
Review of Yearly Status Report	$697
Compliance Tracking	$596
Determination on Monitoring Frequency Reduction[a]	$0[a]
Record Keeping	$141
ODCs Lump Sum	$31
Total[b]	$1,464

[a] One-time cost of $464 incurred only by those facilities operating in 2013 (Region 6) or 2014 (Regions 4 and 10).

[b] Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2006.

D2-1.3 Administrative Costs for Existing Facilities

The requirements of section 316(b) are implemented through the National Pollutant Discharge Elimination System (NPDES) permit program. Forty-five States and one Territory currently have NPDES permitting authority under section 402(c) of the Clean Water Act (CWA). EPA estimates that States and Territories would have incured three types of costs associated with implementing the requirements of the three regulatory analysis options for existing facilities: (1) start-up activities, (2) permitting activities associated with the initial NPDES permit containing the new section 316(b) requirements and subsequent permit renewals, and (3) annual activities.[1] EPA estimates that the total costs for these activities under the three regulatory analysis options would be between $0.16 million and $0.64 million, annualized over 30 years at a 7% discount rate. Table D2-3presents the estimated annualized costs of the three major administrative activities under the "50 MGD All", the "200 MGD All," and the "100 MGD All" options.

Table D2-3: - Annualized Government Administrative Costs (millions, $2004)

Activity	50 MGD All Option	200 MGD All Option	100 MGD CWB Option
Start-Up Activities	$0.01	$0.01	$0.01
Permitting Activities	$0.45	$0.11	$0.14
Annual Activities	$0.18	$0.04	$0.04
Total	**$0.64**	**$0.16**	**$0.19**

Source: U.S. EPA Analysis, 2006.

Based on the specific permitting requirements of each facility (see *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities*), EPA calculated total government costs of implementing the regulatory analysis options by adding the cost of start-up activities to the aggregate costs for each facility's first post-promulgation permit, repermitting activities, and annual activities. The maximum one-year undiscounted implementation cost incurred by governments under the three regulatory analysis options is approximately $2.3 million in 2011 ("50 MGD All" option). EPA notes that the annualized cost of administrative activities depends on when they are incurred. If facilities reach compliance later than assumed in this analysis, permitting authorities' administrative activities would also occur in later years. As a result, the annualized costs of the options to permitting authorities would be lower because administrative costs incurred in later years have lower present values.

D2-1.3.1 Start-Up Activities

Forty-five States and one Territory with NPDES permitting authority would be expected to undertake start-up activities to prepare for administering these regulatory analysis options. Start-up activities include reading and understanding the rule, mobilization and planning of the resources required to address the rule's requirements, and training technical staff on how to review materials submitted by facilities and make determinations on the Phase III requirements for each facility's NPDES permit. In addition, permitting authorities would be expected to incur other direct costs, e.g., for purchasing supplies and copying. Table D2-4shows the total start-up costs EPA estimated permitting authorities to incur. Each permitting authority would incur start-up costs of $4,000 under each analysis option. EPA assumes that all permitting authorities would incur the initial start-up activities at the beginning of 2007, the year the Phase III requirements would take effect.

[1] The costs associated with implementing Phase III requirements are documented in EPA's Information Collection Request (U.S. EPA, 2003).

Table D2-4: Government Costs of Start-Up Activities (per Permitting Authority; $2004)

Start-Up Activity	Start-Up Costs
Read and Understand Rule	$1,007
Mobilization/Planning	$1,750
Training	$1,257
Other Direct Costs	$50
Total	$4,064

Source: U.S. EPA, 2006.

D2-1.3.2 Initial Post-Promulgation Permitting and Repermitting Activities

Permitting authorities would be required to implement the Phase III requirements by adding compliance requirements to each facility's NPDES permit. Permitting activities include incorporating section 316(b) requirements into the first post-promulgation permit and making modifications, if necessary, to each subsequent permit. For this analysis, EPA assumed that each complying facility's first permit containing the new section 316(b) requirements would be issued between 2010 and 2014.[2] Repermitting activities would take place every five years after initial permitting.

The regulatory analysis options require facilities to submit the same type of information for their initial post-promulgation permit and for each permit renewal application. Therefore, the type of administrative activities required by the initial post-promulgation and each subsequent permit are similar. EPA identified the following major activities associated with State permitting activities: reviewing submitted documents and supporting materials, verifying data sources, consulting with facilities and the interested public, determining specific permit requirements, and issuing the permit. Table D2-5 presents the State permitting activities and associated costs, on a per permit basis. The permitting costs do not vary by type of facility to be permitted (however, the costs associated with permitting facilities with (a) a recirculating system or a wedgewire screen in the baseline or (b) a facility installing a new wedgewire screen are less). The burden of repermitting is expected to be smaller than the burden of initial permitting because the permitting authority is already familiar with the facility's case and the type of information the facility would provide.

Two of the permitting activities presented within Table D2-5 pertain only to facilities opting for a site-specific determination of best technology available (BTA). An authorized State is able to permit a facility to opt for a site-specific determination if it can demonstrate that the proposed technology would result in environmental performance within a watershed that is comparable to the reductions in impingement and entrainment mortality that would otherwise be achieved under the regulatory analysis options.

[2] For an explanation of how the compliance years were assigned to facilities subject to Phase III regulation, see Chapter C1.

Table D2-5: Government Permitting Costs (per Permit; $2004)

Activity	First Post-Promulgation Permit	Repermitting
Review Source Water Physical Data	$299	$117
Review CWIS Data	$898	$267
Review CWS Operation Narrative	$898	$267
Review Proposal for Collection of Information for Comprehensive Demonstration Study	$1,342	$420
Review Source Water Body Flow Information	$299	$117
Review Design and Construction Technology Plan	$1,487	$423
Review Impingement Mortality Monitoring Results	$4,409	$1,323
Review Entrainment Characterization Monitoring Results	$4,409	$1,323
Review Baseline Characterization Monitoring Results and Study Findings	$13,063	$3,935
Review Pilot Study for New Impingement & Entrainment Technology	$1,342	-
Review Restoration Measures[a]	$2,369	$711
Review Technology Installation and Operation Plan & Verification Monitoring Plan	$1,079	$321
Determine Monitoring Frequency	$299	$117
Determine Record Keeping and Reporting Frequency	$299	$117
Considering Public Comments	$1,342	$420
Issuing Permit	$273	$66
Permit Record Keeping	$134	$25
Other Direct Costs	$310	$310
Total Cost (without site specific determination)[b]	**$34,551**	**$10,279**
Review Information to Support Site-Specific Determination of BTA	$47,380	$14,214
Establish Requirements for Site-Specific Technology	$1,198	$332
Site-Specific Costs[c]	$48,578	$14,546
Total Cost (with site specific determination)[b]	**$83,129**	**$24,825**

[a] Assumed to apply to only 10% of facilities. Only 10% of the per permit costs of $23,690 and $7,107 is accounted for in this framework.

[b] Individual numbers may not add up to total due to independent rounding.

[c] Cost incurred only for permits of facilities conducting site-specific demonstrations.

Source: U.S. EPA, 2006.

As shown in Table D2-5, initial post-promulgation permits that do not require a site-specific determination of BTA are expected to impose an average per permit cost of $34,600 on the issuing permitting authority. For initial post-promulgation permits that include a site-specific determination, the State administrative costs associated with the site-specific determination are estimated to increase by $48,600, resulting in total per permit costs of approximately $83,000.

The State administrative cost for a permit renewal that does not include a site-specific determination is $10,000. For facilities that conduct a site-specific determination, the cost per permit imposed on the permitting authority increases by $14,500, resulting in an average repermitting cost of almost $25,000.

Permitting authorities also incur costs associated with review of verification studies conducted at facilities. In addition to reviewing the studies, permitting authorities must modify permits in case of unfavorable study results. In total, verification study review is expected to cost permitting authorities $800 per permit. Table D2-6 lists the components of verification study review.

Table D2-6: Government Costs of Verification Study Review (per Permit; $2004)

Activity	Post-Promulgation Permit Costs
Review of Verification Studies	$234
Permit Modification Due to Unfavorable Results	$533
Recordkeeping	$25
Other Direct Costs	$10
Total	**$802**

Source: U.S. EPA, 2006.

Finally, State governments may incur costs associated with alternative regulatory requirements. States may adopt in their NPDES programs, alternative regulatory requirements to reduce impingement mortality and entrainment within a watershed. If these States demonstrate to the Administrator that the reductions are comparable to what would otherwise be achieved under rule, the Administrator would approve these alternative regulatory requirements. For the final Phase II rule, EPA estimated that 10 regulatory permitting authorities would incur costs associated with alternative regulatory requirements. For this analysis, EPA assumed that those States interested in adopting alternative regulatory requirements would have done so under the Phase II rule. As a result, EPA assumes that these States would incur no additional costs for establishing alternative regulatory requirements under the regulatory analysis options. Table D2-7 reports the cost of each component of establishing alternative regulatory requirements.

Table D2-7: Government Costs of Alternative Regulatory Requirements (per Permitting Authority; $2004)

Activity	Post-Promulgation Permit Costs
Document Alternative Regulatory Requirements	$1,402
Document Environmental Conditions within Watershed	$1,869
Include Supporting Historical Studies, Calculations, and Analyses	$3,652
Submit Documentation	$100
Recordkeeping	$142
Other Direct Costs	$100
Total[a]	$7,264

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2006.

D2-1.3.3 Annual activities

In addition to the start-up and permitting activities discussed above, permitting authorities would have to perform certain annual activities to ensure the continued implementation of the requirements of the regulatory analysis options. These annual activities include reviewing biannual status reports, tracking compliance, making determinations on monitoring frequency reduction, and record keeping.

Table D2-8 outlines the annual activities necessary for each permit, along with their estimated costs. These costs begin with the issuance of the first permit following promulgation of the rule. A total cost of approximately $1,600 is estimated for each permit per year.

Table D2-8: Government Costs for Annual Activities (per Permit; $2004)

Annual Activity	Annual Costs
Review of Biannual Status Report[a]	$350
Compliance Tracking	$599
Determination of Monitoring Frequency Reduction	$467
Record Keeping	$142
Other Direct Costs	$30
Total[b]	**$1,588**

[a] This is a cost that is incurred once every two years. Therefore, only half of the total review cost of $701 is accounted for in this annual framework.

[b] Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2006.

The Federal government would likely incur costs for reviewing and validating proper implementation of the section 316(b) elements of States' NPDES permits that are issued after promulgation of one of the analysis opitons. Table D2-9 outlines the annual activities associated with reviewing a permit issued after promulgation of a rule, along with the estimated cost of each activity. EPA estimates a cost of approximately $2,600 per permit for post-promulgation review. Costs incurred by the Federal government are not part of the UMRA analysis but are part of the social cost analysis presented in Chapter E1 of this EA.

Table D2-9: Federal Government Permit Program Oversight Activities (per Permit; $2004)

Annual Activity	Post-Promulgation Permit Costs
Review Source Water Physical Data	$150
Review CWIS Data	$117
Review CWS Operation Narrative	$117
Review Proposal for Collection of Information for Comprehensive Demonstration Study	$117
Review Source Water Body Flow Information	$117
Review Design and Construction Technology Plan	$150
Review Impingement Mortality Study and/or Entrainment Characterization Study	$350
Review Pilot Study for New Impingement & Entrainment Technology	$117
Review Restoration Measures[a]	$35
Review Technology Installation and Operation Plan & Verification Monitoring Plan	$150
Review the Monitoring Frequency	$117
Permit Record Keeping	$134
Other Direct Costs	$50
Total Cost (without site specific determination)[b]	$1,721
Review Information to Support Site-Specific Determination of BTA	$701
Review the Established Requirements for Site-Specific Technology	$150
Site-Specific Costsc	$851
Total Cost (with site specific determination)b	**$2,572**

[a] Assumed to apply to only 10% of facilities. Only 10% of the per permit cost of $350 is accounted for in this framework.

[b] Applies only to certain facilities, according to site specific determination of BTA Compliance Schedule.

[c] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2006.

D2-1.4 Impacts on Small Governments

EPA's analysis also considered whether the final rule may significantly or uniquely affect small governments (i.e., governments with a population of less than 50,000). As described earlier, the Electric Generating Industry is the only industry segment with government-owned facilities; governments own no facilities in either the Manufacturers or new offshore oil and gas extraction facility segments. No government-owned facility exceeds the 50 MGD DIF applicability threshold (the smallest DIF applicability threshold of the three regulatory analysis options). Therefore, no government-owned facility would incur compliance costs under the Final Regulation or the three regulatory analysis options. As no facilities owned by small governments are subject to national requirements under the regulatory analysis options, EPA has determined that the Final Regulation and the regulatory analysis options contain no regulatory requirements that might significantly or uniquely affect small governments.

D2-2 COMPLIANCE COSTS FOR THE PRIVATE SECTOR

The only compliance costs incurred by the private sector result from facilities complying with the Final Regulation or the regulatory analysis options. These options all require the same reduction in impingement and entrainment (I&E), and differ only by applicability threshold, which is based on the facilities' design intake flow and waterbody type. These direct facility costs already include the cost to facilities of obtaining their NPDES permits. The methodology for determining compliance costs for Phase III new offshore oil and gas extraction facilities is presented in Chapter B1: *Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities;* the methodology for Phase III existing facilities is presented in *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* of this EA. EPA determined that all facilities subject to national categorical requirements under the three regulatory analysis options to be owned by private entities.

Private sector costs for the Final Regulation for Phase III new facilities and for the regulatory analysis options for Phase III existing facilities (discounted at a 7% rate) are as follows:

- Under the ***Final Regulation for new offshore oil and gas extraction facilities,*** 124 facilities are estimated to incur annualized compliance costs of $1.9 million and a maximum one-year cost of $1.5 million in 2013.
- Under the ***50 MGD for All Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities***, 270 facilities are estimated to incur annualized compliance costs of $32.8 million and a maximum one-year cost of $132.1 million in 2011.
- Under the ***200 MGD for All Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities***, 155 privately-owned facilities are estimated to incur annualized compliance costs of $17.9 million and a maximum one year cost, in 2010, of $78 million.
- Under the ***100 MGD for Certain Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities***, 147 privately-owned facilities are estimated to incur annualized compliance costs of $13.0 million and a maximum one year cost, in 2011, of $79 million.

D2-3 SUMMARY OF UMRA ANALYSIS

EPA estimates that the final rule will not result in aggregate expenditures of at least $100 million for State and local governments as well as the private sector in any one year. Table D2-9, following page, summarizes the after-tax compliance costs for facilities, and the costs to implement the rule for permitting authorities, under the final rule and the regulatory analysis options.

Table D2-10: Summary of UMRA Costs (millions, $2004)

Sector	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs	Government Implementation Costs	Total	Facility Compliance Costs	Government Implementation Costs	Total
Final Rule for New Offshore Oil and Gas Extraction Facilities						
Government Sector (excl. Federal)	n/a	n/a	n/a	n/a	n/a	n/a
Private Sector	$1.9	n/a	$1.9	$1.5	n/a	$1.5
50 MGD for All Waterbodies Option for Existing Facilities / Final Rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.6	$0.6	$0.0	$2.3	$2.3
Private Sector	$32.8	n/a	$32.8	$132.1	n/a	$132.1
200 MGD for All Waterbodies Option for Existing Facilities / Final Rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.2	$0.2	$0.0	$0.8	$0.8
Private Sector	$17.9	n/a	$17.9	$77.9	n/a	$77.9
100 MGD for Certain Waterbodies Option for Existing Facilities / Final Rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.2	$0.2	$0.0	$1.2	$1.2
Private Sector	$13.0	n/a	$13.0	$79.5	n/a	$79.5

Source: U.S. EPA Analysis, 2006.

Costs for new offshore oil and gas extraction facilities and the three regulatory analysis options for Phase III existing facilities are as follows:

- The ***Final Regulation*** would impose no annual costs on State and local governments, and $1.9 million on the private sector. Maximum one-year costs are estimated to be approximately $1.5 million for the private sector. This maximum annual cost value is estimated to occur in 2013.
- The ***500 MGD for All Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities Final Regulation*** would impose annual costs of $0.6 million on State and local governments (in implementation costs only), and $32.8 million on the private sector. Maximum one-year costs under this option would be approximately $2.3 million for government entities, and $132.1 million for the private sector. Both of these maximum annual cost values would occur in 2011.
- The ***200 MGD for All Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities*** would impose annual costs of $0.2 million on State and local governments (in implementation costs only), and $17.9 million on the private sector. Maximum one-year costs under this option are approximately $0.8 million for government entities in 2011, and $78 million for the private sector in 2010.
- The ***100 MGD for Certain Waterbodies option for existing facilities and the Final Regulation for new offshore oil and gas extraction facilities*** would impose annual costs of $0.2 million on State and local governments (in implementation costs only), and $13.0 million on the private sector. Maximum one-year costs under this option are approximately $1.2 million for government entities and $79 million for the private sector, both of which are estimated to occur in 2011.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Information Collection Request for Cooling Water Intake Structures at Phase III Facilities (Final Rule)*. ICR Number 2169.01. June 2006.

Appendix D2A: Summary Results for Supplemental Options

INTRODUCTION

This appendix presents the results of the UMRA analysis for the supplemental options considered for Phase III existing facilities, combined with the final rule for new offshore oil and gas extraction facilities. For all options, results only include those Phase III existing facilities that are (1) non-baseline closures and (2) subject to national categorical requirements under the option. See the main body of this chapter for a description of data sources and methodologies used in these analyses.

D2A-1 SUMMARY OF RESULTS

Table D2A-1 below, presents results for the I-only Everywhere supplemental option. Table D2A-2 and Table D2A-3, following page, present results under the I&E Like Phase II option and I&E Everywhere option, respectively. The other supplemental options for Phase III existing facilities, combined with the final rule for new offshore oil and gas extraction facilities, are presented in order of increasing stringency (e.g., the most stringent option in terms of regulatory requirements is the I&E Everywhere option, compared to the other evaluated supplemental options).

Table D2A-1: Summary of UMRA Costs for the I-only Everywhere option (millions, $2004)

Sector	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs	Government Implementation Costs	Total	Facility Compliance Costs	Government Implementation Costs	Total
Final rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Private Sector	$1.8	n/a	$1.8	$712.2	n/a	$712.2
For Electric Generators with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	$1.4	$0.1	$1.5	$2.3	$0.1	$2.4
Private Sector	$1.0	n/a	$1.0	$1.2	n/a	$1.2
For Manufacturers with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	n/a	$0.5	$0.5	n/a	$1.7	$1.7
Private Sector	$19.2	n/a	$19.2	$471.5	n/a	$471.5
For Manufacturers with a DIF of 50 MGD or greater						
Government Sector (excl. Federal)	n/a	$0.4	$0.4	n/a	$1.2	$1.2
Private Sector	$20.6	n/a	$20.6	$123.3	n/a	$123.3

Source: U.S. EPA Analysis, 2006.

Table D2A-2: Summary of UMRA Costs for the I&E Like Phase II option (millions, $2004)

Sector	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs	Government Implementation Costs	Total	Facility Compliance Costs	Government Implementation Costs	Total
Final rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Private Sector	$1.8	n/a	$1.8	$712.2	n/a	$712.2
For Electric Generators with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	$2.0	$0.1	$2.2	$3.0	$0.2	$3.2
Private Sector	$1.3	n/a	$1.3	$1.6	n/a	$1.6
For Manufacturers with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	n/a	$0.8	$0.8	n/a	$2.6	$2.6
Private Sector	$30.7	n/a	$30.7	$491.3	n/a	$491.3
For Manufacturers with a DIF of 50 MGD or greater						
Government Sector (excl. Federal)	n/a	$0.6	$0.6	n/a	$2.4	$2.4
Private Sector	$31.0	n/a	$31.0	$138.6	n/a	$138.6

Source: U.S. EPA Analysis, 2006.

Table D2A-3: Summary of UMRA Costs for the I&E Everywhere option (millions, $2004)

Sector	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs	Government Implementation Costs	Total	Facility Compliance Costs	Government Implementation Costs	Total
Final rule for New OOGE Facilities						
Government Sector (excl. Federal)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Private Sector	$1.8	n/a	$1.8	$712.2	n/a	$712.2
For Electric Generators with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	$2.5	$0.2	$2.7	$3.6	$0.2	$3.8
Private Sector	$5.5	n/a	$5.5	$25.2	n/a	$25.2
For Manufacturers with a DIF of 2 – 50 MGD						
Government Sector (excl. Federal)	n/a	$1.2	$1.2	n/a	$4.0	$4.0
Private Sector	$50.7	n/a	$50.7	$596.4	n/a	$596.4
For Manufacturers with a DIF of 50 MGD or greater						
Government Sector (excl. Federal)	n/a	$0.8	$0.8	n/a	$3.1	$3.1
Private Sector	$37.3	n/a	$37.3	$190.3	n/a	$190.3

Source: U.S. EPA Analysis, 2006.

Chapter D3: Other Administrative Requirements

INTRODUCTION

This chapter presents several other analyses conducted in developing this final rule. These analyses address the requirements of Executive Orders and other legislation and regulations applicable to the Phase III regulation.

CHAPTER CONTENTS:

D3-1 EXECUTIVE ORDER 12866: REGULATORY PLANNING AND REVIEW

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The order defines a "significant regulatory action" as one that is likely to result in a rule that may:

- have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or Tribal governments or communities; or
- create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; or
- materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, EPA determined that this final rule is a "significant regulatory action." As such, this action was submitted to OMB for review. Changes made in response to OMB suggestions or recommendations are documented in the public record.

D3-2 PAPERWORK REDUCTION ACT OF 1995

The Paperwork Reduction Act of 1995 (PRA) (superseding the PRA of 1980) is implemented by the Office of Management and Budget (OMB) and requires that agencies submit a supporting statement to OMB for any information collection that solicits the same data from more than nine parties. The PRA seeks to ensure that

Federal agencies balance their need to collect information with the paperwork burden imposed on the public by the collection.

The definition of "information collection" includes activities required by regulations, such as permit development, monitoring, record keeping, and reporting. The term "burden" refers to the "time, effort, or financial resources" the public expends to provide information to or for a Federal agency, or to otherwise fulfill statutory or regulatory requirements. PRA paperwork burden is measured in terms of annual time and financial resources the public devotes to meet one-time and recurring information requests (44 U.S.C. 3502(2); 5 C.F.R. 1320.3(b)).

Information collection activities may include:

- reviewing instructions;
- using technology to collect, process, and disclose information;
- adjusting existing practices to comply with requirements;
- searching data sources;
- completing and reviewing the response; and
- transmitting or disclosing information.

Agencies must provide information to OMB on the parties affected, the annual reporting burden, the annualized cost of responding to the information collection, and whether the request significantly impacts a substantial number of small entities. An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a currently valid OMB control number.

EPA's estimate of the information collection requirements imposed by the final Phase III regulation are documented in the Information Collection Request (ICR), which accompanies this regulation (U.S. EPA, 2006).

D3-3 EXECUTIVE ORDER 13132: FEDERALISM

Executive Order 13132 (64 FR 43255, August 10, 1999) requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." Policies that have federalism implications are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

Under section 6 of Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments or unless EPA consults with State and local officials early in the process of developing the regulation. EPA also may not issue a regulation that has federalism implications and that preempts State law, unless the Agency consults with State and local officials early in the process of developing the regulation.

This final rule does not have federalism implications. It would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. Rather, this final rule would result in no additional administrative costs on States that have an authorized NPDES program since EPA is not promulgating a rule for Phase III existing facilities. For the three regulatory analysis options considered in developing a regulation for Phase III existing facilities, EPA estimated that States *would* have been subject to the following annual burden if EPA were promulgating a rule for Phase III existing facilities:

- 50 MGD for All Waterbodies option: 20,263 hours with a cost of $920,995 ($912,975 in labor costs and $8,020 in non-labor costs);
- 200 MGD for All Waterbodies option: 7,396 hours with a cost of $333,825 ($330,995 in labor costs and $2,830 in non-labor costs);
- 100 MGD for Certain Waterbodies option: 8,362 hours with a cost of $380,960 ($378,647 in labor costs and $2,313 in non-labor costs).

It is noted that States do not incur any burden hours and costs to administer the final rule for the new offshore oil and gas extraction facilities because the EPA Regions administer their permits; as these facilities are outside the jurisdictional waters of the States.

The final national cooling water intake structure requirements would be implemented through permits issued under the NPDES program. Forty-five States and one territory are currently authorized pursuant to section 402(b) of the CWA to implement the NPDES program. In States not authorized to implement the NPDES program, EPA issues NPDES permits. Under the CWA, States are not required to become authorized to administer the NPDES program. Rather, such authorization is available to States if they operate their programs in a manner consistent with section 402(b) and applicable regulations. Generally, these provisions require that State NPDES programs include requirements that are as stringent as Federal program requirements. States retain the ability to implement requirements that are broader in scope or more stringent than Federal requirements. (See section 510 of the CWA.)

EPA does not expect this final rule to have substantial direct effects on either authorized or nonauthorized States or on local governments because it would not change how EPA and the States and local governments interact or their respective authority or responsibilities for implementing the NPDES program. For purposes of this rule, the relationship and distribution of power and responsibilities between the Federal government and the State and local governments are established under the CWA (e.g., sections 402(b) and 510); nothing in this rule alters that. Thus, the requirements of section 6 of the Executive Order do not apply to this rule.

Although section 6 of Executive Order 13132 does not apply to this rule, EPA did consult extensively with State governments and representatives of local governments in developing definitions and concepts relevant to the section 316(b) rulemaking and this final rule. These consultations – which included meetings with, and presentations to, State and local officials in a range of venues – aided in developing the proposed and final Phase III regulation. These consultations are documented in the EA for the proposed Phase III regulation (*Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities*, November 2004, EPA-821-R-04-006) and in the public record.

D3-4 EXECUTIVE ORDER 13175: CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

Executive Order 13175 (65 FR 67249, November 6, 2000) requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." "Policies that have tribal implications" is defined in the Executive Order to include regulations that have "substantial direct effects on one or more Indian Tribes, on the relationship between the Federal government and the Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes." The Phase III final regulation does not have tribal implications. It would not have substantial direct effects on tribal governments, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes, as specified in Executive Order 13175. EPA's analyses show that no facility subject to Phase III regulation is owned by tribal

governments. The Phase III final regulation does not affect Tribes in any way in the foreseeable future. Accordingly, the requirements of Executive Order 13175 do not apply to this rule.

D3-5 EXECUTIVE ORDER 13045: PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS

Executive Order 13045 (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866 and (2) concerns an environmental health or safety risk that EPA has reason to believe might have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health and safety effects of the planned rule on children and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. EPA considers the Phase III final regulation to be a significant rule under Executive Order 12866. However, it does not concern an environmental health or safety risk that would have a disproportionate effect on children. Therefore, it is not subject to Executive Order 13045.

D3-6 EXECUTIVE ORDER 13211: ACTIONS CONCERNING REGULATIONS THAT SIGNIFICANTLY AFFECT ENERGY SUPPLY, DISTRIBUTION, OR USE

Executive Order 13211, ("Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001)) requires EPA to prepare a Statement of Energy Effects when undertaking regulatory actions identified as "significant energy actions." For the purposes of Executive Order 13211, "significant energy action" means:

> "any action by an agency (normally published in the Federal Register) that promulgates or is expected to lead to the promulgation of a proposed rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking:
>
> (1) (i) that is a significant regulatory action under Executive Order 12866 or any successor order, and
>
> (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or
>
> (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs (OIRA) as a significant energy action."

For those regulatory actions identified as "significant energy actions," a Statement of Energy Effects must include a detailed statement relating to (1) any adverse effects on energy supply, distribution, or use (including a shortfall in supply, price increases, and increased use of foreign supplies) and (2) reasonable alternatives to the action with adverse energy effects and the expected effects of such alternatives on energy supply, distribution, and use.

Today's final rule does not constitute a "significant energy action" as defined in Executive Order 13211 because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. The final rule contains no compliance requirements that would:

- reduce crude oil supply in excess of 10,000 barrels per day;
- reduce fuel production in excess of 4,000 barrels per day;
- reduce coal production in excess of 5 million tons per day;
- reduce electricity production in excess of 1 billion kilowatt hours per day or in excess of 500 megawatts of installed capacity;

- increase energy prices in excess of 10 percent;
- increase the cost of energy distribution in excess of 10 percent;
- significantly increase dependence on foreign supplies of energy; or
- have other similar adverse outcomes, particularly unintended ones.

Of the potential significant adverse effects on the supply, distribution, or use of energy (listed above) only a few potentially apply to this final rule. Regulation of new offshore oil and gas facilities might affect (1) the production of oil and gas, (2) energy prices, and (3) the dependence on foreign supplies of energy. If EPA were promulgating a rule for Phase III existing facilities, regulation of existing manufacturing facilities could lead to (1) reduced electricity production and, (2) because the rule will apply to facilities in the petroleum refinery sector, could lead to reduced refining capacity and therefore reduced domestic fuel production. Potential energy effects associated with the regulation of new offshore oil and gas extraction facilities and existing manufacturing facilities are described in the following two subsections.

D3-6.1 New Offshore Oil and Gas Extraction Facilities

This rule applies only to new offshore oil and gas extraction facilities and not existing ones. Hence the rule would have no impact on existing production of oil and gas, energy prices, installed capacity, nor would it significantly increase dependence on foreign supplies of energy. EPA's analysis identified no barriers to entry or energy effects. EPA therefore concludes that the final rule would not significantly affect new offshore oil and gas production, energy prices, or dependence on foreign supplies of energy.

Based on these analyses for regulated existing and new facilities, EPA concludes that this final rule will not cause a *Significant Adverse Effect* and does not constitute a *Significant Energy Action* within the meaning of Executive Order 13211. As a result, EPA did not prepare a Statement of Energy Effects.

D3-6.2 Existing Manufacturing Facilities

As documented at Proposal, EPA considered the potential impact of the Phase III regulation on power production in manufacturing facilities. While facilities in the manufacturing industry segments generate electricity, their contribution to the overall supply of electricity is insignificant (less than 0.02%); therefore, compliance with the regulatory analysis options considered for Phase III existing facilities regulation by this industry segment would not perceptibly affect the supply, distribution, or use of energy.

Based on comments received at Proposal, in its analysis for the final regulation, EPA examined the potential for the regulation to cause a "significant adverse effect" on the Nation's energy economy through its potential impact on petroleum refining operations. EPA performed this analysis in accordance with guidance for implementing Executive Order 13211 ("Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use"). Specifically, EPA examined whether the shut-down of refinery operations for installing compliance equipment could cause a substantial share of total U.S refinery capacity to be out of service during technology installation. Among the three primary options considered for Phase III existing facilities, the 50 MGD for All Waterbodies option is the broadest in scope. From it's analysis of this option, EPA concluded that the annualized loss in refining capacity from the due to installation would amount to approximately 1,800 barrels per day or approximately a 0.01% loss in total U.S. refining capacity. Relative to total U.S. refinery capacity, this impact is minimal and less than the OMB defined threshold of 4,000 barrels per day of fuel production for a Significant Adverse Effect under Executive Order 13211.[1]

[1] This analysis is documented in the public record for the Phase III final regulation.

D3-7 NATIONAL TECHNOLOGY TRANSFER AND ADVANCEMENT ACT OF 1995

Section 12(d) of the National Technology Transfer and Advancement Act (NTTAA) of 1995, Pub L. No. 104-113, Sec. 12(d) directs EPA to use voluntary consensus standards in its regulatory activities unless doing so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standard bodies. The NTTAA directs EPA to provide Congress, through the Office of Management and Budget (OMB), explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This final rule does not involve such technical standards. Therefore, EPA is not considering the use of any voluntary consensus standards.

D3-8 EXECUTIVE ORDER 12898: FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

Executive Order 12898 (59 FR 7629, February 11, 1994) requires that, to the greatest extent practicable and permitted by law, each Federal agency must make achieving environmental justice part of its mission. E.O. 12898 provides that each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures such programs, policies, and activities do not have the effect of (1) excluding persons (including populations) from participation in, or (2) denying persons (including populations) the benefits of, or (3) subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin.

Today's final rule requires that the location, design, construction, and capacity of cooling water intake structures (CWIS) at Phase III facilities reflect the best technology available for minimizing adverse environmental impact. For several reasons, EPA does not expect that this final rule would have an exclusionary effect, deny persons the benefits of the participation in a program, or subject persons to discrimination because of their race, color, or national origin. In fact, because EPA expects that this final rule would help to preserve the health of aquatic ecosystems located in reasonable proximity to Phase III facilities, it believes that all populations, including minority and low-income populations, would benefit from improved environmental conditions as a result of this rule.

D3-9 EXECUTIVE ORDER 13158: MARINE PROTECTED AREAS

Executive Order 13158 (65 FR 34909, May 31, 2000) requires EPA to "expeditiously propose new science-based regulations, as necessary, to ensure appropriate levels of protection for the marine environment." EPA may take action to enhance or expand protection of existing marine protected areas and to establish or recommend, as appropriate, new marine protected areas. The purpose of the Executive Order is to protect the significant natural and cultural resources within the marine environment, which means "those areas of coastal and ocean waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law." EPA expects that the Final Section 316(b) Rule for Phase III Facilities would advance the objective of Executive Order 13158.

Marine protected areas (MPAs) include designated areas with varying levels of protection, from fishery closure areas, to aquatic National Parks, Marine Sanctuaries, and Wildlife Refuges (NOAA, 2002). The Departments of Commerce and the Interior are developing an inventory of MPAs in the U.S. that are protected and managed under Federal, State, Territorial, Tribal, or local laws. This list has not been completed, but it currently includes 32 Federal sites in the New England region, 31 in the Middle Atlantic region, 43 in the South Atlantic region, 45 in the Gulf of Mexico region, 12 in the Caribbean region, 15 in the Great Lakes region, and 46 in the U.S. West

Coast region. Examples of marine protected areas include the Great Bay National Wildlife Refuge in New Hampshire, the Cape Cod Bay Northern Right Whale Critical Habitat in Massachusetts, the Narragansett Bay National Estuarine Research Reserve in Rhode Island, Everglades National Park and the Tortugas Shrimp Sanctuary in Florida, and the Point Reyes National Seashore in California.

Marine protected areas can help address problems related to the depletion of marine resources by prohibiting, or severely curtailing, activities that are permitted or regulated by law outside of marine protected areas. Such activities include oil exploration, dredging, dumping, fishing, certain types of vessel traffic, and the focus of section 316(b) rulemaking, the impingement and entrainment of aquatic organisms by cooling water intake structures.

Impingement and entrainment affects many kinds of aquatic organisms, including fish, shrimp, crabs, birds, sea turtles, and marine mammals. Aquatic environments are harmed both directly and indirectly by impingement and entrainment of these organisms. In addition to the harm that results from the direct removal of organisms by impingement and entrainment, there are the indirect effects on aquatic food webs that result from the impingement and entrainment of organisms that serve as prey for predator species. There are also cumulative impacts that result from multiple intake structures operating in the same local area, or when multiple intakes affect individuals within the same population over a broad geographic range.

Decreased numbers of aquatic organisms resulting from the direct and indirect effects of impingement and entrainment can have a number of consequences for marine resources, including impairment of food webs, disruption of nutrient cycling and energy transfer within aquatic ecosystems, loss of native species, and reduction of biodiversity. By reducing the impingement and entrainment of aquatic organisms, this final rule would not only help protect individual species but also the overall marine environment, thereby advancing the objective of Executive Order 13158 to protect marine areas.

REFERENCES

Executive Office of the President. 2001. Executive Order 13211. "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use." 66 FR 28355. May 22, 2001.

Executive Office of the President. 2000a. Executive Order 13175. "Consultation and Coordination with Indian Tribal Governments." 65 FR 67249, November 6, 2000.

Executive Office of the President. 2000b. Executive Order 13158. "Marine Protected Areas." 65 FR 34909, May 31, 2000.

Executive Office of the President. 1999. Executive Order 13132. "Federalism." 64 FR 43255. August 10, 1999.

Executive Office of the President. 1997. Executive Order 13045. "Protection of Children from Environmental Health Risks and Safety Risks." 62 FR 19885, April 23, 1997.

Executive Office of the President. 1994. Executive Order 12898. "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." 59 FR 7629, February 11, 1994.

Executive Office of the President. 1993. Executive Order 12866. "Regulatory Planning and Review." 58 FR 51735. October 4, 1993.

National Oceanic and Atmospheric (NOAA) and U.S. Department of Commerce. 2002. Marine Protected Areas of the United States. http://mpa.gov/welcome.html. Accessed 2/22/02.

National Technology Transfer and Advancement Act of 1995. 1995. Public Law 104-113. Available at: http://standards.gov/standards_gov/index.cfm?do=documents.NTTAA

Paperwork Reduction Act (PRA). 44 U.S.C. 3501 et seq.

U.S. Department of Commerce (U.S. DOC), Bureau of the Census. 2000. *2000 Census of Population and Housing*.

U.S. Department of Commerce (U.S. DOC), Bureau of the Census. 1998. *1998 Small Area Income and Poverty Estimates*.

U.S. Department of the Interior (U.S. DOI), Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. 1997. *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Information Collection Request for Cooling Water Intake Structures at Phase III Facilities (Final Rule)*. ICR Number 2169.01. June 2006.

Chapter E1: Summary of Social Costs

INTRODUCTION

CHAPTER CONTENTS

This chapter presents EPA's estimates of the costs to society associated with the options evaluated for the Final Regulation for Phase III facilities. The ***social costs*** of regulatory actions are the ***opportunity costs*** to society of employing scarce resources to reduce environmental damages. The social costs of regulation include both monetary and non-monetary outlays made by society. Monetary outlays include the resource costs of compliance, government administrative costs, and other adjustment costs, such as the cost of relocating displaced workers. Non-monetary outlays, some of which can be assigned monetary values, include losses in consumers' and producers' surplus in affected product markets, the adverse effects of involuntary unemployment, possible loss of time (e.g., delays in investment decisions), and possible adverse impacts on the rate of innovation.

EPA's estimates of social costs for the evaluated section 316(b) Phase III options include three components:

1. Direct costs of complying with the regulation within each regulated industry segment,
2. Cost to State governments in administering the regulation, and
3. Cost to the Federal government in administering the regulation.

This chapter presents the social cost analysis for the Phase III final regulation, which applies national performance standards to new offshore oil and gas extraction facilities (also abbreviated as "new OOGE facilities"). The final requirements for this industry segment are based on a 2 MGD DIF applicability threshold and apply to an estimated 124 new offshore oil and gas extraction facilities. This chapter also presents costs for Phase III existing facilities under three regulatory analysis options: facilities with a design intake flow of 50 MGD or more that are located on any source waterbody type ("50 MGD All Watebodies" option), facilities with a design intake flow of 200 MGD or more that are located on any source waterbody type ("200 MGD for All Waterbodies" option), and facilities with a design intake flow of 100 MGD or more that are located on certain waterbody types ("100 MGD for Certain Waterbodies" option). These options differ with regard to: (1) their design intake flow (DIF) applicability thresholds: 50, 100 and 200 MGD, respectively; and (2) the type of waterbodies to which they would apply: the options with the 50 and 200 MGD applicability thresholds would apply to all waterbody types while the option with the 100 MGD applicability threshold would apply only to facilities withdrawing cooling water from certain waterbody types (i.e., an ocean, estuary, tidal river/stream or one of the Great Lakes). For the purposes of analysis, facilities meeting these applicability criteria would be required to meet similar performance standards, including a 80-95% reduction in impingement mortality and a 60-90% reduction in entrainment. For the purposes of analysis, facilities not meeting the applicability criteria set forth under each option would continue to be subject to permit requirements based on Best Professional Judgment (BPJ). The number of facilities required to meet the national requirements would vary depending on the applicability threshold considered. Among the three options considered, the 50 MGD for All Waterbodies option applies the national categorical requirements to the largest number of facilities, with the 200 MGD for All Waterbodies and the 100 MGD for All Waterbodies applying to successively smaller numbers of facilities.

E1-1 COSTS OF COMPLIANCE BY REGULATED INDUSTRY SEGMENT

The compliance costs used to estimate total social costs differ in their consideration of taxes from those in *Part B: Economic Analysis for Phase III Existing Facilities*, and *Part C: Economic Analysis for Phase III New Offshore Oil and Gas Extraction Facilities*, which were calculated for the purpose of estimating the private costs and impacts of the evaluated options. For the impact analyses, compliance costs are measured according to their effect on the financial performance of the regulated facilities and firms. The analyses therefore explicitly consider the tax deductibility of compliance outlays.[1] In the analysis of costs to society, however, these compliance costs are considered on a pre-tax basis. The costs to society are the full value of the resources used, whether they are paid for by the regulated facilities or by all taxpayers in the form of lost tax revenues.

EPA included no costs for facilities that were assessed as baseline closures or that are subject to permit specifications based on best professional judgment (BPJ), instead of the national categorical requirements of the Final rule or the regulatory analysis options for existing facilities. However, EPA's estimates do include compliance costs for facilities estimated to close because of the rule.[2] This approach may overstate the social costs of compliance, to the extent that the net economic loss to society in facility closures is less than the estimated cost to society of compliance.[3]

To assess the cost to society of complying with Phase III regulation, EPA estimated the costs to facilities for the labor, equipment, materials, and other economic resources needed to comply with each evaluated option. In this analysis, EPA assumed that the market prices for labor, equipment, materials, and other compliance resources represent the opportunity costs to society for use of those resources in regulatory compliance.

EPA estimates that the offshore oil and gas extraction industry segment would not incur cost from installation downtime because only new offshore oil and gas extraction facilities would be regulated under this final rule. The potential disruption in ongoing business operation estimated for existing Manufacturers is not relevant for new facilities.

For the analysis of installation downtime in the Manufacturer's segment, EPA assumed that the cost of society is equal to the increase in production cost for providing the electricity or other replacement goods and services not provided by the facilities that incur downtime in reaching compliance with the 316(b) Phase III regulation. For Manufacturers, this cost is approximated as the lost revenue from installation downtime *less* the variable cost of producing goods and services not produced due to the installation downtime. Implicit in this assumption is that the variable production cost of replacing the lost goods and services are essentially the same as the price received for the sale of the electricity or other goods and services not produced by the facilities incurring the installation downtime. For the goods and services not produced by affected Manufacturers facilities, this assumption is consistent with a competitive market model of increasing marginal production cost, such that the production cost of the "last" or highest cost goods and services produced and sold in any period is approximately equal to the price received for those goods and services in the market. For Manufacturers – which do not necessarily produce and sell goods in orderly markets and where, as a result, the cost of producing replacement goods and services may be less than selling price – this assumption may overstate the cost to society of installation downtime (see

[1] Because government facilities and cooperatives are not subject to income taxes, their costs are not adjusted for taxes.

[2] To the extent such impacts occur under any of the options analyzed.

[3] Including costs for regulatory closures yields an estimate of social costs assuming that all facilities, except those assessed as baseline closures, would incur the costs of regulatory compliance and continue to operate post-regulation. Calculating costs as if all facilities continue operating will overstate social costs if the social cost of compliance is greater than the net economic loss to society from facility closure. Whether this result will hold depends, in part, on the difference between social and private discount rates, and the marginal cost to society to replace the lost production of goods and services in closing facilities.

discussion in *Appendix B3A2: Calculation of Installation Downtime Cost*). Absent specific knowledge of the overall production cost structure of the affected industries, EPA adopted this assumption for its analysis of the social cost of the regulatory analysis options considered for Phase III regulation.

Finally, EPA assumes in its social cost analysis that none of the evaluated options would affect the aggregate quantity of goods and services sold to consumers by producers in the affected industry segments. The resource costs of compliance therefore manifest only as a reduction in the total of ***producers' surplus*** and ***consumers' surplus***, with no change in the quantity of goods and services produced and consumed. In the impact analyses, specific assumptions are made about the distribution of this effect between producers and consumers (i.e., the impact analyses of all analyzed section 316(b) Phase III industry segments – new offshore oil and gas extraction facilities and manufacturers – assume that all compliance costs are absorbed by complying businesses with no increase in prices to consumers). However, for the social cost analysis, the distribution of this effect between producers and consumers is irrelevant. Given the very small impact of the options on total costs within the industry segments, EPA believes the assumption of no effect on total quantity of goods and services produced and consumed is reasonable.

Table E1-1, following page, summarizes total direct facility costs for the Final Regulation for new offshore oil and gas extraction facilities as well as the costs of the regulatory analysis options considered for existing facilities, which are defined as the Final Regulation for the new offshore oil and gas extraction facilities *combined* with the primary analysis alternatives for existing facilities. As described in *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* and *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities*, costs were first tallied on an as-incurred, year-by-year basis over the total time period of analysis, considering the latest year in which any affected facility is assumed to reach compliance (2026 for new offshore oil and gas extraction facilities, 2014 for existing facilities) and for a period of 30 years in which facilities are assumed to continue compliance, for the purposes of the social cost analysis. Thus, for the social cost analysis, the analysis period extends to 2055 for new facilities and to 2043 for existing facilities.[4] These profiles of costs by year were then discounted to the assumed year when this final rule would take effect, beginning of year 2007, at two values of the discount rate, 3% and 7%. These discount rate values reflect guidance from the Office of Management and Budget (OMB) regulatory analysis guidance document, Circular A-4 (OMB, 2003). After calculating the present value of these cost streams, EPA calculated their constant annual equivalent value (annualized value) using the annualization formula presented in *Chapter C1*, again using the two values of the discount rate, 3% and 7%.

At a 3% discount rate, EPA estimates annualized direct costs of compliance of $3.5 million under the Phase III final regulation. The three regulatory analysis options considered resulted in annualized direct costs of compliance of $41.1 million (50 MGD All option), $22.8 million (200 MGD All Option) and $17.9 million (100 MGD CWB Option). At a 7% discount rate, these costs amount to $2.9 million (final rule), $41.2 million (50 MGD All Option), $22.9 million (200 MGD All Option), and $16.8 million (100 MGD CWB Option).

[4] Tables E1-6 through E1-8 below present the time profiles of regulatory costs for the three regulatory analysis options for existing facilities, combined with the final rule for new offshore oil and gas extraction facilities.

Table E1-1: Summary of Annualized Direct Costs by Industry Segments (millions, $2004)

	50 MGD All for Existing Facilities and for New OOGE Facilities (2 MGD All)		200 MGD All for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)		100 MGD CWB for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)	
	3%	7%	3%	7%	3%	7%
New Oil & Gas Facilities	$3.5	$2.9	$3.5	$2.9	$3.5	$2.9
Existing Manufacturing Facilities						
Primary Manufacturing Industries	$36.3	$37.1	$18.8	$19.5	$13.7	$13.3
Other Industries	$1.3	$1.2	$0.5	$0.4	$0.7	$0.7
Total Existing Facilities[a]	$37.6	$38.3	$19.3	$20.0	$14.4	$13.9
Total Direct Facility Costs[a]	$41.1	$41.2	$22.8	$22.9	$17.9	$16.8

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

E1-2 STATE AND FEDERAL ADMINISTRATIVE COSTS

Social costs also include costs to State and Federal governments of administering the permitting and compliance monitoring activities under the final regulation. State and Federal permitting authorities incur costs to administer the rule, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. *Chapter D2: UMRA Analysis* presents more information on State and Federal implementation costs.

EPA's estimate of State and Federal government cost for administering the final rule is $0.44 million at a 3% discount rate and $0.34 million at a 7% discount rate. When the regulatory analysis options for existing facilities are included, EPA estimates administrative costs of $1.09 million at a 3% discount rate under the 50 MGD All option. The 200 MGD and 100 MGD options resulted in administrative costs of $0.61 million and $0.64 million at a 3% discount rate, respectively. At a 7% discount rate, these costs amount to $0.99 million (50 MGD All Option), $0.50 million (200 MGD All Option), and $0.54 million (100 MGD CWB Option).

Table E1-2: Summary of Annualized Government Costs (millions, $2004)

	Final Regulation for New OOGE Facilities (2 MGD All)	
	3%	7%
New OOGE Facilities:		
State Admin. Costs	n/a	n/a
Federal Admin. Costs	$0.44	$0.34
Total New OOGE Facilities Administrative Cost	$0.44	$0.34

[a] Individual numbers may not add up to totals due to independent rounding.

Table E1-3: Summary of Annualized Government Costs (millions, $2004)

	50 MGD All for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)		200 MGD All for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)		100 MGD CWB for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)	
	3%	7%	3%	7%	3%	7%
Existing Facilities:						
State Admin. Costs	$0.63	$0.64	$0.16	$0.16	$0.19	$0.19
Federal Admin. Costs	$0.01	$0.01	<$0.01	< $0.01	< $0.01	< $0.01
Total Existing Facilities Administrative Cost[a]	$0.64	$0.65	$0.17	$0.16	$0.19	$0.19
New OOGE Facilities:						
State Admin. Costs	n/a	n/a	N/a	n/a	n/a	n/a
Federal Admin. Costs	$0.44	$0.34	$0.44	$0.34	$0.44	$0.34
Total New OOGE Facilities Administrative Cost	$0.44	$0.34	$0.44	$0.34	$0.44	$0.34
Total Gov. Administrative Costs[a]	$1.09	$0.99	$0.61	$0.50	$0.64	$0.54

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

E1-3 TOTAL SOCIAL COST

Table E1-4 and Table E1-5 combine the information presented above by industry segment and major cost category – direct facility costs and administrative costs – and reports the total social costs of the final rule and the three alternative options considered discounted at a 3% and 7% rate. At 3% and 7% discount rates, the estimated total annualized social costs of the final rule are $3.9 and $3.2 million, respectively. When the regulatory analysis options for existing facilities are included, the estimated total annualized social costs at a 3% discount rate are $42.0 million for the 50 MGD All option, $23.2 million for the 200 MGD All Option, and $18.3 million for the 100 MGD CWB Option. At a 7% discount rate the estimated total annualized social costs are $42.1 million for the 50 MGD All Option, $23.2 million for the 200 MGD All Option, and $17.2 million for the 100 MGD CWB Option (all values in 2003$).

As shown in Table E1-5, following page, existing facilities (Manufacturers) account for the substantial majority of total social cost under the three regulatory analysis options. At a 3% discount rate, annualized pre-tax costs *per facility* in the Manufacturers segment amount to $262,000 for the 50 MGD All option, $628,000 for the 200 MGD All option, and $633,000 for the 100 MGD CWB option. At a 7% discount rate, annualized pre-tax costs in the manufacturers segment amount to $267,000 for the 50 MGD All option, $650,000 for the 200 MGD All option, and $ 614,000 for the 100 MGD CWB option. Because the 200 MGD option and the 100 MGD option apply national categorical requirements to a smaller number of facilities than the 50 MGD All option, they result in a lower total national cost but a higher cost per regulated facility. Facilities that are subject to the national requirements of the 200 MGD option and the 100 MGD option incur the same compliance costs as under the 50 MGD All option; however, the average costs per regulated facility are higher under the 200 MGD and 100 MGD options because only the higher flow, and therefore higher cost, facilities incur costs under these options. For facilities in the new offshore oil and gas extraction industry segment, *per facility* costs under the final rule are approximately $32,000 at a 3% discount rate and $26,000 at a 7% discount rate.

Table E1-4: Summary of Annualized Social Costs (millions, $2004)

	Final Regulation for New OOGE Facilities (2 MGD All)	
	3%	7%
New OOGE Facilities:		
Total Direct Facility Costs	$3.5	$2.9
Total Government Administrative Costs	$0.4	$0.3
Total New OOGE Facilities Social Cost	$3.9	$3.2

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Table E1-5: Summary of Annualized Social Costs (millions, $2004)

	Final Regulation for Existing Facilities (50 MGD All) and for New OOGE Facilities (2 MGD All)		200 MGD All for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)		100 MGD CWB for Existing Facilities and Final Regulation for New OOGE Facilities (2 MGD All)	
	3%	7%	3%	7%	3%	7%
Existing Facilities:						
Total Direct Facility Costs	$37.6	$38.3	$19.3	$20.0	$14.4	$13.9
Total Government Administrative Costs	$0.6	$0.6	$0.2	$0.2	$0.2	$0.2
Total Existing Facilities Social Cost	$38.2	$39.0	$19.5	$20.2	$14.6	$14.1
New OOGE Facilities:						
Total Direct Facility Costs	$3.5	$2.9	$3.5	$2.9	$3.5	$2.9
Total Government Administrative Costs	$0.4	$0.3	$0.4	$0.3	$0.4	$0.3
Total New OOGE Facilities Social Cost	$3.9	$3.2	$3.9	$3.2	$3.9	$3.2
Total Social Cost	$42.1	$42.2	$23.4	$23.4	$18.5	$17.4

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Table E1-6 through Table E1-8, beginning at page E1-7, provide additional detail on the compliance cost calculations. The tables compile, for the three regulatory analysis options for existing facilities, and for the final rule for new offshore oil and gas extraction facilities, the time profiles of costs incurred by the regulated industry segments, administrative costs, and total costs. The tables also report the calculated present and annualized values of costs at 3% and 7% discount rates. Time profiles for the supplemental options analyzed for existing facilities are presented in the appendix to this chapter.

Table E1-6: Time Profile of Compliance Costs for the 50 MGD All Waterbodies Option for Existing Facilities and the Final Rule for New OOGE Facilities (millions; $2004)

Year	Existing Facilities (Manufacturers)			New OOGE Facilities			Total
	Facilities	Administrative Costs	Total	Facilities	Administrative Costs	Total	
2007	$3.0	$0.2	$3.2	$2.0	$0.0	$2.0	$5.2
2008	$12.1	$0.0	$12.1	$1.9	$0.0	$1.9	$13.9
2009	$17.5	$0.0	$17.5	$1.9	$0.0	$1.9	$19.4
2010	$136.7	$1.3	$138.0	$1.2	$0.0	$1.2	$139.2
2011	$92.7	$2.4	$95.2	$1.8	$0.0	$1.8	$96.9
2012	$57.7	$1.1	$58.8	$2.0	$0.5	$2.5	$61.3
2013	$57.9	$1.1	$59.0	$2.4	$0.2	$2.5	$61.5
2014	$18.6	$0.4	$19.0	$2.2	$0.7	$2.9	$21.9
2015	$21.3	$0.5	$21.8	$1.9	$0.3	$2.2	$24.0
2016	$16.0	$0.9	$16.8	$1.8	$0.3	$2.1	$18.9
2017	$16.9	$0.5	$17.3	$4.4	$0.5	$4.9	$22.2
2018	$13.2	$0.4	$13.7	$2.9	$0.3	$3.2	$16.9
2019	$17.7	$0.2	$17.9	$4.0	$0.6	$4.6	$22.5
2020	$38.1	$0.5	$38.6	$3.1	$0.4	$3.5	$42.1
2021	$91.1	$0.9	$92.0	$3.1	$0.4	$3.5	$95.5
2022	$21.3	$0.5	$21.7	$5.1	$0.7	$5.9	$27.6
2023	$57.8	$0.4	$58.2	$3.2	$0.4	$3.6	$61.8
2024	$18.5	$0.2	$18.8	$4.8	$0.7	$5.5	$24.3
2025	$21.3	$0.5	$21.8	$3.2	$0.5	$3.7	$25.5
2026	$16.0	$0.9	$16.8	$3.2	$0.5	$3.6	$20.5
2027	$16.9	$0.5	$17.3	$5.2	$0.8	$6.0	$23.3
2028	$13.2	$0.4	$13.7	$3.1	$0.3	$3.4	$17.1
2029	$17.7	$0.2	$17.9	$4.4	$0.7	$5.1	$23.0
2030	$38.1	$0.5	$38.6	$3.1	$0.3	$3.4	$42.0
2031	$91.1	$0.9	$92.0	$3.1	$0.3	$3.4	$95.4
2032	$21.3	$0.5	$21.7	$5.5	$0.8	$6.2	$27.9
2033	$57.8	$0.4	$58.2	$3.1	$0.3	$3.4	$61.6
2034	$18.5	$0.2	$18.8	$4.9	$0.7	$5.6	$24.4
2035	$21.3	$0.5	$21.8	$3.1	$0.3	$3.4	$25.2
2036	$16.0	$0.9	$16.8	$3.1	$0.3	$3.4	$20.2
2037	$16.9	$0.5	$17.3	$4.2	$0.7	$4.9	$22.2
2038	$13.2	$0.4	$13.7	$2.0	$0.3	$2.3	$16.0
2039	$12.2	$0.2	$12.5	$3.2	$0.6	$3.8	$16.3
2040	$10.1	$0.1	$10.2	$1.9	$0.3	$2.2	$12.4
2041	$4.8	$0.1	$4.9	$1.9	$0.3	$2.1	$7.0
2042	$3.5	$0.0	$3.5	$3.9	$0.5	$4.4	$7.9
2043	$0.3	$0.0	$0.3	$1.8	$0.2	$2.0	$2.3
2044				$2.6	$0.4	$3.0	$3.0
2045				$1.7	$0.2	$1.8	$1.8
2046				$1.6	$0.2	$1.8	$1.8
2047				$2.2	$0.3	$2.5	$2.5
2048				$0.6	$0.1	$0.7	$0.7
2049				$1.1	$0.2	$1.3	$1.3
2050				$0.3	$0.1	$0.4	$0.4
2051				$0.2	$0.1	$0.3	$0.3
2052				$1.5	$0.1	$1.7	$1.7
2053				$0.1	$0.0	$0.2	$0.2
2054				$0.6	$0.1	$0.7	$0.7
2055				$0.0	$0.0	$0.1	$0.1
PV 3%	$759.6	$13.0	$772.6	$70.6	$9.0	$79.5	$852.1
Annualized 3%	$37.6	$0.64	$38.3	$3.5	$0.44	$3.9	$42.2
PV 7%	$509.1	$8.62	$517.8	$38.8	$4.5	$43.3	$561.1
Annualized 7%	$38.3	$0.65	$39.0	$2.9	$0.34	$3.3	$42.3

Source: U.S. EPA Analysis, 2006.

Table E1-7: Time Profile of Compliance Costs for the 200 MGD for All Waterbodies Option for Existing Facilities and the Final Rule for New OOGE Facilities (millions; $2004)

Year	Existing Facilities (Manufacturers)			New OOGE Facilities			Total
	Facilities	Administrative Costs	Total	Facilities	Administrative Costs	Total	
2007	$0.0	$0.2	$0.2	$2.0	$0.0	$2.0	$2.2
2008	$2.6	$0.0	$2.6	$1.9	$0.0	$1.9	$4.5
2009	$3.1	$0.0	$3.1	$1.9	$0.0	$1.9	$5.0
2010	$108.9	$0.0	$108.9	$1.2	$0.0	$1.2	$110.1
2011	$43.9	$0.8	$44.7	$1.8	$0.0	$1.8	$46.4
2012	$6.7	$0.1	$6.8	$2.0	$0.5	$2.5	$9.4
2013	$47.7	$0.5	$48.1	$2.4	$0.2	$2.5	$50.6
2014	$5.5	$0.1	$5.7	$2.2	$0.7	$2.9	$8.6
2015	$8.3	$0.1	$8.4	$1.9	$0.3	$2.2	$10.6
2016	$5.9	$0.3	$6.1	$1.8	$0.3	$2.1	$8.2
2017	$7.9	$0.1	$8.0	$4.4	$0.5	$4.9	$12.9
2018	$5.9	$0.2	$6.0	$2.9	$0.3	$3.2	$9.2
2019	$5.5	$0.1	$5.6	$4.0	$0.6	$4.6	$10.1
2020	$14.1	$0.0	$14.2	$3.1	$0.4	$3.5	$17.6
2021	$43.9	$0.3	$44.2	$3.1	$0.4	$3.5	$47.7
2022	$8.3	$0.1	$8.4	$5.1	$0.7	$5.9	$14.3
2023	$47.6	$0.2	$47.8	$3.2	$0.4	$3.6	$51.4
2024	$5.5	$0.1	$5.6	$4.8	$0.7	$5.5	$11.1
2025	$8.3	$0.0	$8.4	$3.2	$0.5	$3.7	$12.1
2026	$5.9	$0.3	$6.1	$3.2	$0.5	$3.6	$9.7
2027	$7.9	$0.1	$8.0	$5.2	$0.8	$6.0	$13.9
2028	$5.9	$0.2	$6.0	$3.1	$0.3	$3.4	$9.4
2029	$5.5	$0.1	$5.6	$4.4	$0.7	$5.1	$10.6
2030	$14.1	$0.0	$14.2	$3.1	$0.3	$3.4	$17.6
2031	$43.9	$0.3	$44.2	$3.1	$0.3	$3.4	$47.6
2032	$8.3	$0.1	$8.4	$5.5	$0.8	$6.2	$14.6
2033	$47.6	$0.2	$47.8	$3.1	$0.3	$3.4	$51.2
2034	$5.5	$0.1	$5.6	$4.9	$0.7	$5.6	$11.2
2035	$8.3	$0.0	$8.4	$3.1	$0.3	$3.4	$11.8
2036	$5.9	$0.3	$6.1	$3.1	$0.3	$3.4	$9.5
2037	$7.9	$0.1	$8.0	$4.2	$0.7	$4.9	$12.9
2038	$5.9	$0.2	$6.0	$2.0	$0.3	$2.3	$8.3
2039	$5.5	$0.1	$5.5	$3.2	$0.6	$3.8	$9.3
2040	$5.2	$0.0	$5.3	$1.9	$0.3	$2.2	$7.4
2041	$2.6	$0.0	$2.6	$1.9	$0.3	$2.1	$4.7
2042	$2.4	$0.0	$2.4	$3.9	$0.5	$4.4	$6.8
2043	$0.1	$0.0	$0.1	$1.8	$0.2	$2.0	$2.1
2044				$2.6	$0.4	$3.0	$3.0
2045				$1.7	$0.2	$1.8	$1.8
2046				$1.6	$0.2	$1.8	$1.8
2047				$2.2	$0.3	$2.5	$2.5
2048				$0.6	$0.1	$0.7	$0.7
2049				$1.1	$0.2	$1.3	$1.3
2050				$0.3	$0.1	$0.4	$0.4
2051				$0.2	$0.1	$0.3	$0.3
2052				$1.5	$0.1	$1.7	$1.7
2053				$0.1	$0.0	$0.2	$0.2
2054				$0.6	$0.1	$0.7	$0.7
2055				$0.0	$0.0	$0.1	$0.1
PV 3%	$390.0	$3.2	$393.2	$70.6	$9.0	$79.5	$472.8
Annualized 3%	$19.3	$0.16	$19.5	$3.5	$0.44	$3.9	$23.4
PV 7%	$265.2	$2.2	$267.4	$38.8	$4.5	$43.3	$310.7
Annualized 7%	$20.0	$0.16	$20.1	$2.9	$0.34	$3.3	$23.4

Source: U.S. EPA Analysis, 2006.

Table E1-8: Time Profile of Compliance Costs for the 100 MGD for Certain Waterbodies Option for Existing Facilities and the Final Rule for New OOGE Facilities (millions; $2004)

Year	Existing Facilities (Manufacturers)			New OOGE Facilities			Total
	Facilities	Administrative Costs	Total	Facilities	Administrative Costs	Total	
2007	$0.4	$0.2	$0.6	$2.0	$0.0	$2.0	$2.6
2008	$5.2	$0.0	$5.2	$1.9	$0.0	$1.9	$7.1
2009	$5.1	$0.0	$5.1	$1.9	$0.0	$1.9	$7.1
2010	$14.7	$0.1	$14.8	$1.2	$0.0	$1.2	$15.9
2011	$55.6	$1.2	$56.8	$1.8	$0.0	$1.8	$58.6
2012	$5.7	$0.1	$5.9	$2.0	$0.5	$2.5	$8.4
2013	$36.3	$0.3	$36.6	$2.4	$0.2	$2.5	$39.1
2014	$4.3	$0.1	$4.5	$2.2	$0.7	$2.9	$7.4
2015	$8.8	$0.1	$8.8	$1.9	$0.3	$2.2	$11.0
2016	$4.3	$0.4	$4.7	$1.8	$0.3	$2.1	$6.8
2017	$5.6	$0.1	$5.7	$4.4	$0.5	$4.9	$10.6
2018	$4.3	$0.1	$4.4	$2.9	$0.3	$3.2	$7.6
2019	$4.3	$0.0	$4.4	$4.0	$0.6	$4.6	$8.9
2020	$12.8	$0.1	$12.9	$3.1	$0.4	$3.5	$16.3
2021	$54.7	$0.4	$55.1	$3.1	$0.4	$3.5	$58.6
2022	$6.0	$0.1	$6.1	$5.1	$0.7	$5.9	$12.0
2023	$36.3	$0.1	$36.4	$3.2	$0.4	$3.6	$40.0
2024	$4.3	$0.0	$4.4	$4.8	$0.7	$5.5	$9.9
2025	$8.8	$0.1	$8.8	$3.2	$0.5	$3.7	$12.5
2026	$4.3	$0.4	$4.7	$3.2	$0.5	$3.6	$8.3
2027	$5.6	$0.1	$5.7	$5.2	$0.8	$6.0	$11.7
2028	$4.3	$0.1	$4.4	$3.1	$0.3	$3.4	$7.8
2029	$4.3	$0.0	$4.4	$4.4	$0.7	$5.1	$9.4
2030	$12.8	$0.1	$12.9	$3.1	$0.3	$3.4	$16.3
2031	$54.7	$0.4	$55.1	$3.1	$0.3	$3.4	$58.5
2032	$6.0	$0.1	$6.1	$5.5	$0.8	$6.2	$12.3
2033	$36.3	$0.1	$36.4	$3.1	$0.3	$3.4	$39.8
2034	$4.3	$0.0	$4.4	$4.9	$0.7	$5.6	$10.0
2035	$8.8	$0.1	$8.8	$3.1	$0.3	$3.4	$12.2
2036	$4.3	$0.4	$4.7	$3.1	$0.3	$3.4	$8.1
2037	$5.6	$0.1	$5.7	$4.2	$0.7	$4.9	$10.6
2038	$4.3	$0.1	$4.4	$2.0	$0.3	$2.3	$6.7
2039	$3.9	$0.0	$4.0	$3.2	$0.6	$3.8	$7.8
2040	$3.8	$0.0	$3.9	$1.9	$0.3	$2.2	$6.0
2041	$1.0	$0.0	$1.0	$1.9	$0.3	$2.1	$3.1
2042	$0.8	$0.0	$0.9	$3.9	$0.5	$4.4	$5.2
2043	$0.1	$0.0	$0.1	$1.8	$0.2	$2.0	$2.1
2044				$2.6	$0.4	$3.0	$3.0
2045				$1.7	$0.2	$1.8	$1.8
2046				$1.6	$0.2	$1.8	$1.8
2047				$2.2	$0.3	$2.5	$2.5
2048				$0.6	$0.1	$0.7	$0.7
2049				$1.1	$0.2	$1.3	$1.3
2050				$0.3	$0.1	$0.4	$0.4
2051				$0.2	$0.1	$0.3	$0.3
2052				$1.5	$0.1	$1.7	$1.7
2053				$0.1	$0.0	$0.2	$0.2
2054				$0.6	$0.1	$0.7	$0.7
2055				$0.0	$0.0	$0.1	$0.1
PV 3%	$290.3	$3.8	$294.1	$70.6	$9.0	$79.5	$373.6
Annualized 3%	$14.4	$0.19	$14.6	$3.5	$0.44	$3.9	$18.5
PV 7%	$184.8	$2.6	$187.4	$38.8	$4.5	$43.3	$230.7
Annualized 7%	$13.9	$0.20	$14.1	$2.9	$0.34	$3.3	$17.4

Source: U.S. EPA Analysis, 2006.

E1-4 LIMITATIONS AND UNCERTAINTIES

EPA did not include in its estimate of social costs the cost associated with unemployment that may result from facility closures. Potential unemployment-related costs would include the cost of administering unemployment programs for workers who are projected to lose employment (but not the cost of unemployment benefits, which are a transfer payment within society); and an estimate of the amount that workers would be willing to pay to avoid involuntary unemployment. However, from its facility impact analysis, EPA estimates that no facilities would close as a result of the final rule. EPA also did not recognize any possible savings in unemployment-related costs from jobs created by the rule as a negative cost (benefit) of the regulation. Accordingly, EPA estimates a zero cost of unemployment for the final rule.

Another key uncertainty factor in the analysis of costs to society is EPA's estimate of the cost of installation downtime in Manufacturers facilities. As described above, EPA adopted the assumption that the production cost for replacing the goods and services not provided by complying facilities due to installation downtime would be approximately equal to the price received for those goods and services in the market. To the extent that these replacement goods and services are produced at a cost less than selling price, this assumption would overstate the cost to society of installation downtime. The amount of potential overstatement is not known.

GLOSSARY

consumer surplus: The value that consumers derive from goods and services above the price they have to pay to obtain the goods and services.

opportunity cost: The lost value of alternative uses of resources (capital, labor, and raw materials) used in regulatory compliance.

producer surplus: The difference between what producers' earn on their output and the economic costs of producing that output, including a normal return on capital.

social cost: The costs incurred by society as a whole as a result of the final rule. Social costs do not include costs that are transfers among parties that do not represent a new cost overall.

REFERENCES

Office of Management and Budget (OMB). 2003. Circular A-4, Regulatory Analysis. September 17, 2003. Available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

Appendix E1A: Summary of Results for Supplemental Options

CHAPTER CONTENTS

INTRODUCTION

This appendix presents the social cost results for additional options that EPA analyzed for potential Phase III existing facilities in developing the Phase III regulation (the "Supplemental Options"). These options include:

- For Electric Generator facilities with a DIF of 2 MGD or greater, but less than 50 MGD:

  Impingement-only requirements for all facilities on all waterbodies;
  Phase II-like requirements for all facilities on all waterbodies; and
  Impingement and Entrainment requirements for all facilities on all waterbodies.

- For Manufacturing facilities with a DIF of 2 MGD or greater, but less than 50 MGD:

  Impingement-only requirements for all facilities on all waterbodies;
  Phase II-like requirements for all facilities on all waterbodies; and
  Impingement and Entrainment requirements for all facilities on all waterbodies.

- For Manufacturing facilities with a DIF of 50 MGD or greater:

  Impingement-only requirements for all facilities on all waterbodies;
  Phase II-like requirements for all facilities on all waterbodies (*the Final Regulation*); and
  Impingement and Entrainment requirements for all facilities on all waterbodies.

The "Impingement-only requirements for all facilities on all waterbodies" and "Impingement and Entrainment requirements for all facilities on all waterbodies" options are bounding cases applying lower and upper bound uniform requirements – *Impingement-only requirements* and *Impingement and Entrainment requirements* – regardless of specific facility circumstances.

Because the Supplemental Options include options with an applicability threshold of less than 50 MGD, the analysis and reported costs for these options include costs for Electric Generators in addition to Manufacturers.

For all options, facility counts and other results only include those potential Phase III existing facilities that are (1) non-baseline closures and (2) subject to national categorical requirements under the option. See *Chapter C3: Economic Impact Analysis for Manufacturers* for more information on baseline closures and counts of facilities subject to national categorical requirements under each option. See the main body of this chapter for a description of data sources and methodologies used in these analyses.

E1A-1 COSTS OF COMPLIANCE BY REGULATED INDUSTRY SEGMENT

Table E1A-1, following page, summarizes total direct facility costs for the five other options evaluated for existing facilities, at a 3% and a 7% discount rate. For a description of this analysis, see Section E1-1 above.

Table E1A-1: Summary of Annualized Direct Costs by Regulated Industry Segments Existing Facilities (millions, $2004)

	I-only Everywhere	I&E Like Phase II	I&E Everywhere
3 % Discount Rate			
Electric Generators	$2.1	$3.0	$7.9
Manufacturers 2-50 MGD	$20.9	$34.0	$55.3
Manufacturers 50+ MGD	$24.6	$37.6	$45.3
Total Direct Facility Costs[a]	$47.6	$74.6	$108.5
7% Discount Rate			
Electric Generators	$2.0	$2.9	$8.6
Manufacturers 2-50 MGD	$22.0	$36.3	$59.1
Manufacturers 50+ MGD	$25.6	$38.3	$45.4
Total Direct Facility Costs[a]	$49.6	$77.5	$113.1

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

E1A-2 STATE AND FEDERAL ADMINISTRATIVE COSTS

Table E1A-2 and Table E1A-3, following page, present annualized costs to State and Federal governments of administering the permitting and compliance monitoring activities for the supplemental options evaluated for existing facilities at the 3% and 7% discount rates, respectively. For a description of this analysis, see section E1-2 above.

Table E1A-2: Summary of Annualized Government Costs for Existing Facilities at 3% Discount Rate (millions, $2004)

	I-only Everywhere	I&E Like Phase II	I&E Everywhere
Electric Generators 2 – 50 MGD			
State Admin. Costs	$0.10	$0.15	$0.20
Federal Admin. Costs	$0.00	$0.00	$0.00
Total Government Admin. Costs[a,b]	$0.10	$0.15	$0.20
Manufacturers 2 – 50 MGD			
State Admin. Costs	$0.56	$0.80	$1.24
Federal Admin. Costs	$0.01	$0.02	$0.02
Total Government Admin. Costs[a,b]	$0.58	$0.82	$1.26
Manufacturers 50+ MGD			
State Admin. Costs	$0.40	$0.57	$0.77
Federal Admin. Costs	$0.01	$0.01	$0.01
Total Government Admin. Costs[a,b]	$0.41	$0.58	$0.78

[a] Individual numbers may not add up to totals due to independent rounding.

[b] Excludes State start-up costs of $8,987 not attributable to industry segments.

Source: U.S. EPA Analysis, 2006.

Table E1A-3: Summary of Annualized Government Costs for Existing Facilities at 7% Discount Rate (millions, $2004)

	I-only Everywhere	I&E Like Phase II	I&E Everywhere
Electric Generators 2 – 50 MGD			
State Admin. Costs	$0.10	$0.14	$0.20
Federal Admin. Costs	$0.00	$0.01	$0.01
Total Government Admin. Costs[a,b]	$0.10	$0.15	$0.20
Manufacturers 2 – 50 MGD			
State Admin. Costs	$0.54	$0.80	$1.22
Federal Admin. Costs	$0.02	$0.02	$0.03
Total Government Admin. Costs[a,b]	$0.56	$0.82	$1.24
Manufacturers 50+ MGD			
State Admin. Costs	$0.39	$0.58	$0.79
Federal Admin. Costs	$0.01	$0.01	$0.01
Total Government Admin. Costs[a,b]	$0.40	$0.59	$0.80

[a] Individual numbers may not add up to totals due to independent rounding.

[b] Excludes State start-up costs of $13,664 not attributable to industry segments.

Source: U.S. EPA Analysis, 2006.

E1A-3 TOTAL SOCIAL COST

Table E1A-4 and Table E1A-5 present the total social costs of the supplemental options evaluated for existing facilities, including direct facility costs and government administrative costs, at a 3% and a 7% discount rate, respectively. Table E1A-6 through Table E1A-13 present the time profiles for the five other options. For a description of these analyses, see section E1-3 above.

Table E1A-4: Summary of Annualized Social Costs for Existing Facilities at 3% Discount Rate (millions, $2004)

	I-only Everywhere	I&E Like Phase II	I&E Everywhere
Electric Generators 2 – 50 MGD			
Total Direct Facility Costs	$2.1	$3.0	$7.9
Total Government Administrative Costs	$0.1	$0.2	$0.2
Total Social Cost[a]	$2.2	$3.2	$8.1
Manufacturers 2 – 50 MGD			
Total Direct Facility Costs	$20.9	$34.0	$55.3
Total Government Administrative Costs	$0.6	$0.8	$1.3
Total Social Cost[a]	$21.5	$34.8	$56.6
Manufacturers 50+ MGD			
Total Direct Facility Costs	$24.6	$37.6	$45.3
Total Government Administrative Costs	$0.4	$0.6	$0.8
Total Social Cost[a]	$25.0	$38.2	$46.1

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Table E1A-5: Summary of Annualized Social Costs for Existing Facilities at 7% Discount Rate (millions, $2004)

	I-only Everywhere	I&E Like Phase II	I&E Everywhere
Electric Generators 2 – 50 MGD			
Total Direct Facility Costs	$2.0	$2.9	$8.6
Total Government Administrative Costs	$0.1	$0.1	$0.2
Total Social Cost[a]	$2.1	$3.0	$8.8
Manufacturers 2 – 50 MGD			
Total Direct Facility Costs	$22.0	$36.3	$59.1
Total Government Administrative Costs	$0.6	$0.8	$1.2
Total Social Cost[a]	$22.5	$37.1	$60.3
Manufacturers 50+ MGD			
Total Direct Facility Costs	$25.6	$38.3	$45.4
Total Government Administrative Costs	$0.4	$0.6	$0.8
Total Social Cost[a]	$26.0	$39.0	$46.2

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Table E1A-6: Time Profile of Compliance Costs for Existing Electric Generators with DIF of 2 to 50 MGD Under the I-only Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Generators	Administrative Costs	Total Cost
2007	$0.2	$0.0	$0.2
2008	$0.9	$0.0	$0.9
2009	$1.6	$0.0	$1.6
2010	$2.4	$0.3	$2.7
2011	$3.9	$0.1	$4.0
2012	$3.3	$0.2	$3.6
2013	$1.9	$0.2	$2.1
2014	$3.3	$0.2	$3.5
2015	$1.2	$0.1	$1.3
2016	$1.6	$0.1	$1.7
2017	$1.5	$0.1	$1.5
2018	$1.8	$0.1	$1.8
2019	$1.7	$0.1	$1.8
2020	$1.9	$0.1	$2.0
2021	$3.1	$0.1	$3.2
2022	$2.8	$0.1	$2.9
2023	$2.0	$0.1	$2.1
2024	$3.0	$0.1	$3.1
2025	$1.2	$0.1	$1.3
2026	$1.6	$0.1	$1.7
2027	$1.5	$0.1	$1.5
2028	$1.8	$0.1	$1.8
2029	$1.7	$0.1	$1.8
2030	$1.9	$0.1	$2.0
2031	$3.1	$0.1	$3.2
2032	$2.8	$0.1	$2.9
2033	$2.0	$0.1	$2.1
2034	$3.0	$0.1	$3.1
2035	$1.2	$0.1	$1.3
2036	$1.6	$0.1	$1.7
2037	$1.5	$0.1	$1.5
2038	$1.8	$0.1	$1.8
2039	$0.8	$0.1	$0.9
2040	$0.6	$0.0	$0.6
2041	$0.5	$0.0	$0.5
2042	$0.3	$0.0	$0.3
2043	$0.2	$0.0	$0.2
PV 3%	$43.1	$2.1	$45.2
Annualized 3%	$2.1	$0.1	$2.2
PV 7%	$27.0	$1.36	$28.4
Annualized 7%	$2.0	$0.1	$2.1

Source: U.S. EPA Analysis, 2006.

Table E1A-7: Time Profile of Compliance Costs for Existing Electric Generators with DIF of 2 to 50 MGD Under the I&E Like Phase II Option (millions, $2004)

Year	Cost of Compliance for Existing Generators	Administrative Costs	Total Cost
2007	$0.2	$0.0	$0.2
2008	$1.4	$0.0	$1.4
2009	$2.1	$0.0	$2.1
2010	$3.9	$0.4	$4.3
2011	$4.9	$0.2	$5.1
2012	$4.1	$0.3	$4.4
2013	$2.6	$0.3	$2.9
2014	$5.2	$0.4	$5.6
2015	$2.2	$0.2	$2.3
2016	$2.3	$0.1	$2.3
2017	$2.2	$0.1	$2.3
2018	$2.5	$0.1	$2.7
2019	$2.4	$0.1	$2.5
2020	$3.3	$0.1	$3.4
2021	$3.2	$0.1	$3.3
2022	$3.5	$0.1	$3.6
2023	$2.8	$0.1	$2.9
2024	$4.5	$0.1	$4.6
2025	$2.2	$0.1	$2.3
2026	$2.3	$0.1	$2.3
2027	$2.2	$0.1	$2.3
2028	$2.5	$0.1	$2.7
2029	$2.4	$0.1	$2.5
2030	$3.3	$0.1	$3.4
2031	$3.2	$0.1	$3.3
2032	$3.5	$0.1	$3.6
2033	$2.8	$0.1	$2.9
2034	$4.5	$0.1	$4.6
2035	$2.2	$0.1	$2.3
2036	$2.3	$0.1	$2.3
2037	$2.2	$0.1	$2.3
2038	$2.5	$0.1	$2.7
2039	$1.4	$0.1	$1.6
2040	$1.1	$0.0	$1.1
2041	$0.9	$0.0	$0.9
2042	$0.6	$0.0	$0.6
2043	$0.4	$0.0	$0.4
PV 3%	$61.1	$3.0	$64.1
Annualized 3%	$3.0	$0.2	$3.2
PV 7%	$38.1	$1.98	$40.1
Annualized 7%	$2.9	$0.1	$3.0

Source: U.S. EPA Analysis, 2006.

Table E1A-8: Time Profile of Compliance Costs for Existing Electric Generators with DIF of 2 to 50 MGD Under the I&E Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Generators	Administrative Costs	Total Cost
2007	$0.3	$0.0	$0.3
2008	$1.8	$0.0	$1.8
2009	$3.4	$0.0	$3.4
2010	$40.4	$0.6	$40.9
2011	$41.7	$0.2	$41.9
2012	$5.3	$0.5	$5.8
2013	$5.0	$0.3	$5.4
2014	$6.3	$0.5	$6.8
2015	$3.3	$0.2	$3.5
2016	$4.2	$0.1	$4.3
2017	$3.3	$0.2	$3.5
2018	$4.0	$0.1	$4.1
2019	$3.7	$0.2	$3.9
2020	$7.6	$0.2	$7.8
2021	$5.8	$0.1	$5.9
2022	$4.7	$0.2	$4.9
2023	$5.4	$0.1	$5.5
2024	$5.6	$0.2	$5.7
2025	$3.3	$0.2	$3.5
2026	$4.2	$0.1	$4.3
2027	$3.3	$0.2	$3.5
2028	$4.0	$0.1	$4.1
2029	$3.7	$0.2	$3.9
2030	$7.6	$0.2	$7.8
2031	$5.8	$0.1	$5.9
2032	$4.7	$0.2	$4.9
2033	$5.4	$0.1	$5.5
2034	$5.6	$0.2	$5.7
2035	$3.3	$0.2	$3.5
2036	$4.2	$0.1	$4.3
2037	$3.3	$0.2	$3.5
2038	$4.0	$0.1	$4.1
2039	$2.5	$0.2	$2.7
2040	$1.9	$0.0	$1.9
2041	$1.5	$0.0	$1.6
2042	$0.9	$0.0	$0.9
2043	$0.5	$0.0	$0.5
PV 3%	$158.7	$4.1	$162.8
Annualized 3%	$7.9	$0.2	$8.1
PV 7%	$113.8	$2.69	$116.5
Annualized 7%	$8.6	$0.2	$8.8

Source: U.S. EPA Analysis, 2006.

Table E1A-9: Time Profile of Compliance Costs for Existing Manufacturers with DIF of 2 to 50 MGD Under the I-only Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Manufacturers	Administrative Costs	Total Cost
2007	$0.4	$0.0	$0.4
2008	$5.0	$0.0	$5.0
2009	$9.6	$0.0	$9.6
2010	$21.3	$0.5	$21.8
2011	$27.8	$1.1	$28.9
2012	$177.5	$1.8	$179.3
2013	$14.0	$1.3	$15.3
2014	$10.7	$0.8	$11.5
2015	$12.3	$0.4	$12.6
2016	$13.7	$0.5	$14.2
2017	$11.9	$0.7	$12.6
2018	$8.1	$0.5	$8.6
2019	$7.4	$0.4	$7.8
2020	$15.9	$0.3	$16.3
2021	$23.8	$0.5	$24.3
2022	$19.5	$0.7	$20.2
2023	$13.8	$0.5	$14.3
2024	$10.7	$0.4	$11.0
2025	$12.3	$0.3	$12.6
2026	$13.7	$0.5	$14.2
2027	$11.9	$0.7	$12.6
2028	$8.1	$0.5	$8.6
2029	$7.4	$0.4	$7.8
2030	$15.9	$0.3	$16.3
2031	$23.8	$0.5	$24.3
2032	$19.5	$0.7	$20.2
2033	$13.8	$0.5	$14.3
2034	$10.7	$0.4	$11.0
2035	$12.3	$0.3	$12.6
2036	$13.7	$0.5	$14.2
2037	$11.9	$0.7	$12.6
2038	$8.1	$0.5	$8.6
2039	$6.0	$0.4	$6.3
2040	$5.5	$0.2	$5.7
2041	$4.0	$0.1	$4.2
2042	$2.1	$0.1	$2.2
2043	$0.7	$0.0	$0.7
PV 3%	$422.6	$11.7	$434.3
Annualized 3%	$20.9	$0.6	$21.5
PV 7%	$291.5	$7.43	$298.9
Annualized 7%	$22.0	$0.6	$22.5

Source: U.S. EPA Analysis, 2006.

Table E1A-10: Time Profile of Compliance Costs for Existing Manufacturers with DIF of 2 to 50 MGD Under the I&E Like Phase II Option (millions, $2004)

Year	Cost of Compliance for Existing Manufacturers	Administrative Costs	Total Cost
2007	$1.7	$0.0	$1.7
2008	$8.4	$0.0	$8.4
2009	$14.8	$0.0	$14.8
2010	$63.9	$0.9	$64.8
2011	$127.8	$2.4	$130.2
2012	$187.5	$2.7	$190.3
2013	$21.3	$2.0	$23.3
2014	$18.1	$1.0	$19.0
2015	$18.6	$0.5	$19.1
2016	$19.9	$0.6	$20.5
2017	$17.7	$0.9	$18.6
2018	$14.5	$0.6	$15.1
2019	$14.7	$0.4	$15.1
2020	$25.9	$0.5	$26.4
2021	$32.6	$0.6	$33.2
2022	$29.1	$0.9	$29.9
2023	$21.6	$0.6	$22.2
2024	$17.9	$0.4	$18.4
2025	$18.6	$0.5	$19.0
2026	$19.9	$0.6	$20.5
2027	$17.7	$0.9	$18.6
2028	$14.5	$0.6	$15.1
2029	$14.7	$0.4	$15.1
2030	$25.9	$0.5	$26.4
2031	$32.6	$0.6	$33.2
2032	$29.1	$0.9	$29.9
2033	$21.6	$0.6	$22.2
2034	$17.9	$0.4	$18.4
2035	$18.6	$0.5	$19.0
2036	$19.9	$0.6	$20.5
2037	$17.7	$0.9	$18.6
2038	$14.5	$0.6	$15.1
2039	$11.1	$0.4	$11.5
2040	$9.5	$0.2	$9.7
2041	$6.2	$0.1	$6.4
2042	$3.1	$0.1	$3.1
2043	$0.9	$0.0	$1.0
PV 3%	$686.0	$16.5	$702.5
Annualized 3%	$34.0	$0.8	$34.8
PV 7%	$481.5	$10.85	$492.3
Annualized 7%	$36.3	$0.8	$37.1

Source: U.S. EPA Analysis, 2006.

Table E1A-11: Time Profile of Compliance Costs for Existing Manufacturers with DIF of 2 to 50 MGD Under the I&E Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Manufacturers	Administrative Costs	Total Cost
2007	$2.0	$0.0	$2.0
2008	$10.4	$0.0	$10.4
2009	$18.3	$0.0	$18.3
2010	$73.7	$1.5	$75.2
2011	$136.9	$2.6	$139.6
2012	$196.5	$4.1	$200.6
2013	$317.4	$3.3	$320.7
2014	$28.2	$1.7	$29.9
2015	$26.8	$0.8	$27.6
2016	$30.3	$0.9	$31.1
2017	$28.2	$1.4	$29.6
2018	$23.0	$1.0	$24.0
2019	$24.6	$0.8	$25.4
2020	$38.3	$0.8	$39.1
2021	$43.0	$0.8	$43.8
2022	$39.5	$1.4	$40.9
2023	$29.7	$1.0	$30.7
2024	$27.9	$0.8	$28.7
2025	$26.8	$0.8	$27.6
2026	$30.3	$0.8	$31.1
2027	$28.2	$1.4	$29.6
2028	$23.0	$1.0	$24.0
2029	$24.6	$0.8	$25.4
2030	$38.3	$0.8	$39.1
2031	$43.0	$0.8	$43.8
2032	$39.5	$1.4	$40.9
2033	$29.7	$1.0	$30.7
2034	$27.9	$0.8	$28.7
2035	$26.8	$0.8	$27.6
2036	$30.3	$0.8	$31.1
2037	$28.2	$1.4	$29.6
2038	$23.0	$1.0	$24.0
2039	$19.2	$0.8	$20.0
2040	$15.9	$0.4	$16.2
2041	$12.0	$0.3	$12.2
2042	$6.6	$0.2	$6.8
2043	$2.4	$0.1	$2.5
PV 3%	$1,117.1	$25.4	$1,142.5
Annualized 3%	$55.3	$1.3	$56.6
PV 7%	$784.5	$16.50	$801.0
Annualized 7%	$59.1	$1.2	$60.3

Source: U.S. EPA Analysis, 2006.

Table E1A-12: Time Profile of Compliance Costs for Existing Manufacturers with DIF of 50 MGD or Greater Under the I-Only Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Manufacturers	Administrative Costs	Total Cost
2007	$1.6	$0.0	$1.6
2008	$8.2	$0.0	$8.2
2009	$12.2	$0.0	$12.2
2010	$119.7	$0.7	$120.5
2011	$40.3	$1.3	$41.6
2012	$53.6	$0.7	$54.3
2013	$29.2	$0.8	$30.0
2014	$12.9	$0.4	$13.2
2015	$16.2	$0.4	$16.6
2016	$11.8	$0.5	$12.3
2017	$11.6	$0.3	$12.0
2018	$9.5	$0.3	$9.8
2019	$12.0	$0.2	$12.2
2020	$26.8	$0.3	$27.2
2021	$38.8	$0.5	$39.3
2022	$16.4	$0.3	$16.7
2023	$29.1	$0.3	$29.4
2024	$12.8	$0.2	$13.0
2025	$16.2	$0.3	$16.5
2026	$11.8	$0.5	$12.3
2027	$11.6	$0.3	$12.0
2028	$9.5	$0.3	$9.8
2029	$12.0	$0.2	$12.2
2030	$26.8	$0.3	$27.2
2031	$38.8	$0.5	$39.3
2032	$16.4	$0.3	$16.7
2033	$29.1	$0.3	$29.4
2034	$12.8	$0.2	$13.0
2035	$16.2	$0.3	$16.5
2036	$11.8	$0.5	$12.3
2037	$11.6	$0.3	$12.0
2038	$9.5	$0.3	$9.8
2039	$8.5	$0.2	$8.7
2040	$7.1	$0.1	$7.2
2041	$3.2	$0.1	$3.3
2042	$2.3	$0.0	$2.3
2043	$0.2	$0.0	$0.2
PV 3%	$496.3	$8.3	$504.6
Annualized 3%	$24.6	$0.4	$25.0
PV 7%	$340.3	$5.35	$345.7
Annualized 7%	$25.6	$0.4	$26.0

Source: U.S. EPA Analysis, 2006.

Table E1A-13: Time Profile of Compliance Costs for Existing Manufacturers with DIF of 50 MGD or Greater Under the I&E Everywhere Option (millions, $2004)

Year	Cost of Compliance for Existing Manufacturers	Administrative Costs	Total Cost
2007	$3.3	$0.0	$3.3
2008	$14.2	$0.0	$14.2
2009	$21.5	$0.0	$21.5
2010	$58.0	$2.1	$60.0
2011	$166.6	$3.2	$169.8
2012	$64.7	$1.3	$66.0
2013	$116.3	$1.7	$118.1
2014	$28.1	$0.7	$28.9
2015	$26.3	$0.6	$26.9
2016	$20.0	$0.8	$20.9
2017	$21.8	$0.4	$22.2
2018	$18.6	$0.6	$19.1
2019	$23.8	$0.3	$24.1
2020	$45.6	$0.6	$46.2
2021	$101.4	$0.8	$102.3
2022	$28.0	$0.4	$28.4
2023	$66.1	$0.6	$66.7
2024	$28.0	$0.3	$28.4
2025	$26.3	$0.6	$26.9
2026	$20.0	$0.8	$20.8
2027	$21.8	$0.4	$22.2
2028	$18.6	$0.6	$19.1
2029	$23.8	$0.3	$24.1
2030	$45.6	$0.6	$46.2
2031	$101.4	$0.8	$102.3
2032	$28.0	$0.4	$28.4
2033	$66.1	$0.6	$66.7
2034	$28.0	$0.3	$28.4
2035	$26.3	$0.6	$26.9
2036	$20.0	$0.8	$20.8
2037	$21.8	$0.4	$22.2
2038	$18.6	$0.6	$19.1
2039	$16.7	$0.3	$17.0
2040	$13.2	$0.2	$13.4
2041	$6.8	$0.1	$6.9
2042	$5.0	$0.1	$5.1
2043	$0.8	$0.0	$0.8
PV 3%	$914.7	$15.9	$930.6
Annualized 3%	$45.3	$0.8	$46.1
PV 7%	$603.3	$10.76	$614.0
Annualized 7%	$45.4	$0.8	$46.2

Source: U.S. EPA Analysis, 2006.

Chapter E2: Summary of Benefits

INTRODUCTION

This chapter summarizes EPA's analysis of the benefits of the three regulatory analysis options for Phase III existing facilities, the "50 MGD for All Waterbodies" option ("50 MGD All"), the "200 MGD for All Waterbodies" option ("200 MGD All"), and the "100 MGD for Certain Waterbodies" option ("100 MGD CWB"). The chapter presents the total monetary value of regional and national baseline losses and benefits for the regulatory analysis options. Benefits results for the supplemental options analyzed by EPA in developing the proposed and final Phase III regulation are presented in the appendix to this chapter.

CHAPTER CONTENTS

The *Regional Benefits Assessment for the Final Section 316(b) Rule for Phase III Facilities* (RBA) provides greater detail on the methods and data used in the regional analyses (U.S. EPA, 2006). See Chapter A1 for a discussion of the methods used to estimate impingement and entrainment (I&E), and see Chapters A2 through A9 for discussion of the methods used to estimate the value of I&E losses and the benefits of the options evaluated for the final rule. The results of the regional analyses are presented in Parts B through H of the RBA.

EPA does not project benefits for facilities that have not yet been built because to do so would require projecting where these facilities would be built and/or operate. Therefore, the benefits estimates presented in this section are underestimates because they do not reflect benefits associated with reducing I&E at new offshore oil and gas extraction facilities.

E2-1 CALCULATING LOSSES AND BENEFITS

EPA's analysis of national baseline losses and benefits under the evaluated options includes 629 sample-weighted facilities in seven case study regions, excluding facilities that are expected to close in the baseline. The Agency calculated baseline losses by summing losses from all 629 facilities. EPA's estimates of benefits are based on only those facilities that have requirements under each option.

Quantifying and monetizing reductions in I&E due to the evaluated options considered for the final rule is challenging. As described in Chapters A3 and A6 of the RBA, EPA estimated non-use values qualitatively and, as a result, the estimated total benefits of the evaluated options reflect use values only. The RBA discusses specific limitations and uncertainties associated with estimation of commercial and recreational benefits at the regional level. National benefit estimates, which are based on the regional estimates, are subject to the same uncertainties. The overall effect of these uncertainties is of unknown magnitude and direction (i.e., the estimates may over- or understate the anticipated national-level of use benefits); however, EPA has no data to indicate that the results for any of the benefit categories are atypical or unreasonable.

E2-2 SUMMARY OF BASELINE LOSSES AND EXPECTED REDUCTIONS IN I&E

Based on the results of the regional analyses, EPA calculated total baseline I&E losses and the amount by which these losses would be reduced under each of the evaluated options. Losses are presented using two measures of I&E:

1. Age-one equivalent losses – the number of individual fish of different ages impinged and entrained by facility intakes, expressed as age-one equivalents; and
2. Foregone fishery yield – pounds of commercial harvest and numbers of recreational fish and shellfish that are not harvested due to I&E, including indirect losses of harvested species due to losses of forage species.

Table E2-1 presents baseline I&E losses for both measures. As reported in Table E2-1, EPA estimates total national losses of age-one equivalents for all 629 facilities of 265 million fish. Nationwide, EPA estimates that 9.6 million pounds of fishery yield per year is foregone under current rates of I&E. Approximately 33% of all age-one equivalent losses, or 86.4 million fish, occur in the Mid-Atlantic region. The Gulf of Mexico region has the highest foregone fishery yields with approximately 7.5 million pounds, followed by the Mid-Atlantic region with approximately 0.7 million pounds. More detailed discussions of the I&E losses in each region are provided in Parts B through H of the RBA.

Table E2-1: Total Annual Baseline I&E Losses for Potential Phase III Existing Facilities by Region (thousands)

Region	Age-One Equivalents	Foregone Fishery Yield (lbs)
California	1,710	121
North Atlantic	2,310	11
Mid-Atlantic	86,400	682
South Atlantic	42,100	391
Gulf of Mexico	35,800	7,450
Great Lakes	31,500	374
Inland	65,100	609
National Total	265,000	9,640

Reflects all existing facilities *potentially* subject to the Phase III regulation as defined during the regulation's development, and thus includes all manufacturing and electric power generating with design intake flow as low as 2 MGD.

Source: U.S. EPA Analysis, 2006.

To gauge the expected benefits of the regulatory analysis options, EPA estimated the extent to which these options would reduce the estimated baseline losses. These avoided losses are based on the expected reductions in I&E at each facility from implementation of the required compliance technologies. Table E2-2 reports, by region and option, the expected percentage reductions in I&E, and the estimated quantities of reduction in (1) losses in age-one equivalents and (2) foregone fishery yield. At the national level, EPA estimates that the 50 MGD All option would reduce age-one equivalent losses by 98.2 million fish and fishery yield loss by 4.8 million pounds. In comparison, the 200 MGD All option and the 100 MGD CWB option apply to smaller numbers of facilities and would result in slightly smaller reductions in I&E. The 200 MGD All option would reduce age-one equivalent losses by 74.5 million fish and fishery yield losses by 3.3 million pounds. The 100 MGD All option would reduce age-one equivalent losses by 71.1 million fish and fishery yield losses by 4.5 million pounds.

The study regions show substantial variation in the estimated reductions in I&E losses and avoided losses in age-one equivalents and foregone fishery yield. As reported in Table E2-2, the largest percentage reductions in I&E occur in the Gulf of Mexico for the 50 MGD option, the 100 MGD CWB, and 200 MGD options, with 51% and 58% in the 50 MGD and the 100 MGD option, and 30% and 42% in the 200 MGD option.

In terms of avoided age-one equivalent losses, the Mid-Atlantic region accounts for the largest reductions for the 50 MGD All, the 200 MGD All, and 100 MGD CWB options, with 45%, 53%, and 55%, respectively.

On the basis of avoided losses in fishery yield, the Gulf of Mexico generates the greatest benefits under each of the three options. This region account for 88%, 88%, and 93% of the avoided fishery yield losses achieved by the 50 MGD All, the 200 MGD All, and 100 MGD CWB options, respectively.

More detailed discussions of regional benefits are provided in Parts B through H of the RBA.

Table E2-2: Expected Reduction in I&E for Phase III Existing Facilities by Option and Region

Region	Number of Facilities Installing Technology	Impingement	Entrainment	Age-One Equivalents (thousands)	Foregone Fishery Yield (thousands; lbs)
50 MGD All Option					
California	1	37%	28%	474	33
North Atlantic	4	0%	40%	910	4
Mid-Atlantic	3	23%	53%	44,500	212
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	7	51%	58%	19,400	4,200
Great Lakes	18	42%	45%	13,300	160
Inland	78	39%	15%	19,700	155
National Total	111			98,200	4,770
200 MGD All Option					
California[b]	0	0%	0%	0	0
North Atlantic	1	0%	8%	193	1
Mid-Atlantic	2	16%	47%	39,400	163
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	3	30%	42%	12,500	2,900
Great Lakes	7	30%	36%	9,650	119
Inland	13	23%	13%	12,700	107
National Total	27			74,500	3,290
100 MGD CWB Option					
California[b]	0	0%	0%	0	0
North Atlantic	3	0%	32%	736	4
Mid-Atlantic	2	16%	47%	39,400	163
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	7	51%	58%	19,400	4,200
Great Lakes	10	36%	40%	11,600	141
Inland[c]	0	0%	0%	0	0
National Total	22			71,100	4,510

[a] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

[b] No I&E reductions are expected in the California region because all potentially regulated facilities in this region withdraw less than 100 MGD and therefore would not be required to install technologies to comply with the 200 MGD All and the 100 MGD CWB options.

[c] The 100 MGD CWB option would not apply national categorical requirements to facilities located on freshwater rivers and lakes/reservoirs. Thus, no I&E reductions are expected at the potentially regulated facilities in the Inland region.

Source: U.S. EPA Analysis, 2006.

E2-3 TIME PROFILE OF BENEFITS

To account for the difference in timing of benefits and costs, EPA developed a time profile of total benefits from all Phase III facilities that reflects when benefits from each facility would be realized. For each study region,

EPA first calculated the undiscounted commercial and recreational fishing benefits from the expected annual I&E reductions under the regulatory analysis options, based on the assumptions that all facilities in each region have achieved compliance with the rule and that benefits are realized immediately following compliance. Then, since there are regulatory and biological time lags between promulgation of the rule and the realization of benefits, EPA created a time profile of benefits that takes into account the fact that benefits do not begin immediately. The development of the time profile of benefits is discussed in detail in *Chapter A8: Discounting Benefits*.

Table E2-3, following page, provides the time profile of the monetary value of baseline I&E losses for existing Phase III facilities, by region. EPA developed similar time profiles for monetary benefits for the regulatory analysis options (see Table E2-4 through Table E2-6, beginning page E2-6).

Table E2-3: Time Profile of Mean Monetary Value of Total Baseline I&E Losses (thousands; $2004)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$345	$128	$125	$598
2008	$14	$5	$39	$142	$690	$256	$249	$1,396
2009	$29	$11	$77	$285	$2,759	$1,025	$997	$5,182
2010	$115	$43	$308	$1,138	$3,104	$1,153	$1,121	$6,982
2011	$129	$49	$347	$1,280	$3,277	$1,217	$1,184	$7,482
2012	$136	$51	$366	$1,352	$3,449	$1,281	$1,246	$7,881
2013	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2014	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2015	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2016	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2017	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2018	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2019	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2020	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2021	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2022	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2023	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2024	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2025	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2026	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2027	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2028	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2029	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2030	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2031	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2032	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2033	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2034	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2035	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2036	$143	$54	$385	$1,423	$3,449	$1,281	$1,246	$7,981
2037	$143	$54	$385	$1,423	$3,104	$1,153	$1,121	$7,384
2038	$129	$49	$347	$1,280	$2,759	$1,025	$997	$6,585
2039	$115	$43	$308	$1,138	$690	$256	$249	$2,799
2040	$29	$11	$77	$285	$345	$128	$125	$999
2041	$14	$5	$39	$142	$172	$64	$62	$499
2042	$7	$3	$19	$71	$0	$0	$0	$100
2043	$0	$0	$0	$0	$0	$0	$0	$0
2044	$0	$0	$0	$0	$0	$0	$0	$0
2045	$0	$0	$0	$0	$0	$0	$0	$0
2046	$0	$0	$0	$0	$0	$0	$0	$0
2047	$0	$0	$0	$0	$0	$0	$0	$0
2048	$0	$0	$0	$0	$0	$0	$0	$0
PV 3%[b]	$2,646	$999	$7,109	$26,260	$65,575	$24,350	$23,685	$150,625
Annualized 3%[c]	$135	$51	$363	$1,340	$3,346	$1,242	$1,208	$7,685
PV 7%[b]	$1,553	$586	$4,172	$15,411	$39,979	$14,845	$14,440	$90,986
Annualized 7%[c]	$125	$47	$336	$1,242	$3,222	$1,196	$1,164	$7,332

[a] Because EPA estimated non-use benefits qualitatively, the total monetary value of I&E losses includes only losses in use values.

[b] The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

[c] Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

Source: U.S. EPA Analysis, 2006.

Table E2-4: Time Profile of Mean Total Use Benefits - 50 MGD All Option (thousands; $2004)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$3	$6	$9
2011	$3	$0	$2	$0	$0	$30	$29	$64
2012	$7	$1	$3	$0	$165	$75	$84	$335
2013	$27	$3	$22	$0	$330	$249	$195	$825
2014	$30	$11	$36	$0	$1,320	$315	$235	$1,946
2015	$32	$13	$96	$0	$1,484	$460	$291	$2,377
2016	$33	$19	$125	$0	$1,567	$495	$313	$2,552
2017	$33	$20	$133	$0	$1,649	$507	$318	$2,662
2018	$33	$21	$139	$0	$1,649	$518	$322	$2,683
2019	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2020	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2021	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2022	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2023	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2024	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2025	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2026	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2027	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2028	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2029	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2030	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2031	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2032	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2033	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2034	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2035	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2036	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2037	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2038	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2039	$33	$21	$141	$0	$1,649	$518	$323	$2,685
2040	$33	$21	$141	$0	$1,649	$515	$316	$2,676
2041	$30	$21	$139	$0	$1,649	$488	$294	$2,622
2042	$27	$20	$138	$0	$1,484	$444	$238	$2,351
2043	$7	$18	$119	$0	$1,320	$269	$127	$1,860
2044	$3	$10	$105	$0	$330	$203	$87	$739
2045	$2	$8	$45	$0	$165	$58	$31	$309
2046	$0	$2	$16	$0	$82	$23	$10	$133
2047	$0	$1	$8	$0	$0	$11	$4	$24
2048	$0	$0[e]	$2	$0	$0	$0	$0[e]	$2
PV 3%[c]	$565	$336	$2,244	$0	$27,050	$8,543	$5,389	$44,128
Annualized 3%[d]	$29	$17	$115	$0	$1,380	$436	$275	$2,251
PV 7%[c]	$296	$165	$1,090	$0	$13,631	$4,341	$2,786	$22,308
Annualized 7%[d]	$24	$13	$88	$0	$1,098	$350	$224	$1,798

[a] Because EPA estimated non-use benefits qualitatively, the monetary value of benefits includes use values only.

[b] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with this option.

[c] The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

[d] Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[e] Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2-5: Time Profile of Mean Total Use Benefits - 200 MGD All Option (thousands; $2004)[a]

Year	California[b]	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$0	$3	$3
2011	$0	$0	$0	$0	$0	$19	$20	$39
2012	$0	$0	$0	$0	$106	$38	$52	$197
2013	$0	$0	$9	$0	$213	$172	$142	$536
2014	$0	$0[e]	$20	$0	$851	$210	$163	$1,245
2015	$0	$1	$76	$0	$958	$337	$203	$1,575
2016	$0	$4	$102	$0	$1,011	$366	$215	$1,698
2017	$0	$4	$110	$0	$1,064	$376	$218	$1,772
2018	$0	$4	$116	$0	$1,064	$386	$221	$1,790
2019	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2020	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2021	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2022	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2023	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2024	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2025	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2026	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2027	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2028	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2029	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2030	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2031	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2032	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2033	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2034	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2035	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2036	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2037	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2038	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2039	$0	$4	$117	$0	$1,064	$386	$221	$1,792
2040	$0	$4	$117	$0	$1,064	$386	$218	$1,789
2041	$0	$4	$117	$0	$1,064	$367	$201	$1,753
2042	$0	$4	$117	$0	$958	$348	$169	$1,595
2043	$0	$4	$108	$0	$851	$214	$78	$1,256
2044	$0	$4	$97	$0	$213	$176	$58	$547
2045	$0	$4	$41	$0	$106	$49	$17	$217
2046	$0	$1	$15	$0	$53	$20	$5	$94
2047	$0	$0[e]	$7	$0	$0	$10	$3	$20
2048	$0	$0[e]	$1	$0	$0	$0	$0	$2
PV 3%[c]	$0	$69	$1,849	$0	$17,451	$6,324	$3,693	$29,386
Annualized 3%[d]	$0	$4	$94	$0	$890	$323	$188	$1,499
PV 7%[c]	$0	$32	$889	$0	$8,794	$3,191	$1,912	$14,817
Annualized 7%[d]	$0	$3	$72	$0	$709	$257	$154	$1,194

[a] Because EPA estimated non-use benefits qualitatively, the monetary value of benefits includes use values only.

[b] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 200 MGD and therefore would not be required to install technologies to comply with this option.

[c] The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

[d] Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[e] Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2-6: Time Profile of Mean Total Use Benefits - 100 MGD CWB Option (thousands; $2004)[a]

Year	California[b]	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland[c]	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$3	$0	$3
2011	$0	$0	$0	$0	$0	$28	$0	$28
2012	$0	$1	$0	$0	$165	$66	$0	$232
2013	$0	$3	$9	$0	$330	$223	$0	$564
2014	$0	$10	$20	$0	$1,320	$267	$0	$1,618
2015	$0	$12	$76	$0	$1,484	$403	$0	$1,976
2016	$0	$15	$102	$0	$1,567	$435	$0	$2,120
2017	$0	$17	$110	$0	$1,649	$445	$0	$2,221
2018	$0	$17	$116	$0	$1,649	$456	$0	$2,238
2019	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2020	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2021	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2022	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2023	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2024	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2025	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2026	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2027	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2028	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2029	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2030	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2031	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2032	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2033	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2034	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2035	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2036	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2037	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2038	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2039	$0	$17	$117	$0	$1,649	$456	$0	$2,239
2040	$0	$17	$117	$0	$1,649	$453	$0	$2,237
2041	$0	$17	$117	$0	$1,649	$428	$0	$2,212
2042	$0	$16	$117	$0	$1,484	$390	$0	$2,007
2043	$0	$14	$108	$0	$1,320	$233	$0	$1,675
2044	$0	$7	$97	$0	$330	$189	$0	$622
2045	$0	$5	$41	$0	$165	$52	$0	$263
2046	$0	$2	$15	$0	$82	$21	$0	$119
2047	$0	$0[f]	$7	$0	$0	$10	$0	$18
2048	$0	$0[f]	$1	$0	$0	$0	$0	$2
PV 3%[d]	$0	$274	$1,849	$0	$27,050	$7,513	$0	$36,687
Annualized 3%[e]	$0	$14	$94	$0	$1,380	$383	$0	$1,872
PV 7%[d]	$0	$136	$889	$0	$13,631	$3,816	$0	$18,472
Annualized 7%[e]	$0	$11	$72	$0	$1,098	$308	$0	$1,489

a Because EPA estimated non-use benefits qualitatively, the monetary value of benefits includes use values only.
b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 100 MGD and therefore would not be required to install technologies to comply with this option.
c The 100 MGD CWB option would not apply national categorical requirements to facilities located on freshwater rivers and lakes/reservoirs. Thus, no I&E reductions are expected at the potentially regulated facilities in the Inland region.
d The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.
e Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.
f Positive non-zero value less than $500.
Source: U.S. EPA Analysis, 2006.

E2-4 TOTAL ANNUALIZED MONETARY VALUE OF LOSSES AND BENEFITS

EPA used the profiles of benefits, by region, to calculate a total present value of benefits and then to calculate a constant annual equivalent value (annualized value) of the present value. EPA performed the calculations of present value and annualized value using two discount rate values: a real rate of 3% and a real rate of 7%. Although the total period for analysis of benefits extends from 2007 through 2048, a 42-year period, EPA annualized the value of benefits over 30 years, which is the assumed length of each facility's compliance period for the social cost analysis, as described in *Chapter E1: Summary of Social Costs*. Using the same annualization period as in the cost analysis is necessary to provide a conceptually and mathematically consistent comparison of annualized benefit and cost values.

EPA estimated mean values, as well as lower and upper bound values reflecting uncertainty in the recreational benefits estimates. Table E2-7 presents the value of baseline I&E losses for each region and for the nation as a whole. Table E2-8 and Table E2-9 present I&E losses for each region and the nation under the Phase III Final Regulation, 200 MGD All, and 100 MGD CWB options, discounted at 3% and 7%, respectively. Because EPA did not estimate non-use benefits quantitatively, the monetary value of national losses and benefits presented in these tables reflects only use values.[1] As described in Chapter A3 of the RBA, the Agency was not able to monetize any benefits for 97.4% of the age-one equivalent losses of all commercial, recreational, and forage species analyzed for the evaluated options for existing facilities. This means that the estimates of losses and benefits presented in this section represent the losses and benefits associated with 2.6% of the total age-one equivalents lost due to I&E by cooling water intake structures.

Table E2-7 reports the monetized value of baseline losses as outlined above. EPA estimates the national value of these losses at $1.3 million in commercial fishing losses and $6.4 million in recreational fishing losses (2004$, discounted to 2007 at 3%). The total use value of fishery resources lost is $7.7 million per year, with lower and upper bounds of $5.0 million and $12.6 million, respectively (2004$, discounted at 3%). At a 7% discount rate, EPA estimates total annual national value of losses at $1.3 million in commercial fishing losses and $6.1 million in recreational fishing losses (2004$). The total use value of fishery resources lost, discounted at 7%, is $7.3 million per year, with lower and upper bounds of $4.8 million and $12.0 million, respectively (2004$). Total monetized losses are greatest in the Gulf of Mexico region. More detailed discussions of the valuation of recreational and commercial fishing losses under the baseline conditions in each region are provided in Parts B through H of the RBA.

[1] See Chapter A6 of the RBA for a detailed description of the qualitative non-use benefits from reduced I&E.

Table E2-7: Summary of Monetary Values of Baseline I&E Losses (thousands; $2004)[a]

Region	Annualized Use Value of Baseline I&E Losses						
	Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
				3% discount rate			
California	$0 - $54	$42	$81	$155	$97	$135	$209
North Atlantic	$0 - $1	$26	$50	$95	$27	$51	$97
Mid-Atlantic	$0 - $84	$142	$279	$569	$226	$363	$653
South Atlantic	$0 - $168	$769	$1,246	$2,042	$936	$1,414	$2,210
Gulf of Mexico	$0 - $990	$1,255	$2,356	$4,544	$2,245	$3,346	$5,533
Great Lakes	$0 - $97	$786	$1,145	$1,679	$883	$1,242	$1,776
Inland[c]	n/a	$670	$1,208	$2,194	$670	$1,208	$2,194
National Total	**$0 -$1,320**	**$3,689**	**$6,365**	**$11,278**	**$5,009**	**$7,658**	**$12,597**
				7% discount rate			
California	$0 - $50	$39	$75	$143	$89	$125	$194
North Atlantic	$0 - $1	$24	$46	$88	$25	$47	$90
Mid-Atlantic	$0 - $78	$131	$258	$527	$209	$336	$605
South Atlantic	$0 - $156	$712	$1,155	$1,893	$868	$1,311	$2,049
Gulf of Mexico	$0 - $953	$1,209	$2,269	$4,376	$2,162	$3,222	$5,328
Great Lakes	$0 - $94	$757	$1,103	$1,617	$850	$1,196	$1,710
Inland[c]	$0	$645	$1,164	$2,113	$645	$1,164	$2,113
National Total	**$0 -$1,263**	**$3,517**	**$6,070**	**$10,757**	**$4,780**	**$7,332**	**$12,020**

[a] All losses presented in this table are annualized. These estimated annualized losses represent the value of all losses generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[b] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits qualitatively. A range of recreational fishing benefits is provided, based on the Krinsky and Robb technique to estimated the 95th and 5th percentile limits on the marginal value per fish predicted by EPA's meta-analysis (see chapter A5 of the RBA). Commercial fishing benefits are computed based on a region- and species-specific range of gross revenue (see Chapter A4 of the RBA). To calculate the total use value columns (low, mean, and high), the high-end value for commercial fishing benefits is added to the low, mean, and high values for recreational fishing benefits, respectively.

[c] No significant commercial fishing takes place in the Inland region. Thus, this region is excluded from the commercial fishing analysis.

Source: U.S. EPA Analysis, 2006.

Tables E2-8 and E2-9 present EPA's estimates of the national and regional values of avoided I&E losses (all values are in 2004$, discounted at 3% and 7% to beginning of year 2007, and annualized over a 30-year period). National values of avoided I&E losses at a 3% discount rate are as follows:

- For the 50 MGD All option, a mean value of $2.3 million per year, with lower and upper bounds of $1.4 million and $3.8 million (see Table E2-8);
- For the 200 MGD All option, a mean value of $1.5 million per year, with lower and upper bounds of $1.0 million and $2.5 million (see Table E2-8); and
- For the 100 MGD CWB option, a mean value of $1.9 million per year, with lower and upper bounds of $1.2 million and $3.1 million (see Table E2-8).

The 7% discount rate calculations yield smaller values as follows:

- For the 50 MGD All option, a mean value of $1.8 million per year, with lower and upper bounds of $1.1 million and $3.0 million (see Table E2-9);

- For the 200 MGD All option, a mean value of $1.2 million per year, with lower and upper bounds of $0.8 million and $2.0 million (see Table E2-9); and
- For the 100 MGD CWB option, a mean value of $1.5 million per year, with lower and upper bounds of $1.0 million and $2.5 million (see Table E2-9).

The majority of the use benefit value is attributable to benefits to recreational anglers from improved catch rates. As shown in Tables E2-8 and E2-9, use benefits are largest in the Gulf of Mexico for the 50 MGD All option, 100 MGD CWB option, and the 200 MGD All option. More detailed discussions of regional benefits under each option are provided in Parts B through H of the RBA.

Table E2-8: Summary of Monetized Benefits by Option (thousands; $2004; discounted at 3%)[a]

Region	Annualized Commercial Fishing Benefits	Annualized Recreational Fishing Benefits			Total Annualized Value of Monetized Impingement and Entrainment Reductions[b]		
		Low	Mean	High	Low	Mean	High
50 MGD All Option							
California	$0 - $8	$11	$21	$40	$19	$29	$48
North Atlantic	$0 - $0[g]	$9	$17	$33	$9	$17	$33
Mid-Atlantic	$0 - $18	$48	$96	$198	$67	$115	$216
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $283	$589	$1,097	$2,101	$872	$1,380	$2,384
Great Lakes	$0 - $11	$292	$425	$624	$302	$436	$634
Inland[d]	n/a	$152	$275	$501	$152	$275	$501
National Total	**$0 -$321**	**$1,101**	**$1,931**	**$3,496**	**$1,421**	**$2,251**	**$3,816**
200 MGD All Option							
California[e]	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0 - $0[g]	$2	$3	$7	$2	$4	$7
Mid-Atlantic	$0 - $15	$40	$80	$164	$55	$94	$179
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $188	$382	$702	$1,328	$570	$890	$1,516
Great Lakes	$0 - $8	$216	$315	$462	$224	$323	$470
Inland[d]	n/a	$104	$188	$343	$104	$188	$343
National Total	**$0 -$211**	**$744**	**$1,288**	**$2,303**	**$955**	**$1,499**	**$2,514**
100 MGD CWB Option							
California[e]	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0 - $0[g]	$7	$14	$27	$7	$14	$27
Mid-Atlantic	$0 - $15	$40	$80	$164	$55	$94	$179
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $283	$589	$1,097	$2,101	$872	$1,380	$2,384
Great Lakes	$0 - $9	$257	$374	$548	$266	$383	$558
Inland[d,f]	n/a	$0	$0	$0	$0	$0	$0
National Total	**$0 -$308**	**$892**	**$1,564**	**$2,840**	**$1,200**	**$1,872**	**$3,148**

[a] All benefits presented in this table are annualized. These annualized benefits represent the value of all losses generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[b] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits qualitatively. A range of recreational fishing benefits is provided, based on the Krinsky and Robb technique to estimated the 95th and 5th percentile limits on the marginal value per fish predicted by EPA's meta-analysis (see chapter A5 of the RBA). Commercial fishing benefits are computed based on a region- and species-specific range of gross revenue (see Chapter A4 of the RBA). To calculate the total use value columns (low, mean, and high), the high-end value for commercial fishing benefits is added to the low, mean, and high values for recreational fishing benefits, respectively.

[c] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

[d] No significant commercial fishing takes place in the Inland region. Thus, this region is excluded from the commercial fishing analysis.

[e] No I&E reductions are expected in the California region because all potentially regulated facilities in this region withdraw less than 100 MGD and therefore would not be required to install technologies to comply with the 200 MGD All and the 100 MGD CWB options.

[f] The 100 MGD CWB option would not apply national categorical requirements to facilities located on freshwater rivers and lakes/reservoirs. Thus, no I&E reductions are expected at the potentially regulated facilities in the Inland region.

[g] Denotes a positive value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2-9: Summary of Monetized Benefits by Option (thousands; $2004; discounted at 7%)[a]

Region	Annualized Commercial Fishing Benefits	Annualized Recreational Fishing Benefits			Total Annualized Value of Monetized Impingement and Entrainment Reductions[b]		
		Low	Mean	High	Low	Mean	High
50 MGD All Option							
California	$0 - $7	$9	$17	$33	$16	$24	$39
North Atlantic	$0 - $0[g]	$7	$13	$25	$7	$13	$25
Mid-Atlantic	$0 - $14	$37	$74	$152	$51	$88	$166
South Atlanticc	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $225	$468	$873	$1,672	$694	$1,098	$1,898
Great Lakes	$0 - $9	$234	$341	$500	$243	$350	$509
Inland[d]	n/a	$124	$224	$409	$124	$224	$409
National Total	**$0 -$255**	**$880**	**$1,543**	**$2,792**	**$1,135**	**$1,798**	**$3,047**
200 MGD All Option							
California[e]	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0 - $0[g]	$1	$3	$5	$1	$3	$5
Mid-Atlantic	$0 - $11	$30	$60	$125	$42	$72	$136
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $150	$304	$559	$1,057	$454	$709	$1,207
Great Lakes	$0 - $6	$172	$251	$368	$178	$257	$374
Inland[d]	n/a	$85	$154	$280	$85	$154	$280
National Total	**$0 -$167**	**$593**	**$1,027**	**$1,835**	**$760**	**$1,194**	**$2,002**
100 MGD CWB Option							
California[e]	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0 - $0[g]	$6	$11	$21	$6	$11	$21
Mid-Atlantic	$0 - $11	$30	$60	$125	$42	$72	$136
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $225	$468	$873	$1,672	$694	$1,098	$1,898
Great Lakes	$0 - $7	$206	$300	$440	$213	$308	$447
Inland[d,f]	n/a	$0	$0	$0	$0	$0	$0
National Total	**$0 -$244**	**$710**	**$1,244**	**$2,258**	**$955**	**$1,489**	**$2,502**

[a] All benefits presented in this table are annualized. These annualized benefits represent the value of all losses generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[b] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits qualitatively. A range of recreational fishing benefits is provided, based on the Krinsky and Robb technique to estimated the 95th and 5th percentile limits on the marginal value per fish predicted by EPA's meta-analysis (see chapter A5 of the RBA). Commercial fishing benefits are computed based on a region- and species-specific range of gross revenue (see Chapter A4 of the RBA). To calculate the total use value columns (low, mean, and high), the high-end value for commercial fishing benefits is added to the low, mean, and high values for recreational fishing benefits, respectively.

[c] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

[d] No significant commercial fishing takes place in the Inland region, and thus this region is excluded from the commercial fishing benefits analysis.

[e] No I&E reductions are expected in the California region because all potentially regulated facilities in this region withdraw less than 100 MGD and therefore would not be required to install technologies to comply with the 200 MGD All and the 100 MGD CWB options.

[f] The 100 MGD CWB option would not apply national categorical requirements to facilities located on freshwater rivers and lakes/reservoirs. Thus, no I&E reductions are expected at the potentially regulated facilities in the Inland region.

[g] Denotes a positive value less than $500.

Source: U.S. EPA Analysis, 2006.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Regional Analysis for the Final Section 316(b) Phase III Existing Facilities Rule*. EPA-821-R-06-002. June 2006.

Appendix E2A: Summary of Results for Supplemental Options

INTRODUCTION

This appendix supplements *Chapter E2* by presenting the results of the benefits analysis for eight supplemental options evaluated for potential Phase III existing facilities. For all options, facility counts and other results only include those potential Phase III existing facilities that are (1) non-baseline closures and (2) subject to national categorical requirements under the option. See the main body of this chapter for a description of methodologies used in this analysis.

APPENDIX CONTENTS

E2A-1 SUMMARY OF EXPECTED REDUCTIONS IN I&E

Table E2A-1 presents the number of facilities with technology requirements under the supplemental options, by region, and EPA's estimates of the percentage by which I&E would be reduced under each option. The table also presents estimates of regional and national reductions in I&E losses under each option, expressed as age-one equivalents lost and foregone fishery yields.

Table E2A-2: Expected Reductions in I&E for Existing Phase III Facilities by Option

Region	Number of Facilities Installing Technology	Impingement	Entrainment	Age-One Equivalents (thousands)	Foregone Fishery Yield (thousands; lbs)
"Electric Generators 2-50 MGD I-only Everywhere" Option					
California	0	0%	0%	0	0
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	1	1%	0%	27	3
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	0	0%	0%	0	0
Great Lakes	3	1%	0%	303	3
Inland	14	1%	0%	473	3
National Total	**19**			**802**	**9**
"Electric Generators 2-50 MGD I&E like Phase II" Option					
California	0	0%	0%	0	0
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	1	1%	0%	27	3
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	0	0%	0%	0	0
Great Lakes	3	1%	1%	327	4
Inland	15	1%	0%	509	4
National Total	**20**			**863**	**10**

Table E2A-2: Expected Reductions in I&E for Existing Phase III Facilities by Option

Region	Number of Facilities Installing Technology	Impingement	Entrainment	Age-One Equivalents (thousands)	Foregone Fishery Yield (thousands; lbs)
"Electric Generators 2-50 MGD I&E Everywhere" Option					
California	0	0%	0%	0	0
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	2	1%	2%	1,480	6
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	0	0%	0%	0	0
Great Lakes	3	1%	1%	331	4
Inland	16	1%	1%	802	8
National Total	**22**			**2,610**	**18**
"Manufacturers 2-50 MGD I-only Everywhere" Option					
California	3	37%	0%	10	0
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	3	4%	0%	150	18
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	4	3%	0%	543	48
Great Lakes	16	2%	0%	698	7
Inland	126	8%	0%	3,320	21
National Total	**152**			**4,720**	**94**
"Manufacturers 2-50 MGD I&E like Phase II" Option					
California	3	37%	28%	481	34
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	3	4%	3%	2,310	22
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	4	3%	2%	855	162
Great Lakes	16	2%	1%	732	8
Inland	140	8%	2%	3,660	27
National Total	**166**			**8,040**	**252**
"Manufacturers 2-50 MGD I&E Everywhere" Option					
California	3	37%	31%	534	38
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	3	4%	3%	2,310	22
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	4	3%	2%	855	162
Great Lakes	16	2%	2%	764	9
Inland	142	8%	7%	4,880	44
National Total	168			9,340	275
"Manufacturers 50+ MGD I-only Everywhere" Option					
California	**1**	**37%**	**0%**	**10**	**0**
North Atlantic	0	0%	0%	0	0
Mid-Atlantic	2	23%	0%	1,000	118
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	5	51%	0%	10,400	917
Great Lakes	15	42%	0%	11,700	109
Inland	74	38%	0%	16,200	105
National Total	**97**			**39,400**	**1,250**

Table E2A-2: Expected Reductions in I&E for Existing Phase III Facilities by Option

Region	Number of Facilities Installing Technology	Impingement	Entrainment	Age-One Equivalents (thousands)	Foregone Fishery Yield (thousands; lbs)
"Manufacturers 50+ MGD I&E Everywhere" Option					
California	1	37%	28%	474	33
North Atlantic	4	0%	40%	910	4
Mid-Atlantic	3	23%	53%	44,500	212
South Atlantic[a]	0	0%	0%	0	0
Gulf of Mexico	7	51%	58%	19,400	4,200
Great Lakes	18	42%	46%	13,400	161
Inland	94	38%	37%	24,600	228
National Total	**127**			**103,000**	**4,840**

[a] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with these options.

Source: U.S. EPA Analysis, 2006.

E2A-2 TIME PROFILE OF BENEFITS

Table E2A-3 through Table E2A-4 below provide the time profiles of regional benefits for the eight supplemental options.

Table E2A-5: Time Profile of Mean Total Use Benefits - "Electric Generators 2-50 MGD I-only Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$0	$0[e]	$0[e]
2011	$0	$0	$0	$0	$0	$0[e]	$1	$1
2012	$0	$0	$0	$0	$0	$1	$2	$3
2013	$0	$0	$0	$0	$0	$4	$4	$7
2014	$0	$0	$0	$0	$0	$4	$5	$10
2015	$0	$0	$0[e]	$0	$0	$6	$6	$12
2016	$0	$0	$0[e]	$0	$0	$8	$6	$14
2017	$0	$0	$1	$0	$0	$8	$6	$16
2018	$0	$0	$1	$0	$0	$9	$7	$16
2019	$0	$0	$1	$0	$0	$9	$7	$16
2020	$0	$0	$1	$0	$0	$9	$7	$16
2021	$0	$0	$1	$0	$0	$9	$7	$16
2022	$0	$0	$1	$0	$0	$9	$7	$16
2023	$0	$0	$1	$0	$0	$9	$7	$16
2024	$0	$0	$1	$0	$0	$9	$7	$16
2025	$0	$0	$1	$0	$0	$9	$7	$16
2026	$0	$0	$1	$0	$0	$9	$7	$16
2027	$0	$0	$1	$0	$0	$9	$7	$16
2028	$0	$0	$1	$0	$0	$9	$7	$16
2029	$0	$0	$1	$0	$0	$9	$7	$16
2030	$0	$0	$1	$0	$0	$9	$7	$16
2031	$0	$0	$1	$0	$0	$9	$7	$16
2032	$0	$0	$1	$0	$0	$9	$7	$16
2033	$0	$0	$1	$0	$0	$9	$7	$16
2034	$0	$0	$1	$0	$0	$9	$7	$16
2035	$0	$0	$1	$0	$0	$9	$7	$16
2036	$0	$0	$1	$0	$0	$9	$7	$16
2037	$0	$0	$1	$0	$0	$9	$7	$16
2038	$0	$0	$1	$0	$0	$9	$7	$16
2039	$0	$0	$1	$0	$0	$9	$7	$16
2040	$0	$0	$1	$0	$0	$9	$6	$16
2041	$0	$0	$1	$0	$0	$8	$6	$15
2042	$0	$0	$1	$0	$0	$8	$4	$13
2043	$0	$0	$1	$0	$0	$5	$3	$9
2044	$0	$0	$1	$0	$0	$4	$1	$7
2045	$0	$0	$1	$0	$0	$3	$1	$5
2046	$0	$0	$1	$0	$0	$1	$0[e]	$2
2047	$0	$0	$0[e]	$0	$0	$0[e]	$0[e]	$1
2048	$0	$0	$0[e]	$0	$0	$0[e]	$0[e]	$0[e]
PV 3%[c]	**$0**	**$0**	**$15**	**$0**	**$0**	**$142**	**$109**	**$267**
Annualized 3%[d]	**$0**	**$0**	**$1**	**$0**	**$0**	**$7**	**$6**	**$14**
PV 7%[c]	**$0**	**$0**	**$7**	**$0**	**$0**	**$71**	**$57**	**$135**
Annualized 7%[d]	**$0**	**$0**	**$1**	**$0**	**$0**	**$6**	**$5**	**$11**

[a] Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

[b] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

[c] The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

[d] Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[e] Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-6: Time Profile of Mean Total Use Benefits - "Electric Generators 2-50 MGD I&E like Phase II" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$0	$0[e]	$0[e]
2011	$0	$0	$0	$0	$0	$1	$1	$1
2012	$0	$0	$0	$0	$0	$1	$3	$4
2013	$0	$0	$0	$0	$0	$5	$4	$9
2014	$0	$0	$0	$0	$0	$6	$6	$12
2015	$0	$0	$0[e]	$0	$0	$7	$7	$15
2016	$0	$0	$0[e]	$0	$0	$11	$7	$18
2017	$0	$0	$1	$0	$0	$11	$8	$19
2018	$0	$0	$1	$0	$0	$11	$8	$20
2019	$0	$0	$1	$0	$0	$12	$8	$20
2020	$0	$0	$1	$0	$0	$12	$8	$20
2021	$0	$0	$1	$0	$0	$12	$8	$20
2022	$0	$0	$1	$0	$0	$12	$8	$20
2023	$0	$0	$1	$0	$0	$12	$8	$20
2024	$0	$0	$1	$0	$0	$12	$8	$20
2025	$0	$0	$1	$0	$0	$12	$8	$20
2026	$0	$0	$1	$0	$0	$12	$8	$20
2027	$0	$0	$1	$0	$0	$12	$8	$20
2028	$0	$0	$1	$0	$0	$12	$8	$20
2029	$0	$0	$1	$0	$0	$12	$8	$20
2030	$0	$0	$1	$0	$0	$12	$8	$20
2031	$0	$0	$1	$0	$0	$12	$8	$20
2032	$0	$0	$1	$0	$0	$12	$8	$20
2033	$0	$0	$1	$0	$0	$12	$8	$20
2034	$0	$0	$1	$0	$0	$12	$8	$20
2035	$0	$0	$1	$0	$0	$12	$8	$20
2036	$0	$0	$1	$0	$0	$12	$8	$20
2037	$0	$0	$1	$0	$0	$12	$8	$20
2038	$0	$0	$1	$0	$0	$12	$8	$20
2039	$0	$0	$1	$0	$0	$12	$8	$20
2040	$0	$0	$1	$0	$0	$12	$7	$20
2041	$0	$0	$1	$0	$0	$11	$7	$19
2042	$0	$0	$1	$0	$0	$10	$4	$16
2043	$0	$0	$1	$0	$0	$7	$3	$11
2044	$0	$0	$1	$0	$0	$6	$1	$8
2045	$0	$0	$1	$0	$0	$4	$1	$6
2046	$0	$0	$1	$0	$0	$1	$0[e]	$2
2047	$0	$0	$0[e]	$0	$0	$1	$0[e]	$1
2048	$0	$0	$0[e]	$0	$0	$0[e]	$0[e]	$0[e]
PV 3%[c]	**$0**	**$0**	**$15**	**$0**	**$0**	**$187**	**$128**	**$330**
Annualized 3%[d]	**$0**	**$0**	**$1**	**$0**	**$0**	**$10**	**$7**	**$17**
PV 7%[c]	**$0**	**$0**	**$7**	**$0**	**$0**	**$93**	**$67**	**$167**
Annualized 7%[d]	**$0**	**$0**	**$1**	**$0**	**$0**	**$8**	**$5**	**$13**

[a] Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

[b] No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

[c] The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

[d] Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

[e] Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-7: Time Profile of Mean Total Use Benefits - "Electric Generators 2-50 MGD I&E Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$0	$1	$1
2011	$0	$0	$0	$0	$0	$1	$2	$2
2012	$0	$0	$0[e]	$0	$0	$1	$6	$8
2013	$0	$0	$1	$0	$0	$5	$9	$14
2014	$0	$0	$2	$0	$0	$6	$13	$21
2015	$0	$0	$3	$0	$0	$8	$15	$25
2016	$0	$0	$3	$0	$0	$11	$16	$29
2017	$0	$0	$4	$0	$0	$11	$16	$31
2018	$0	$0	$4	$0	$0	$12	$16	$32
2019	$0	$0	$4	$0	$0	$12	$16	$32
2020	$0	$0	$4	$0	$0	$12	$16	$32
2021	$0	$0	$4	$0	$0	$12	$16	$32
2022	$0	$0	$4	$0	$0	$12	$16	$32
2023	$0	$0	$4	$0	$0	$12	$16	$32
2024	$0	$0	$4	$0	$0	$12	$16	$32
2025	$0	$0	$4	$0	$0	$12	$16	$32
2026	$0	$0	$4	$0	$0	$12	$16	$32
2027	$0	$0	$4	$0	$0	$12	$16	$32
2028	$0	$0	$4	$0	$0	$12	$16	$32
2029	$0	$0	$4	$0	$0	$12	$16	$32
2030	$0	$0	$4	$0	$0	$12	$16	$32
2031	$0	$0	$4	$0	$0	$12	$16	$32
2032	$0	$0	$4	$0	$0	$12	$16	$32
2033	$0	$0	$4	$0	$0	$12	$16	$32
2034	$0	$0	$4	$0	$0	$12	$16	$32
2035	$0	$0	$4	$0	$0	$12	$16	$32
2036	$0	$0	$4	$0	$0	$12	$16	$32
2037	$0	$0	$4	$0	$0	$12	$16	$32
2038	$0	$0	$4	$0	$0	$12	$16	$32
2039	$0	$0	$4	$0	$0	$12	$16	$32
2040	$0	$0	$4	$0	$0	$12	$15	$32
2041	$0	$0	$4	$0	$0	$11	$15	$30
2042	$0	$0	$4	$0	$0	$11	$10	$25
2043	$0	$0	$4	$0	$0	$7	$7	$18
2044	$0	$0	$2	$0	$0	$6	$3	$11
2045	$0	$0	$2	$0	$0	$4	$1	$8
2046	$0	$0	$2	$0	$0	$1	$1	$3
2047	$0	$0	$0[e]	$0	$0	$1	$0[e]	$1
2048	$0	$0	$0[e]	$0	$0	$0[e]	$0[e]	$0[e]
PV 3%[c]	**$0**	**$0**	**$70**	**$0**	**$0**	**$195**	**$270**	**$534**
Annualized 3% [d]	**$0**	**$0**	**$4**	**$0**	**$0**	**$10**	**$14**	**$27**
PV 7% [c]	**$0**	**$0**	**$34**	**$0**	**$0**	**$97**	**$140**	**$271**
Annualized 7% [d]	**$0**	**$0**	**$3**	**$0**	**$0**	**$8**	**$11**	**$22**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

e Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-8: Time Profile of Mean Total Use Benefits - "Manufacturers 2-50 MGD I-only Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$1	$0[e]	$1
2011	$0	$0	$0	$0	$0	$2	$2	$3
2012	$0	$0	$1	$0	$5	$7	$7	$19
2013	$0	$0	$1	$0	$9	$12	$14	$36
2014	$0[e]	$0	$5	$0	$37	$18	$26	$85
2015	$0[e]	$0	$5	$0	$42	$19	$35	$102
2016	$1	$0	$5	$0	$44	$20	$42	$113
2017	$1	$0	$6	$0	$47	$20	$44	$118
2018	$1	$0	$6	$0	$47	$20	$45	$119
2019	$1	$0	$6	$0	$47	$20	$46	$120
2020	$1	$0	$6	$0	$47	$20	$46	$120
2021	$1	$0	$6	$0	$47	$20	$46	$120
2022	$1	$0	$6	$0	$47	$20	$46	$120
2023	$1	$0	$6	$0	$47	$20	$46	$120
2024	$1	$0	$6	$0	$47	$20	$46	$120
2025	$1	$0	$6	$0	$47	$20	$46	$120
2026	$1	$0	$6	$0	$47	$20	$46	$120
2027	$1	$0	$6	$0	$47	$20	$46	$120
2028	$1	$0	$6	$0	$47	$20	$46	$120
2029	$1	$0	$6	$0	$47	$20	$46	$120
2030	$1	$0	$6	$0	$47	$20	$46	$120
2031	$1	$0	$6	$0	$47	$20	$46	$120
2032	$1	$0	$6	$0	$47	$20	$46	$120
2033	$1	$0	$6	$0	$47	$20	$46	$120
2034	$1	$0	$6	$0	$47	$20	$46	$120
2035	$1	$0	$6	$0	$47	$20	$46	$120
2036	$1	$0	$6	$0	$47	$20	$46	$120
2037	$1	$0	$6	$0	$47	$20	$46	$120
2038	$1	$0	$6	$0	$47	$20	$46	$120
2039	$1	$0	$6	$0	$47	$20	$46	$120
2040	$1	$0	$6	$0	$47	$20	$45	$119
2041	$1	$0	$6	$0	$47	$18	$44	$117
2042	$1	$0	$5	$0	$42	$13	$39	$101
2043	$1	$0	$5	$0	$37	$9	$32	$84
2044	$1	$0	$1	$0	$9	$3	$20	$35
2045	$1	$0	$1	$0	$5	$1	$10	$18
2046	$0[e]	$0	$0[e]	$0	$2	$0[e]	$3	$7
2047	$0[e]	$0	$0	$0	$0	$0	$1	$2
2048	$0[e]	$0	$0	$0	$0	$0	$0[e]	$0[e]
PV 3%c	**$23**	**$0**	**$94**	**$0**	**$768**	**$340**	**$745**	**$1,969**
Annualized 3%d	**$1**	**$0**	**$5**	**$0**	**$39**	**$17**	**$38**	**$100**
PV 7%c	**$11**	**$0**	**$47**	**$0**	**$387**	**$177**	**$373**	**$995**
Annualized 7%d	**$1**	**$0**	**$4**	**$0**	**$31**	**$14**	**$30**	**$80**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

e Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-9: Time Profile of Mean Total Use Benefits - "Manufacturers 2-50 MGD I&E like Phase II" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$1	$1	$1
2011	$0	$0	$0	$0	$0	$2	$2	$4
2012	$0	$0	$1	$0	$7	$8	$8	$25
2013	$0	$0	$2	$0	$15	$14	$18	$48
2014	$3	$0	$9	$0	$58	$21	$32	$124
2015	$7	$0	$10	$0	$66	$23	$44	$148
2016	$27	$0	$10	$0	$69	$23	$52	$182
2017	$31	$0	$11	$0	$73	$24	$54	$192
2018	$32	$0	$11	$0	$73	$24	$55	$195
2019	$34	$0	$11	$0	$73	$24	$56	$197
2020	$34	$0	$11	$0	$73	$24	$56	$197
2021	$34	$0	$11	$0	$73	$24	$56	$197
2022	$34	$0	$11	$0	$73	$24	$56	$197
2023	$34	$0	$11	$0	$73	$24	$56	$197
2024	$34	$0	$11	$0	$73	$24	$56	$197
2025	$34	$0	$11	$0	$73	$24	$56	$197
2026	$34	$0	$11	$0	$73	$24	$56	$197
2027	$34	$0	$11	$0	$73	$24	$56	$197
2028	$34	$0	$11	$0	$73	$24	$56	$197
2029	$34	$0	$11	$0	$73	$24	$56	$197
2030	$34	$0	$11	$0	$73	$24	$56	$197
2031	$34	$0	$11	$0	$73	$24	$56	$197
2032	$34	$0	$11	$0	$73	$24	$56	$197
2033	$34	$0	$11	$0	$73	$24	$56	$197
2034	$34	$0	$11	$0	$73	$24	$56	$197
2035	$34	$0	$11	$0	$73	$24	$56	$197
2036	$34	$0	$11	$0	$73	$24	$56	$197
2037	$34	$0	$11	$0	$73	$24	$56	$197
2038	$34	$0	$11	$0	$73	$24	$56	$197
2039	$34	$0	$11	$0	$73	$24	$56	$197
2040	$34	$0	$11	$0	$73	$23	$55	$196
2041	$34	$0	$11	$0	$73	$22	$54	$193
2042	$34	$0	$10	$0	$66	$16	$47	$173
2043	$34	$0	$9	$0	$58	$10	$38	$149
2044	$31	$0	$2	$0	$15	$3	$23	$74
2045	$27	$0	$1	$0	$7	$1	$12	$49
2046	$7	$0	$1	$0	$4	$1	$4	$15
2047	$3	$0	$0	$0	$0	$0	$2	$5
2048	$2	$0	$0	$0	$0	$0	$0[e]	$2
PV 3%c	**$525**	**$0**	**$178**	**$0**	**$1,195**	**$404**	**$910**	**$3,211**
Annualized 3%d	**$27**	**$0**	**$9**	**$0**	**$61**	**$21**	**$46**	**$164**
PV 7%c	**$245**	**$0**	**$89**	**$0**	**$602**	**$210**	**$457**	**$1,604**
Annualized 7%d	**$20**	**$0**	**$7**	**$0**	**$49**	**$17**	**$37**	**$129**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

e Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-10: Time Profile of Mean Total Use Benefits - "Manufacturers 2-50 MGD I&E Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$1	$1	$2
2011	$0	$0	$0	$0	$0	$2	$4	$6
2012	$0	$0	$1	$0	$7	$9	$14	$32
2013	$0	$0	$2	$0	$15	$16	$30	$62
2014	$4	$0	$9	$0	$58	$24	$53	$148
2015	$8	$0	$10	$0	$66	$26	$72	$181
2016	$30	$0	$10	$0	$69	$27	$85	$221
2017	$34	$0	$11	$0	$73	$28	$89	$234
2018	$36	$0	$11	$0	$73	$28	$90	$237
2019	$38	$0	$11	$0	$73	$28	$91	$240
2020	$38	$0	$11	$0	$73	$28	$91	$240
2021	$38	$0	$11	$0	$73	$28	$91	$240
2022	$38	$0	$11	$0	$73	$28	$91	$240
2023	$38	$0	$11	$0	$73	$28	$91	$240
2024	$38	$0	$11	$0	$73	$28	$91	$240
2025	$38	$0	$11	$0	$73	$28	$91	$240
2026	$38	$0	$11	$0	$73	$28	$91	$240
2027	$38	$0	$11	$0	$73	$28	$91	$240
2028	$38	$0	$11	$0	$73	$28	$91	$240
2029	$38	$0	$11	$0	$73	$28	$91	$240
2030	$38	$0	$11	$0	$73	$28	$91	$240
2031	$38	$0	$11	$0	$73	$28	$91	$240
2032	$38	$0	$11	$0	$73	$28	$91	$240
2033	$38	$0	$11	$0	$73	$28	$91	$240
2034	$38	$0	$11	$0	$73	$28	$91	$240
2035	$38	$0	$11	$0	$73	$28	$91	$240
2036	$38	$0	$11	$0	$73	$28	$91	$240
2037	$38	$0	$11	$0	$73	$28	$91	$240
2038	$38	$0	$11	$0	$73	$28	$91	$240
2039	$38	$0	$11	$0	$73	$28	$91	$240
2040	$38	$0	$11	$0	$73	$27	$90	$238
2041	$38	$0	$11	$0	$73	$25	$87	$234
2042	$38	$0	$10	$0	$66	$18	$77	$208
2043	$38	$0	$9	$0	$58	$12	$61	$178
2044	$34	$0	$2	$0	$15	$4	$38	$92
2045	$30	$0	$1	$0	$7	$2	$19	$59
2046	$8	$0	$1	$0	$4	$1	$6	$19
2047	$4	$0	$0	$0	$0	$0	$2	$6
2048	$2	$0	$0	$0	$0	$0	$1	$3
PV 3%[c]	**$581**	**$0**	**$178**	**$0**	**$1,195**	**$465**	**$1,487**	**$3,906**
Annualized 3%[d]	**$30**	**$0**	**$9**	**$0**	**$61**	**$24**	**$76**	**$199**
PV 7%[c]	**$271**	**$0**	**$89**	**$0**	**$602**	**$243**	**$747**	**$1,953**
Annualized 7%[d]	**$22**	**$0**	**$7**	**$0**	**$49**	**$20**	**$60**	**$157**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

Source: U.S. EPA Analysis, 2006.

Table E2A-11: Time Profile of Mean Total Use Benefits - "Manufacturers 50+ MGD I-only Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$3	$4	$7
2011	$0[e]	$0	$1	$0	$0	$14	$20	$35
2012	$0[e]	$0	$3	$0	$90	$41	$58	$191
2013	$1	$0	$10	$0	$180	$117	$134	$442
2014	$1	$0	$14	$0	$718	$164	$162	$1,059
2015	$1	$0	$17	$0	$808	$292	$201	$1,320
2016	$1	$0	$33	$0	$853	$318	$216	$1,422
2017	$1	$0	$36	$0	$898	$329	$220	$1,485
2018	$1	$0	$37	$0	$898	$339	$223	$1,499
2019	$1	$0	$38	$0	$898	$339	$223	$1,501
2020	$1	$0	$38	$0	$898	$339	$223	$1,501
2021	$1	$0	$38	$0	$898	$339	$223	$1,501
2022	$1	$0	$38	$0	$898	$339	$223	$1,501
2023	$1	$0	$38	$0	$898	$339	$223	$1,501
2024	$1	$0	$38	$0	$898	$339	$223	$1,501
2025	$1	$0	$38	$0	$898	$339	$223	$1,501
2026	$1	$0	$38	$0	$898	$339	$223	$1,501
2027	$1	$0	$38	$0	$898	$339	$223	$1,501
2028	$1	$0	$38	$0	$898	$339	$223	$1,501
2029	$1	$0	$38	$0	$898	$339	$223	$1,501
2030	$1	$0	$38	$0	$898	$339	$223	$1,501
2031	$1	$0	$38	$0	$898	$339	$223	$1,501
2032	$1	$0	$38	$0	$898	$339	$223	$1,501
2033	$1	$0	$38	$0	$898	$339	$223	$1,501
2034	$1	$0	$38	$0	$898	$339	$223	$1,501
2035	$1	$0	$38	$0	$898	$339	$223	$1,501
2036	$1	$0	$38	$0	$898	$339	$223	$1,501
2037	$1	$0	$38	$0	$898	$339	$223	$1,501
2038	$1	$0	$38	$0	$898	$339	$223	$1,501
2039	$1	$0	$38	$0	$898	$339	$223	$1,501
2040	$1	$0	$38	$0	$898	$337	$219	$1,494
2041	$1	$0	$37	$0	$898	$326	$204	$1,466
2042	$1	$0	$36	$0	$808	$299	$165	$1,309
2043	$0[e]	$0	$28	$0	$718	$223	$89	$1,059
2044	$0[e]	$0	$24	$0	$180	$176	$61	$441
2045	$0[e]	$0	$21	$0	$90	$47	$22	$180
2046	$0	$0	$5	$0	$45	$21	$7	$78
2047	$0	$0	$3	$0	$0	$10	$3	$16
2048	$0	$0	$1	$0	$0	$0	$0[e]	$2
PV 3%[c]	**$25**	**$0**	**$608**	**$0**	**$14,728**	**$5,538**	**$3,731**	**$24,630**
Annualized 3% [d]	**$1**	**$0**	**$31**	**$0**	**$751**	**$283**	**$190**	**$1,257**
PV 7% [c]	**$13**	**$0**	**$296**	**$0**	**$7,422**	**$2,777**	**$1,928**	**$12,435**
Annualized 7% [d]	**$1**	**$0**	**$24**	**$0**	**$598**	**$224**	**$155**	**$1,002**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

e Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-12: Time Profile of Mean Total Use Benefits - "Manufacturers 50+ MGD I&E Everywhere" Option (thousands; 2004$)[a]

Year	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
2007	$0	$0	$0	$0	$0	$0	$0	$0
2008	$0	$0	$0	$0	$0	$0	$0	$0
2009	$0	$0	$0	$0	$0	$0	$0	$0
2010	$0	$0	$0	$0	$0	$3	$10	$13
2011	$3	$0	$2	$0	$0	$30	$43	$78
2012	$7	$1	$3	$0	$165	$75	$130	$381
2013	$27	$3	$22	$0	$330	$251	$288	$920
2014	$30	$11	$36	$0	$1,320	$318	$343	$2,057
2015	$32	$13	$96	$0	$1,484	$464	$423	$2,513
2016	$33	$19	$125	$0	$1,567	$500	$454	$2,698
2017	$33	$20	$133	$0	$1,649	$512	$461	$2,809
2018	$33	$21	$139	$0	$1,649	$523	$467	$2,833
2019	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2020	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2021	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2022	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2023	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2024	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2025	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2026	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2027	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2028	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2029	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2030	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2031	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2032	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2033	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2034	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2035	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2036	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2037	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2038	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2039	$33	$21	$141	$0	$1,649	$523	$468	$2,835
2040	$33	$21	$141	$0	$1,649	$520	$457	$2,822
2041	$30	$21	$139	$0	$1,649	$492	$425	$2,757
2042	$27	$20	$138	$0	$1,484	$448	$338	$2,454
2043	$7	$18	$119	$0	$1,320	$272	$179	$1,915
2044	$3	$10	$105	$0	$330	$205	$125	$779
2045	$2	$8	$45	$0	$165	$59	$44	$322
2046	$0	$2	$16	$0	$82	$23	$14	$138
2047	$0	$1	$8	$0	$0	$11	$6	$26
2048	$0	$0[e]	$2	$0	$0	$0	$1	$3
PV 3%[c]	**$565**	**$336**	**$2,244**	**$0**	**$27,050**	**$8,622**	**$7,822**	**$46,640**
Annualized 3% [d]	**$29**	**$17**	**$115**	**$0**	**$1,380**	**$440**	**$399**	**$2,380**
PV 7% [c]	**$296**	**$165**	**$1,090**	**$0**	**$13,631**	**$4,381**	**$4,050**	**$23,613**
Annualized 7% [d]	**$24**	**$13**	**$88**	**$0**	**$1,098**	**$353**	**$326**	**$1,903**

a Because EPA estimated non-use benefits only qualitatively, the monetary value of benefits includes use values only.

b No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

c The present value (PV) is estimated by discounting individual annual values to 2007, using the stated discount rate.

d Annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

e Positive non-zero value less than $500.

Source: U.S. EPA Analysis, 2006.

E2A-3 TOTAL ANNUALIZED MONETARY VALUE OF BENEFITS

Table E2A-13 and Table E2A-14 present EPA's estimates of the value of national and regional reductions in I&E under the supplemental options analyzed in developing the proposed and final regulation, using 3% and 7% discount rates. The tables show that benefits to recreational anglers account for the majority of use benefits for all supplemental options. National use benefits are largest in the Gulf of Mexico region under all eight options. More detailed discussions of regional benefits under each option are provided in Sections B through H of the RBA.

Table E2A-15: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$; discounted at 3%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
"Electric Generators 2-50 MGD I-only Everywhere" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $0[e]	$0[e]	$1	$1	$0[e]	$1	$1
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0	$5	$7	$10	$5	$7	$11
Inland[d]	n/a	$3	$6	$10	$3	$6	$10
National Total	**$0 - $0[e]**	**$8**	**$13**	**$22**	**$9**	**$14**	**$22**
"Electric Generators 2-50 MGD I&E like Phase II" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $0[e]	$0[e]	$1	$1	$0	$1	$1
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0 - $0[e]	$6	$9	$14	$7	$10	$14
Inland[d]	n/a	$4	$7	$12	$4	$7	$12
National Total	**$0 - $0[e]**	**$10**	**$16**	**$27**	**$11**	**$17**	**$27**
"Electric Generators 2-50 MGD I&E Everywhere" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $1	$2	$3	$6	$2	$4	$7
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0 - $0[e]	$7	$10	$14	$7	$10	$14
Inland[d]	n/a	$8	$14	$25	$8	$14	$25
National Total	**$0 - $1**	**$16**	**$26**	**$45**	**$17**	**$27**	**$46**

Table E2A-15: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$; discounted at 3%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
"Manufacturers 2-50 MGD I-only Everywhere" Option							
California	$0	$1	$1	$2	$1	$1	$2
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $1	$2	$4	$8	$3	$5	$9
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $6	$16	$33	$70	$22	$39	$76
Great Lakes	$0 - $0[e]	$12	$17	$25	$12	$17	$25
Inland[d]	n/a	$21	$38	$70	$21	$38	$70
National Total	**$0 - $7**	**$51**	**$93**	**$174**	**$59**	**$100**	**$181**
"Manufacturers 2-50 MGD I&E like Phase II" Option							
California	$0 - $8	$10	$19	$37	$18	$27	$44
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $2	$4	$7	$15	$5	$9	$17
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $12	$26	$49	$96	$38	$61	$108
Great Lakes	$0 - $0[e]	$14	$20	$29	$14	$21	$30
Inland[d]	$0	$26	$46	$85	$26	$46	$85
National Total	**$0 - $22**	**$79**	**$142**	**$262**	**$101**	**$164**	**$284**
"Manufacturers 2-50 MGD I&E Everywhere" Option							
California	$0 - $8	$11	$21	$41	$20	$30	$49
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $2	$4	$7	$15	$5	$9	$17
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $12	$26	$49	$96	$38	$61	$108
Great Lakes	$0 - $1	$16	$23	$34	$16	$24	$35
Inland[d]	n/a	$42	$76	$138	$42	$76	$138
National Total	**$0 - $22**	**$99**	**$177**	**$324**	**$121**	**$199**	**$346**
"Manufacturers 50+ MGD I-only Everywhere" Option							
California	$0	$1	$1	$2	$1	$1	$2
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $6	$13	$25	$49	$19	$31	$55
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $115	$307	$636	$1,339	$422	$751	$1,454
Great Lakes	$0 - $7	$190	$276	$403	$197	$283	$410
Inland[d]	n/a	$105	$190	$348	$105	$190	$348
National Total	**$0 - $128**	**$616**	**$1,129**	**$2,142**	**$744**	**$1,257**	**$2,270**

Table E2A-15: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$; discounted at 3%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
"Manufacturers 50+ MGD I&E Everywhere" Option							
California	$0 - $8	$11	$21	$40	$19	$29	$48
North Atlantic	$0 -$0[e]	$9	$17	$33	$9	$17	$33
Mid-Atlantic	$0 - $18	$48	$96	$198	$67	$115	$216
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $283	$589	$1,097	$2,101	$872	$1,380	$2,384
Great Lakes	$0 - $11	$295	$429	$629	$305	$440	$640
Inland[d]	n/a	$221	$399	$725	$221	$399	$725
National Total	**$0 - $321**	**$1,172**	**$2,059**	**$3,726**	**$1,493**	**$2,380**	**$4,046**

a All benefits presented in this table are annualized. These annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

b The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits only qualitatively. A range of recreational fishing benefits is provided, based on the Krinsky and Robb technique to estimated the 95th and 5th percentile limits on the marginal value per fish predicted by EPA's meta-analysis (see chapter A5 of the RBA). Commercial fishing benefits are computed based on a region- and species-specific range of gross revenue (see Chapter A4 of the RBA). To calculate the total use value columns (low, mean, and high), the high-end value for commercial fishing benefits is added to the low, mean, and high values for recreational fishing benefits, respectively.

c No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with these options.

d No significant commercial fishing takes place in the Inland region, and thus this region is excluded from the commercial fishing benefits analysis.

e Denotes a positive value less than $500.

Source: U.S. EPA Analysis, 2006.

Table E2A-16: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$, discounted at 7%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
"Electric Generators 2-50 MGD I-only Everywhere" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $0[e]	$0[e]	$0[e]	$1	$0[e]	$1	$1
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0 - $0[e]	$4	$6	$8	$4	$6	$8
Inland[d]	n/a	$3	$5	$8	$3	$5	$8
National Total	**$0 - $0[e]**	**$7**	**$11**	**$17**	**$7**	**$11**	**$18**

Table E2A-16: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$, discounted at 7%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
"Electric Generators 2-50 MGD I&E like Phase II" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $0[e]	$0[e]	$0[e]	$1	$0[e]	$1	$1
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0 - $0[e]	$5	$7	$11	$5	$8	$11
Inland[d]	n/a	$3	$5	$10	$3	$5	$10
National Total	**$0 - $0[e]**	**$8**	**$13**	**$21**	**$9**	**$13**	**$22**
"Electric Generators 2-50 MGD I&E Everywhere" Option							
California	$0	$0	$0	$0	$0	$0	$0
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $0[e]	$1	$2	$5	$2	$3	$5
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0	$0	$0	$0	$0	$0	$0
Great Lakes	$0 - $0[e]	$5	$8	$11	$5	$8	$11
Inland[d]	n/a	$6	$11	$21	$6	$11	$21
National Total	**$0 - $1**	**$13**	**$21**	**$36**	**$13**	**$22**	**$37**
"Manufacturers 2-50 MGD I-only Everywhere" Option							
California	$0	$0[e]	$1	$2	$0	$1	$2
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $1	$2	$3	$6	$2	$4	$7
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $5	$13	$26	$56	$18	$31	$60
Great Lakes	$0 - $0[e]	$10	$14	$20	$10	$14	$21
Inland[d]	n/a	$17	$30	$55	$17	$30	$55
National Total	**$0 - $6**	**$41**	**$74**	**$139**	**$47**	**$80**	**$144**
"Manufacturers 2-50 MGD I&E like Phase II" Option							
California	$0 - $6	$7	$14	$27	$13	$20	$33
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $1	$3	$6	$12	$4	$7	$13
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $9	$21	$39	$77	$30	$49	$86
Great Lakes	$0 - $0[e]	$11	$17	$24	$12	$17	$25
Inland[d]	n/a	$20	$37	$67	$20	$37	$67
National Total	**$0 - $17**	**$63**	**$113**	**$207**	**$79**	**$129**	**$224**
"Manufacturers 2-50 MGD I&E Everywhere" Option							
California	$0 - $6	$8	$16	$30	$14	$22	$36
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $1	$3	$6	$12	$4	$7	$13
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0

Table E2A-16: Summary of Monetized Benefits for Existing Phase III Facilities[a] (thousands; 2004$, discounted at 7%)

Region	Annualized Use Benefits of I&E Reductions						
	Annualized Commercial Fishing	Recreational Fishing			Total Use Value[b]		
		Low	Mean	High	Low	Mean	High
Gulf of Mexico	$0 - $9	$21	$39	$77	$30	$49	$86
Great Lakes	$0 - $0[e]	$13	$19	$28	$14	$20	$28
Inland[d]	n/a	$33	$60	$109	$33	$60	$109
National Total	**$0 - $17**	**$78**	**$140**	**$256**	**$96**	**$157**	**$273**
"Manufacturers 50+ MGD I-only Everywhere" Option							
California	$0	$1	$1	$2	$1	$1	$2
North Atlantic	$0	$0	$0	$0	$0	$0	$0
Mid-Atlantic	$0 - $5	$10	$19	$38	$15	$24	$43
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $92	$244	$506	$1,066	$336	$598	$1,157
Great Lakes	$0 - $5	$151	$219	$319	$156	$224	$324
Inland[d]	n/a	$86	$155	$284	$86	$155	$284
National Total	**$0 - $102**	**$491**	**$900**	**$1,709**	**$593**	**$1,002**	**$1,811**
"Manufacturers 50+ MGD I&E Everywhere" Option							
California	$0 - $7	$9	$17	$33	$16	$24	$39
North Atlantic	$0 - $0[e]	$7	$13	$25	$7	$13	$25
Mid-Atlantic	$0 - $14	$37	$74	$152	$51	$88	$166
South Atlantic[c]	$0	$0	$0	$0	$0	$0	$0
Gulf of Mexico	$0 - $225	$468	$873	$1,672	$694	$1,098	$1,898
Great Lakes	$0 - $8	$236	$345	$505	$245	$353	$514
Inland[d]	n/a	$181	$326	$593	$181	$326	$593
National Total	**$0 - $255**	**$939**	**$1,648**	**$2,980**	**$1,194**	**$1,903**	**$3,235**

a All benefits presented in this table are annualized. These annualized benefits represent the value of all benefits generated over the time frame of the analysis, discounted to 2007, and then annualized over a 30-year period.

b The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits only qualitatively. A range of recreational fishing benefits is provided, based on the Krinsky and Robb technique to estimated the 95th and 5th percentile limits on the marginal value per fish predicted by EPA's meta-analysis (see chapter A5 of the RBA). Commercial fishing benefits are computed based on a region- and species-specific range of gross revenue (see Chapter A4 of the RBA). To calculate the total use value columns (low, mean, and high), the high-end value for commercial fishing benefits is added to the low, mean, and high values for recreational fishing benefits, respectively.

c No I&E reductions are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with these options.

d No significant commercial fishing takes place in the Inland region, and thus this region is excluded from the commercial fishing benefits analysis.

e Denotes a positive value less than $500.

Source: U.S. EPA Analysis, 2006.

Chapter E3: Comparison of Benefits and Social Costs

INTRODUCTION

This chapter compares total monetized benefits and social costs for the regulatory analysis options considered in developing in the final regulation, the "50 MGD for All Waterbodies" option ("50 MGD All"), the "200 MGD for All Waterbodies" option ("200 MGD All"), and the "100 MGD for Certain Waterbodies" option ("100 MGD CWB"). Benefits and costs are compared on two bases: (1) for each of the options analyzed and (2) incrementally across options. For more information on the analysis of social costs and benefits, see *Chapter E1: Summary of Social Costs* and *Chapter E2: Summary of Benefits*. Results for the eight supplemental options are presented in Appendix E3A to this chapter. This comparison of benefits and costs is presented only for Phase III existing facilities. New offshore oil and gas extraction facilities were excluded from the comparison of benefits and costs because EPA was unable to estimate benefits for this industry segment.

Table E3-1, below, summarizes compliance action assumptions for the regulatory analysis options based on the performance standard each facility would need to meet (depending on each facility's waterbody type, design intake flow, capacity utilization, and annual intake flow as a percent of source waterbody mean annual flow) and its baseline technologies in-place.

Table E3-1: Number of Existing Phase III Facilities by Compliance Action[a]

Facility Compliance Action	50 MGD All	200 MGD All	100 MGD CWB
Total Facilities Potentially Subject to Regulation (excluding baseline closures)	515	515	515
Facilities Subject to Best Professional Judgment	368	484	491
Facilities Subject to National Categorical Requirements	146	31	23
No compliance action[b]	35	5	1
Impingement controls only	60	5	0
Impingement and entrainment controls	51	21	22

[a] Alternative less stringent requirements based on site-specific assessments of costs, or costs and benefits are allowed. Estimation of compliance responses is uncertain because the number of facilities requesting alternative less stringent requirements based on these site-specific assessments is unknown.

[b] These facilities meet compliance requirements in the baseline and thus would require no action to comply with the regulation.

Source: U.S. EPA Analysis, 2006.

E3-1 COMPARISON OF BENEFITS AND SOCIAL COSTS BY OPTION

The preceding chapters, *Chapter E1: Summary of Social Costs* and *Chapter E2: Summary of Benefits*, present estimates of total social cost and benefit for the three regulatory analysis options and eight supplemental options

evaluated in developing the 316(b) Phase III regulation. Based on these values of estimated benefits and social costs, EPA calculated the cost-benefit ratio to society of each option.

As documented in *Chapter E2: Summary of Benefits*, the monetized benefit values developed by EPA for the 316(b) Phase III regulation, and included in the cost-benefit ratios presented in this chapter, include only *use benefit* values for commercial and recreational fishing. EPA was unable, at this time, to estimate a monetized value of non-use benefits from reduced impingement and entrainment (I&E). EPA has estimated (subject to the limitations and uncertainties noted in Sections A4-12 and A5-5 of the Regional Analysis Document) the use benefits associated with the two main categories of use benefits (commercial and recreational) shown in Figure A3-1 of the Regional Analysis Document. As Table A3-1 of the Regional Analysis Document shows, the complete assessment of these two use benefit categories values the 2.6% of baseline I&E losses that would have been eventually harvested by commercial and recreational fishers. Use values other than commercial and recreational fishing, such as subsistence fishing and other near-water recreation, have not been monetized; the former would only be positive for harvested species, while the latter could be positive for forage species as well. Nonetheless, EPA expects that the largest use-value categories have been captured.

EPA was unable to estimate non-use benefits associated with losses to any categories of species; Table A3-1 shows that 19.4 percent of national baseline I&E losses are in commercial and recreational species, while 80.6 percent are in forage species, and shows regional variation in the breakdown of species type. Non-use values are not necessarily the same for forage species and commercial and recreational species.

Given the absence of any empirical evidence to support an assumption that use values and non-use values are similar on a per-fish basis, it would not be correct to use the values estimated for 2 to 3 percent of baseline fish losses and extrapolate to all fish losses prevented by the regulatory analysis options. As a result, the monetized benefit values that are compared with the estimated values of total social cost in this cost-benefit comparison represent a partial estimate of the true benefits of the given option.

Table E3-2, below, presents EPA's estimates of use benefits and social costs for the regulatory analysis options for existing facilities, at 3% and 7% discount rates. At a 3% discount rate, EPA estimates that social costs exceed monetized use benefits by $36.0 million under the 50 MGD All option, $18.0 million under the 200 MGD All option, and $12.7 million under the 100 MGD CWB option. This results in mean cost-benefit ratios for the 50 MGD, 200 MGD, 100 MGD options of 17.0, 13.0, and 7.8, respectively. At a 7% discount rate, social costs exceed use benefits by $37.2 million under the 50 MGD All option, $19.0 million under the 200 MGD All option, and $12.6 million under the 100 MGD CWB option. At 7% discount, this results in mean cost-benefit ratios for the 50 MGD, 200 MGD, 100 MGD options of 21.7, 16.9, and 9.5, respectively. These values are all in dollars as of 2004 and are based on the discounting of costs and benefits to the beginning of the year 2007, the assumed date when the rule would take effect.

Table E3-2: Total Benefits, Social Costs, and Cost-Benefit Ratios for Existing Phase III Facilities by Option (millions; $2004)

Option	Total Monetized Use Benefits[a]			Total Social Costs	Cost-Benefit Ratios Based on Use Benefits Only[b]		
	Low	Mean	High		Low	Mean	High
3% discount rate							
50 MGD All	$1.4	$2.3	$3.8	$38.3	26.9	17.0	10.0
200 MGD All	$1.0	$1.5	$2.5	$19.5	20.4	13.0	7.7
100 MGD CWB	$1.2	$1.9	$3.1	$14.6	12.1	7.8	4.6
7% discount rate							
50 MGD All	$1.1	$1.8	$3.0	$39.0	34.4	21.7	12.8
200 MGD All	$0.8	$1.2	$2.0	$20.1	26.5	16.9	10.1
100 MGD CWB	$1.0	$1.5	$2.5	$14.1	14.8	9.5	5.6

[a] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits qualitatively. The range (low, mean, and high) of annualized use values is computed by adding the high end value for commercial fishing benefits (based on assumed producer surplus of 40% of gross revenue) to the low, mean, and high values from recreational fishing benefits, respectively (see Chapter A4 of the RBA).

[b] Cost-benefit ratios are computed by dividing total annualized costs by total annual use benefits.

Source: U.S. EPA Analysis, 2006.

The regulatory analysis options are expected to provide benefits that were not accounted for in the benefits analysis. These benefits include reduced I&E losses of fish, shellfish, and other aquatic organisms, which, in turn, increase the numbers of individuals present, increase local and regional fishery populations (a subset of which was accounted for in the benefits analysis), and ultimately contribute to the enhanced environmental functioning of affected waterbodies (rivers, lakes, estuaries, and oceans) and associated ecosystems. See Chapter A6 of the *Regional Benefits Assessment for the Final Section 316(b) Rule for Phase III Facilities* (RBA) for a detailed description of the qualitative non-use benefits from reduced I&E (U.S. EPA, 2006).

Table E3-3, below, and Table E3-4, following page, present cost-benefit ratios for existing Phase III facilities by option and region, discounted at 3% and 7%, respectively. As reported in Table E3-3 and Table E3-4, EPA estimates that costs are largest relative to benefits in the North Atlantic region for each of the three regulatory analysis options. Conversely, costs outweigh benefits by the least amount in the Gulf of Mexico region for all three regulatory analysis options.

Table E3-3: Cost-Benefit Ratios for Existing Phase III Facilities by Option and Region (discounted at 3%)

Option	Cost-Benefit Ratios Based on Use Benefits Only[a]							
	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
Low								
50 MGD All	21.2	225.8	18.3	na	7.7	32.2	113.4	26.9
200 MGD All	n/a	261.1	14.6	na	6.2	19.7	96.9	20.4
100 MGD CWB	n/a	212.4	14.6	na	7.7	19.8	n/a	12.1
Mean								
50 MGD All	14.0	118.6	10.7	na	4.9	22.3	62.8	17.0
200 MGD All	n/a	137.2	8.5	na	4.0	13.7	53.7	13.0
100 MGD CWB	n/a	111.6	8.5	na	4.9	13.8	n/a	7.8
High								
50 MGD All	8.4	62.0	5.7	na	2.8	15.4	34.4	10.0
200 MGD All	n/a	71.7	4.5	na	2.3	9.4	29.5	7.7
100 MGD CWB	n/a	58.3	4.5	na	2.8	9.5	n/a	4.6

[a] Cost-benefit ratios are calculated by dividing total annualized costs by total annual use benefits.

[b] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

Source: U.S. EPA Analysis, 2006.

Table E3-4: Cost-Benefit Ratios for Existing Phase III Facilities by Option and Region (discounted at 7%)

Option	Cost-Benefit Ratios Based on Use Benefits Only[a]							
	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
Low								
50 MGD All	26.6	282.8	22.9	n/a	9.6	40.5	145.3	34.4
200 MGD All	n/a	324.1	17.7	n/a	7.6	23.0	131.9	26.5
100 MGD CWB	n/a	265.6	17.7	n/a	9.6	23.4	n/a	14.8
Mean								
50 MGD All	17.5	148.6	13.4	n/a	6.1	28.1	80.4	21.7
200 MGD All	n/a	170.3	10.3	n/a	4.9	16.0	73.0	16.9
100 MGD CWB	n/a	139.6	10.3	n/a	6.1	16.2	n/a	9.5
High								
50 MGD All	10.6	77.6	7.1	n/a	3.5	19.3	44.1	12.8
200 MGD All	n/a	89.0	5.4	n/a	2.9	11.0	40.1	10.1
100 MGD CWB	n/a	72.9	5.4	n/a	3.5	11.1	n/a	5.6

[a] Cost-benefit ratios are calculated by dividing total annualized costs by total annual use benefits.

[b] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

Source: U.S. EPA Analysis, 2006.

Table E3-5, following page, provides additional detail on net benefits. Table E3-5 compiles for the three regulatory analysis options the time profiles of benefits and costs as presented in the preceding chapters. The table also reports the calculated present and annualized values of benefits and costs at 3% and 7% discount rates.

Table E3-5: Time Profile of Benefits and Social Costs for Existing Phase III Facilities (millions; $2004)

Year	50 MGD All		200 MGD All		100 MGD CWB	
	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)
2007	$0.00	$3.2	$0.00	$0.2	$0.00	$0.6
2008	$0.00	$12.1	$0.00	$2.6	$0.00	$5.2
2009	$0.00	$17.5	$0.00	$3.1	$0.00	$5.1
2010	$0.01	$138.0	$0.00	$108.9	$0.00	$14.8
2011	$0.06	$95.2	$0.04	$44.7	$0.03	$56.8
2012	$0.33	$58.8	$0.20	$6.8	$0.23	$5.9
2013	$0.83	$59.0	$0.54	$48.1	$0.56	$36.6
2014	$1.95	$19.0	$1.25	$5.7	$1.62	$4.5
2015	$2.38	$21.8	$1.57	$8.4	$1.98	$8.8
2016	$2.55	$16.8	$1.70	$6.1	$2.12	$4.7
2017	$2.66	$17.3	$1.77	$8.0	$2.22	$5.7
2018	$2.68	$13.7	$1.79	$6.0	$2.24	$4.4
2019	$2.69	$17.9	$1.79	$5.6	$2.24	$4.4
2020	$2.69	$38.6	$1.79	$14.2	$2.24	$12.9
2021	$2.69	$92.0	$1.79	$44.2	$2.24	$55.1
2022	$2.69	$21.7	$1.79	$8.4	$2.24	$6.1
2023	$2.69	$58.2	$1.79	$47.8	$2.24	$36.4
2024	$2.69	$18.8	$1.79	$5.6	$2.24	$4.4
2025	$2.69	$21.8	$1.79	$8.4	$2.24	$8.8
2026	$2.69	$16.8	$1.79	$6.1	$2.24	$4.7
2027	$2.69	$17.3	$1.79	$8.0	$2.24	$5.7
2028	$2.69	$13.7	$1.79	$6.0	$2.24	$4.4
2029	$2.69	$17.9	$1.79	$5.6	$2.24	$4.4
2030	$2.69	$38.6	$1.79	$14.2	$2.24	$12.9
2031	$2.69	$92.0	$1.79	$44.2	$2.24	$55.1
2032	$2.69	$21.7	$1.79	$8.4	$2.24	$6.1
2033	$2.69	$58.2	$1.79	$47.8	$2.24	$36.4
2034	$2.69	$18.8	$1.79	$5.6	$2.24	$4.4
2035	$2.69	$21.8	$1.79	$8.4	$2.24	$8.8
2036	$2.69	$16.8	$1.79	$6.1	$2.24	$4.7
2037	$2.69	$17.3	$1.79	$8.0	$2.24	$5.7
2038	$2.69	$13.7	$1.79	$6.0	$2.24	$4.4
2039	$2.69	$12.5	$1.79	$5.5	$2.24	$4.0
2040	$2.68	$10.2	$1.79	$5.3	$2.24	$3.9
2041	$2.62	$4.9	$1.75	$2.6	$2.21	$1.0
2042	$2.35	$3.5	$1.60	$2.4	$2.01	$0.9
2043	$1.86	$0.3	$1.26	$0.1	$1.68	$0.1
2044	$0.74		$0.55		$0.62	
2045	$0.31		$0.22		$0.26	
2046	$0.13		$0.09		$0.12	
2047	$0.02		$0.02		$0.02	
2048	$0.00		$0.00		$0.00	
PV 3%	$44.13	$772.6	$29.39	$393.2	$36.69	$294.1
Annualized 3%	$2.25	$38.3	$1.50	$19.5	$1.87	$14.6
PV 7%	$22.31	$517.8	$14.82	$267.4	$18.47	$187.4
Annualized 7%	$1.80	$39.0	$1.19	$20.1	$1.49	$14.1

Source: U.S. EPA Analysis, 2006.

To facilitate consistent comparison of costs and benefits for Phase II and Phase III, 50 MGD All Waterbodies option, these values are reported in Table E3-7, all in 2004$.

Table E-6: Comparison of Break-Even Analysis by Regions for 316(b) Phase II and Phase III Regulations (2004$, discounted at 3%)[a,b]

Option	Total Social Costs (millions)		Total Value of Use Benefits (millions)	
	Phase II Final Rule	*Phase III 50 MGD All*	*Phase II Final Rule*	*Phase III 50 MGD All*[d]
California	$34.73	$0.40	$3.12	$0.03
North Atlantic	$15.70	$2.03	$1.51	$0.02
Mid-Atlantic	$72.52	$1.22	$47.29	$0.11
South Atlantic[c]	$10.62	$0.0	$7.42	$0.0
Gulf of Mexico	$26.72	$6.74	$7.27	$1.38
Great Lakes	$69.36	$9.74	$14.85	$0.44
Inland	$192.91	$17.26	$3.13	$0.27
National Total	**$447.25**	**$38.27**	**$87.02**	**$2.25**

[a] Phase II regional benefit and cost estimates are unweighted; Phase II total national estimates are sample-weighted. Phase III regional benefit and cost estimates are sample-weighted.

[b] Phase II regional benefit and cost estimates have been inflated from 2002$ to 2004$.

[c] No benefits or costs are expected in the South Atlantic region under Phase III because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

d Mean value of total use benefits from the estimated range, as described in Chapter E2 of the EA and Chapter I1 of the RBA).

Source: U.S. EPA Analysis (2004, 2006).

E3-2 INCREMENTAL ANALYSIS OF BENEFITS AND SOCIAL COSTS

In addition to comparing benefits and costs for each primary analysis option, as presented in the preceding section, EPA also analyzed the benefits and costs of the options on an incremental basis. The comparison in the preceding section addresses the simple quantitative relationship between estimated benefits and costs for each option by itself: for a given option, which is greater – costs or benefits – and by how much in relative terms? In contrast, incremental analysis looks at the differential relationship of benefits and costs across options and poses a different question: as increasingly more costly options are considered, by what amount do benefits, costs, and net benefits change from option to option? It is important to emphasize that this incremental analysis does not look at the change in cost-benefit *ratios* across options, but rather, the actual costs and benefits. Analyzing cost-benefit ratios incrementally is not particularly valuable because it would only present the *change in the relative relationship* between costs and benefits across the different options. The most valuable interpretation of an incremental analysis of cost-benefit ratios would be to look for instances where the ratio changes from below 1 to above 1 in order to determine which option is optimal at the margin of stringency. Since all of the regulatory options considered here have a cost-benefit ratio greater than 1, an incremental analysis based on actual net benefits is more applicable. Incremental benefit-cost analysis provides insight into the net gain to society from imposing increasingly more costly requirements and may aid regulatory decision-makers in choosing among a set of regulatory proposals that otherwise have a similar quantitative relationship between benefits and costs based on a one-option-at-a-time comparison.

The Agency conducted the incremental benefit-cost analysis by calculating, for each option, the change in net benefits, from option to option, in moving from the least stringent option to successively more stringent options. As described previously, the regulatory analysis options – the 50 MGD All, the 200 MGD All, and 100 MGD CWB options – differ in terms of design intake flow (DIF) applicability threshold and affected waterbodies. Thus, the difference in benefits and costs across the options derives from the number of facilities each option is expected to cover and what types of waterbodies are affected. As reported in Table E3-8, at a 3% discount rate,

the incremental change in net benefits in moving from the 100 MGD CWB option to the 200 MGD All option is -$5.3 million, and from the 200 MGD All option to the 50 MGD All option, is -$18.0 million. Thus, for both incremental steps, calculated net benefits become increasingly more negative but the step from the 200 MGD All option to the 50 MGD All option is more costly to society, on a net benefit basis, than the step from the 100 MGD CWB option to the 200 MGD All option. The same pattern of change occurs for the analysis under a 7% discount rate: the incremental change in net benefits in moving from the 100 MGD CWB option to the 200 MGD All option is -$6.3 million, and from the 200 MGD All option to the 50 MGD All option, is -$18.3 million.

Table E3-7: Incremental Benefit-Cost Analysis for Existing Phase III Facilities (millions; $2004)

Option[a]	Net Benefits Based on Use Benefits Only[b]			Incremental Net Benefits[c]		
	Low	Mean	High	Low	Mean	High
3% discount rate						
100 MGD CWB	-$13.4	-$12.7	-$11.5	n/a	n/a	n/a
200 MGD All	-$18.5	-$18.0	-$17.0	-$5.2	-$5.3	-$5.5
50 MGD All	-$36.8	-$36.0	-$34.5	-$18.3	-$18.0	-$17.5
7% discount rate						
100 MGD CWB	-$13.2	-$12.6	-$11.6	n/a	n/a	n/a
200 MGD All	-$19.4	-$18.9	-$18.1	-$6.2	-$6.3	-$6.5
50 MGD All	-$37.9	-$37.2	-$35.9	-$18.5	-$18.3	-$17.8

[a] Options are presented in order of increasing applicability of national categorical standards, based on the number of facilities.

[b] Net benefits are computed by subtracting total annualized costs from total annual use benefits. The net benefits presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits.

[c] Incremental net benefits are equal to the difference between net benefits of an option and net benefits of the previous option.

Source: U.S. EPA Analysis, 2006.

E3-3 BREAK-EVEN ANALYSIS OF POTENTIAL NON-USE BENEFITS

As described in Section E3-1, above, EPA's monetized estimates of benefits for the 316(b) Phase III regulation consider only the *use benefit* values for commercial and recreational fishing, and exclude *non-use benefits*. For the final rule, the Agency assessed non-use benefits only qualitatively (see *Chapter A6* of RBA for a qualitative assessment of non-use benefits). As a result, the comparison of costs and benefits presented in *Sections E3-1* and *E3-2* does not reflect potential non-use values that may result from the regulatory analysis options.

Although EPA did not monetarily estimate the non-use benefits of the 316(b) Phase III regulation, it is possible to calculate the amount of non-use benefits that would be needed for the regulation's benefits to equal the estimated total costs (the "break-even" non-use benefits value). This provides another prism through which regulatory decision makers can view the regulatory analysis options' costs and benefits. It is not necessarily a conclusive analysis. Regulatory decision-makers may then judge the reasonableness of these required values in assessing what regulatory option, if any, is warranted.

To perform this break-even analysis, EPA subtracted the estimated commercial and recreational use benefits from the estimated annual costs. EPA then used this required residual to calculate the non-use benefit value, in terms of annual willingness-to-pay (WTP), needed for total benefits to equal total costs. This calculation was done in two different ways: (1) on a per household basis and (2) on a per age-1 equivalent basis. EPA performed this analysis using the regional studies framework as described in the RBA. This approach assumes that all of the facilities in the sample weight of a given sample facility are in the same benefits analysis region as the sample facility.

For the WTP per household analysis, this approach also assumes that the size and other characteristics of potential use and non-use benefit populations, which are assessed for the sample facility, may be extended to the weight of

the sample facility. This assumption embeds considerable uncertainty, but it permits the estimation of a non-use benefit population for each facility, which may then be used to calculate the WTP value by household that equates total benefits and total costs, on a sample-weighted basis, for each option. For this analysis, EPA assumed that only anglers fishing and households residing within a 25-mile radius of the facility hold non-use values for the affected resources (Census, 2000).[1] If the 25-mile radius excludes anglers and households holding positive non-use values, the break-even is overestimated; if anglers and households with zero non-use values are included in the 25-mile radius, the break-even would be underestimated unless it can be applied to only those holding positive non-use values.

At the national level, EPA estimated the following (see Table E3-8):

- **WTP per household.** Under the 50 MGD All option, non-use benefit values per household would need to equal $1.09 (3% discount rate) and $1.13 (7% discount rate) for total annual benefits to equal total annualized costs. Under the 200 MGD All option, which applies to the next smaller set of facilities, these values change to $1.32 (3% discount rate) and $1.39 (7% discount rate). Under the 100 MGD CWB option, which applies to the smallest set of facilities of the regulatory analysis options, these values decrease to $0.83 (3% and 7% discount rate).
- **WTP per age-1 equivalent.** Under the 50 MGD All option, non-use benefit values per age-1 equivalent would need to equal $0.37 (3% discount rate) and $0.38 (7% discount rate) for total annual benefits to equal total annualized costs. Under the 200 MGD All option, which applies to the next smaller set of facilities, these values decrease to $0.24 (3% discount rate) and $0.25 (7% discount rate). Under the 100 MGD CWB option these values decrease, to $0.18 (3% and 7% discount rate).

Table E3-8: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis ($2004)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
3% Discount Rate							
50 MGD All	$38.3	$2.25	$36.0	33,016,327	$1.09	98,200,000	$0.37
200 MGD All	$19.5	$1.50	$18.0	13,639,187	$1.32	74,500,000	$0.24
100 MGD CWB	$14.6	$1.87	$12.7	15,242,880	$0.83	71,100,000	$0.18
7% Discount Rate							
50 MGD All	$39.0	$1.80	$37.2	33,016,327	$1.13	98,200,000	$0.38
200 MGD All	$20.1	$1.19	$18.9	13,639,187	$1.39	74,500,000	$0.25
100 MGD CWB	$14.1	$1.49	$12.6	15,242,880	$0.83	71,100,000	$0.18

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

Source: U.S. EPA Analysis, 2006.

EPA also calculated the annual WTP needed on a per household basis and a per age-1 equivalent basis at the regional level (see Table E3-10 and Table E-6 below). EPA calculated the following:

- **WTP per household.** The Gulf of Mexico region has the highest estimated annual break-even WTP values per household under all three options. The Mid-Atlantic region has the lowest estimated annual

[1] See chapter E2 for details on the estimation of age-1 equivalents.

break-even WTP values per household with $0.19, $0.13, and $0.13 (3% discount rate) under the 50 MGD All, the 200 MGD All, and 100 MGD CWB options, respectively.

- **WTP per age-1 equivalent.** The North Atlantic region has the highest estimated annual break-even WTP value per age-1 equivalent with $1.94, $2.17, and $1.85 (3% discount rate) under the 50 MGD All, the 200 MGD All, and 100 MGD CWB options, respectively. The Mid-Atlantic region has the lowest estimated annual break-even WTP values per age-1 equivalent with $0.02 (3% discount rate) under the 50 MGD All, the 200 MGD All, and 100 MGD CWB options.

Table E3-9: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 3%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
50 MGD All							
California	$0.4	$0.0	$0.4	1,221,712	$0.31	474,000	$0.79
North Atlantic	$2.0	$0.0	$2.0	3,171,400	$0.64	1,040,000	$1.94
Mid-Atlantic	$1.2	$0.1	$1.1	5,899,941	$0.19	44,500,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$6.7	$1.4	$5.4	1,570,063	$3.4	19,400,000	$0.3
Great Lakes	$9.7	$0.4	$9.3	7,300,769	$1.27	13,500,000	$0.69
Inland	$17.3	$0.3	$17.0	13,852,441	$1.2	19,700,000	$0.9
National Total	**$38.3**	**$2.3**	**$36.0**	**33,016,327**	**$1.1**	**98,200,000**	**$0.4**
200 MGD All							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.5	$0.0	$0.5	1,396,669	$0.34	220,000	$2.17
Mid-Atlantic	$0.8	$0.1	$0.7	5,469,251	$0.13	39,400,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$3.5	$0.9	$2.6	404,072	$6.50	12,500,000	$0.21
Great Lakes	$4.4	$0.3	$4.1	4,619,103	$0.88	9,650,000	$0.42
Inland	$10.1	$0.2	$9.9	1,750,092	$5.67	12,700,000	$0.78
National Total	**$19.5**	**$1.5**	**$18.0**	**13,639,187**	**$1.32**	**74,500,000**	**$0.24**
100 MGD CWB							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$1.6	$0.0	$1.5	1,724,169	$0.90	837,000	$1.85
Mid-Atlantic	$0.8	$0.1	$0.7	5,469,251	$0.13	39,400,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$6.7	$1.4	$5.4	1,570,063	$3.41	19,400,000	$0.28
Great Lakes	$5.3	$0.4	$4.9	6,479,397	$0.76	11,600,000	$0.42
Inland	$0.0	$0.0	$0.0	0	n/a	0	n/a
National Total	**$14.6**	**$1.9**	**$12.7**	**15,242,880**	**$0.83**	**71,100,000**	**$0.18**

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

[c] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

[d] Positive non-zero value less than $50,000.

Source: U.S. EPA Analysis, 2006.

Table E3-10: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 7%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
50 MGD All							
California	$0.4	$0.0	$0.4	1,221,712	$0.32	474,000	$0.83
North Atlantic	$2.0	$0.0	$2.0	3,171,400	$0.62	1,040,000	$1.88
Mid-Atlantic	$1.2	$0.1	$1.1	5,899,941	$0.18	44,500,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$6.7	$1.1	$5.6	1,570,063	$3.55	19,400,000	$0.29
Great Lakes	$9.8	$0.3	$9.5	7,300,769	$1.30	13,500,000	$0.70
Inland	$18.1	$0.2	$17.8	13,852,441	$1.29	19,700,000	$0.90
National Total	**$39.0**	**$1.8**	**$37.2**	**33,016,327**	**$1.13**	**98,200,000**	**$0.38**
200 MGD All							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.4	$0.0	$0.4	1,396,669	$0.31	220,000	$1.99
Mid-Atlantic	$0.7	$0.1	$0.7	5,469,251	$0.12	39,400,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$3.4	$0.7	$2.7	404,072	$6.76	12,500,000	$0.22
Great Lakes	$4.1	$0.3	$3.8	4,619,103	$0.83	9,650,000	$0.40
Inland	$11.3	$0.2	$11.1	1,750,092	$6.34	12,700,000	$0.87
National Total	**$20.1**	**$1.2**	**$18.9**	**13,639,187**	**$1.39**	**74,500,000**	**$0.25**
100 MGD CWB							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$1.5	$0.0	$1.5	1,724,169	$0.88	837,000	$1.81
Mid-Atlantic	$0.7	$0.1	$0.7	5,469,251	$0.12	39,400,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	n/a	0	n/a
Gulf of Mexico	$6.7	$1.1	$5.6	1,570,063	$3.55	19,400,000	$0.29
Great Lakes	$5.0	$0.3	$4.7	6,479,397	$0.72	11,600,000	$0.40
Inland	$0.0	$0.0	$0.0	0	n/a	0	n/a
National Total	**$14.1**	**$1.5**	**$12.6**	**15,242,880**	**$0.83**	**71,100,000**	**$0.18**

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

[c] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region withdraw less than 50 MGD and therefore would not be required to install technologies to comply with the regulatory analysis options.

[d] Positive non-zero value less than $50,000.

Source: U.S. EPA Analysis, 2006.

GLOSSARY

opportunity cost: The lost value of alternative uses of resources (capital, labor, and raw materials) used in regulatory compliance.

social cost: The costs incurred by society as a whole as a result of the final rule. Social costs do not include costs that are transfers among parties that do not represent a new cost overall.

REFERENCES

U.S. Department of Commerce, Bureau of the Census, (Census). 2000. "Summary File 1." Available at: http://www.census.gov/Press-Release/www/2001/sumfile1.html.

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Regional Analysis for the Final Section 316(b) Phase III Existing Facilities Rule*. EPA-821-R-06-002. June 2006.

Appendix E3A: Summary of Results for Supplemental Options

INTRODUCTION

This appendix supplements *Chapter E3* by presenting EPA's analysis of the benefits and costs for eight supplemental options evaluated for potential Phase III existing facilities. Results are presented for the comparison of benefits and costs and the breakeven assessment of non-use benefits. As discussed previously in *Chapter E3*, the benefit and cost values presented in this appendix pertain only to the Manufacturers and Electric Generators segments of the industries subject to Phase III regulation.

APPENDIX CONTENTS

EPA estimated the compliance response for each facility under each of the other options (see Table E3A-1, below). In this table and the following tables, the options are listed in order of increasing cost, which reflects the breadth of regulatory coverage based on design intake flow applicability threshold and the stringency of compliance requirements. For a description of this analysis, see section E3-1 of Chapter E3.

Table E3A-1: Number of Existing Phase III Facilities by Compliance Action[a]

Facility Compliance Action	Option							
	Electric Generators 2-50 MGD			Manufacturers 2-50 MGD			Manufacturers 50+ MGD	
	I-only Everywhere	Phase II I&E	I&E Everywhere	I-only Everywhere	Phase II I&E	I&E Everywhere	I-only Everywhere	I&E Everywhere
Facilities Potentially Subject to Regulation (excluding baseline closures)	114	114	114	368	368	368	146	146
Facilities Subject to Best Professional Judgment	0	0	0	0	0	0	0	0
Facilities Subject to National Categorical Requirements	114	114	114	368	368	368	146	146
No compliance action[b]	95	94	82	213	199	186	47	16
Impingement controls only	19	9	n/a	155	103	n/a	99	n/a
Impingement and entrainment controls	n/a	10	32	n/a	67	183	n/a	130

a Alternative less stringent requirements based on a site-specific assessment of costs, or costs and benefits, are allowed. The estimate of number of facilities meeting specific requirements is uncertain because the number of facilities requesting alternative less stringent requirements based on site-specific assessments is unknown.

b These facilities already meet compliance requirements.

Source: U.S. EPA Analysis, 2006.

E3A-1 COMPARISON OF BENEFITS AND SOCIAL COSTS BY OPTION

Table E3A-2, below, reports benefits, costs, and net benefits for all eight supplemental options. For further information on this analysis, see *Section E3-1* of *Chapter E3*.

Table E3A-2: Total Benefits, Social Costs, and Net Benefits for Existing Phase III Facilities by Option (millions; 2004$)

Option	Total Monetized Use Benefits[a]			Total Social Costs	Net Benefits Based on Use Benefits Only[b]		
	Low	Mean	High		Low	Mean	High
				3% Discount Rate			
Electric Generators 2-50 MGD							
I-only Everywhere	$0.0	$0.0	$0.0	$2.2	-$2.2	-$2.2	-$2.2
I&E like Phase II	$0.0	$0.0	$0.0	$3.2	-$3.2	-$3.2	-$3.1
I&E Everywhere	$0.0	$0.0	$0.0	$8.1	-$8.0	-$8.0	-$8.0
Manufacturers 2-50 MGD							
I-only Everywhere	$0.1	$0.1	$0.2	$21.5	-$21.5	-$21.4	-$21.3
I&E like Phase II	$0.1	$0.2	$0.3	$34.8	-$34.7	-$34.6	-$34.5
I&E Everywhere	$0.1	$0.2	$0.3	$56.6	-$56.5	-$56.4	-$56.2
Manufacturers 50+ MGD							
I-only Everywhere	$0.7	$1.3	$2.3	$25.0	-$24.2	-$23.7	-$22.7
I&E Everywhere	$1.5	$2.4	$4.0	$46.1	-$44.6	-$43.7	-$42.0
				7% Discount Rate			
Electric Generators 2-50 MGD							
I-only Everywhere	$0.0	$0.0	$0.0	$2.1	-$2.1	-$2.1	-$2.1
I&E like Phase II	$0.0	$0.0	$0.0	$3.0	-$3.0	-$3.0	-$3.0
I&E Everywhere	$0.0	$0.0	$0.0	$8.8	-$8.8	-$8.8	-$8.7
Manufacturers 2-50 MGD							
I-only Everywhere	$0.0	$0.1	$0.1	$22.5	-$22.5	-$22.4	-$22.4
I&E like Phase II	$0.1	$0.1	$0.2	$37.1	-$37.0	-$36.9	-$36.9
I&E Everywhere	$0.1	$0.2	$0.3	$60.3	-$60.2	-$60.2	-$60.1
Manufacturers 50+ MGD							
I-only Everywhere	$0.6	$1.0	$1.8	$26.0	-$25.4	-$25.0	-$24.2
I&E Everywhere	$1.2	$1.9	$3.2	$46.2	-$45.0	-$44.3	-$43.0

[a] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits only qualitatively. The range (low, mean, and high) of annualized use values is computed by adding the high-end value for commercial fishing benefits (based on assumed producer surplus of 40% of gross revenue) to the low, mean, and high values from recreational fishing benefits, respectively (see Chapter A4 of the RBA).

[b] Net benefits are calculated by subtracting total annualized costs from total annual use benefits. The net benefits presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits.

Source: U.S. EPA Analysis, 2006.

Table E3A-3 and Table E3A-4, following pages, report net benefits, by option and benefit study region for, respectively, the 3% and 7% discount rate calculations. For further information on this analysis, see *Section E3-1* of *Chapter E3*.

Table E3A-3: Total Net Benefits for Existing Phase III Facilities by Option and Region (millions; 2004$, discounted at 3%)

Option	Net Benefits Based on Use Benefits Only[a]							
	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
				Low				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.5)	(1.5)	(2.2)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.8)	(1.9)	(3.2)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.9)	(6.6)	(8.0)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.6)	(8.4)	(10.3)	(21.5)
I&E like Phase II	(1.4)	0.0	(1.1)	0.0	(4.5)	(10.1)	(16.2)	(34.7)
I&E Everywhere	(1.4)	0.0	(1.1)	0.0	(4.5)	(10.0)	(37.5)	(56.5)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	(0.5)	(4.2)	(17.9)	(24.2)
I&E Everywhere	(0.4)	(2.0)	(1.2)	0.0	(3.6)	(9.4)	(27.3)	(44.6)
				Mean				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.5)	(1.5)	(2.2)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.8)	(1.9)	(3.2)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.9)	(6.6)	(8.0)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.6)	(8.4)	(10.3)	(21.4)
I&E like Phase II	(1.4)	0.0	(1.1)	0.0	(4.5)	(10.0)	(16.1)	(34.6)
I&E Everywhere	(1.4)	0.0	(1.1)	0.0	(4.5)	(10.0)	(37.4)	(56.4)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	(0.2)	(4.1)	(17.8)	(23.7)
I&E Everywhere	(0.4)	(2.0)	(1.1)	0.0	(3.0)	(9.3)	(27.1)	(43.7)
				High				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.5)	(1.5)	(2.2)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.8)	(1.9)	(3.1)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.9)	(6.6)	(8.0)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.5)	(8.4)	(10.2)	(21.3)
I&E like Phase II	(1.3)	0.0	(1.1)	0.0	(4.4)	(10.0)	(16.1)	(34.5)
I&E Everywhere	(1.3)	0.0	(1.1)	0.0	(4.4)	(10.0)	(37.4)	(56.2)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	0.5	(4.0)	(17.6)	(22.7)
I&E Everywhere	(0.4)	(2.0)	(1.0)	0.0	(2.0)	(9.1)	(26.7)	(42.0)

[a] Net benefits are computed by subtracting total annualized costs from total annual use benefits. The net benefits presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits.

[b] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

Source: U.S. EPA Analysis, 2006.

Table E3A-4: Total Net Benefits for Existing Phase III Facilities by Option and Region (millions; 2004$, discounted at 7%)

Option	Net Benefits Based on Use Benefits Only[a]							
	California	North Atlantic	Mid-Atlantic	South Atlantic[b]	Gulf of Mexico	Great Lakes	Inland	National Total
				Low				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.5)	(1.5)	(2.1)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.7)	(1.8)	(3.0)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.8)	(7.4)	(8.8)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.6)	(10.1)	(9.7)	(22.5)
I&E like Phase II	(1.3)	0.0	(1.1)	0.0	(5.6)	(11.7)	(15.9)	(37.0)
I&E Everywhere	(1.3)	0.0	(1.1)	0.0	(5.6)	(11.7)	(38.7)	(60.2)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	(0.6)	(4.6)	(18.6)	(25.4)
I&E Everywhere	(0.4)	(2.0)	(1.1)	0.0	(3.7)	(9.6)	(27.4)	(45.0)
				Mean				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.5)	(1.5)	(2.1)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.7)	(1.8)	(3.0)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.8)	(7.4)	(8.8)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.6)	(10.1)	(9.6)	(22.4)
I&E like Phase II	(1.3)	0.0	(1.1)	0.0	(5.6)	(11.7)	(15.9)	(36.9)
I&E Everywhere	(1.3)	0.0	(1.1)	0.0	(5.6)	(11.7)	(38.7)	(60.2)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	(0.4)	(4.5)	(18.5)	(25.0)
I&E Everywhere	(0.4)	(2.0)	(1.1)	0.0	(3.3)	(9.5)	(27.3)	(44.3)
				High				
Electric Generators 2-50 MGD								
I-only Everywhere	0.0	0.0	(0.1)	0.0	0.0	(0.4)	(1.5)	(2.1)
I&E like Phase II	0.0	0.0	(0.3)	0.0	0.0	(0.7)	(1.8)	(3.0)
I&E Everywhere	0.0	0.0	(0.4)	0.0	0.0	(0.8)	(7.4)	(8.7)
Manufacturers 2-50 MGD								
I-only Everywhere	(0.7)	0.0	(0.5)	0.0	(0.6)	(10.1)	(9.6)	(22.4)
I&E like Phase II	(1.2)	0.0	(1.0)	0.0	(5.6)	(11.7)	(15.8)	(36.9)
I&E Everywhere	(1.2)	0.0	(1.0)	0.0	(5.6)	(11.7)	(38.6)	(60.1)
Manufacturers 50+ MGD								
I-only Everywhere	(0.2)	(0.4)	(0.7)	0.0	0.2	(4.4)	(18.4)	(24.2)
I&E Everywhere	(0.4)	(1.9)	(1.0)	0.0	(2.5)	(9.3)	(27.0)	(43.0)

[a] Net benefits are computed by subtracting total annualized costs from total annual use benefits. The net benefits presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits and should be interpreted with caution.

[b] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

Source: U.S. EPA Analysis, 2006.

Table E3A-5, Table E3A-6, and Table E3A-7 compile the time profiles of benefits and costs for the eight supplemental options. The tables also report the calculated present and annualized values of benefits and costs at 3% and 7% discount rates.

Table E3A-5: Time Profile of Benefits and Costs for Existing Phase III Electric Generator 2-50 MGD Facilities (millions; 2004$)

Year	"Electric Generators 2-50 MGD I-only Everywhere"		"Electric Generators 2-50 MGD I&E like Phase II"		"Electric Generators 2-50 MGD I&E Everywhere"	
	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)
2007	$0.00	$2.18	$0.00	$2.18	$0.00	$2.22
2008	$0.00	$2.69	$0.00	$3.23	$0.00	$3.56
2009	$0.00	$3.45	$0.00	$3.96	$0.00	$5.28
2010	$0.00	$3.76	$0.00	$5.36	$0.00	$42.00
2011	$0.00	$5.68	$0.00	$6.78	$0.00	$43.58
2012	$0.00	$5.99	$0.00	$6.78	$0.01	$8.21
2013	$0.01	$4.49	$0.01	$5.28	$0.01	$7.78
2014	$0.01	$6.31	$0.01	$8.39	$0.02	$9.54
2015	$0.01	$3.39	$0.01	$4.43	$0.02	$5.59
2016	$0.01	$3.63	$0.02	$4.31	$0.03	$6.29
2017	$0.02	$6.24	$0.02	$6.97	$0.03	$8.19
2018	$0.02	$4.88	$0.02	$5.70	$0.03	$7.19
2019	$0.02	$6.11	$0.02	$6.86	$0.03	$8.23
2020	$0.02	$5.27	$0.02	$6.69	$0.03	$11.04
2021	$0.02	$6.48	$0.02	$6.55	$0.03	$9.22
2022	$0.02	$8.53	$0.02	$9.27	$0.03	$10.49
2023	$0.02	$5.44	$0.02	$6.25	$0.03	$8.90
2024	$0.02	$8.39	$0.02	$9.87	$0.03	$10.98
2025	$0.02	$4.79	$0.02	$5.84	$0.03	$6.99
2026	$0.02	$5.09	$0.02	$5.77	$0.03	$7.74
2027	$0.02	$7.28	$0.02	$8.01	$0.03	$9.23
2028	$0.02	$5.04	$0.02	$5.86	$0.03	$7.35
2029	$0.02	$6.62	$0.02	$7.37	$0.03	$8.74
2030	$0.02	$5.20	$0.02	$6.62	$0.03	$10.97
2031	$0.02	$6.39	$0.02	$6.46	$0.03	$9.13
2032	$0.02	$8.85	$0.02	$9.59	$0.03	$10.81
2033	$0.02	$5.26	$0.02	$6.07	$0.03	$8.72
2034	$0.02	$8.51	$0.02	$10.00	$0.03	$11.11
2035	$0.02	$4.49	$0.02	$5.54	$0.03	$6.69
2036	$0.02	$4.87	$0.02	$5.55	$0.03	$7.52
2037	$0.02	$6.27	$0.02	$7.00	$0.03	$8.21
2038	$0.02	$4.02	$0.02	$4.83	$0.03	$6.33
2039	$0.02	$4.55	$0.02	$5.22	$0.03	$6.35
2040	$0.02	$2.69	$0.02	$3.17	$0.03	$3.96
2041	$0.02	$2.52	$0.02	$2.89	$0.03	$3.56
2042	$0.01	$4.53	$0.02	$4.85	$0.02	$5.15
2043	$0.01	$2.07	$0.01	$2.29	$0.02	$2.41
2044	$0.01	$2.88	$0.01	$2.88	$0.01	$2.88
2045	$0.00	$1.74	$0.01	$1.74	$0.01	$1.74
2046	$0.00	$1.68	$0.00	$1.68	$0.00	$1.68
2047	$0.00	$2.48	$0.00	$2.48	$0.00	$2.48
2048	$0.00	$0.65	$0.00	$0.65	$0.00	$0.65
PV 3%	$0.27	$121.00	$0.33	$139.92	$0.53	$238.62
Annualized 3%	$0.01	$5.99	$0.02	$6.93	$0.03	$11.82
PV 7%	$0.13	$69.69	$0.17	$81.42	$0.27	$157.82
Annualized 7%	$0.01	$5.25	$0.01	$6.13	$0.02	$11.89

Source: U.S. EPA Analysis, 2006.

Table E3A-6: Time Profile of Benefits and Costs for Existing Phase III Manufacturer 2-50 MGD Facilities (millions; 2004$)

Year	"Manufacturers 2-50 MGD I-only Everywhere"		"Manufacturers 2-50 MGD I&E like Phase II"		"Manufacturers 2-50 MGD I&E Everywhere"	
	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)
2007	$0.00	$2.34	$0.00	$3.65	$0.00	$3.99
2008	$0.00	$6.76	$0.00	$10.19	$0.00	$12.19
2009	$0.00	$11.50	$0.00	$16.65	$0.00	$20.20
2010	$0.00	$22.93	$0.00	$65.88	$0.00	$76.31
2011	$0.00	$30.60	$0.00	$131.86	$0.01	$141.24
2012	$0.02	$181.68	$0.02	$192.66	$0.03	$203.06
2013	$0.04	$17.76	$0.05	$25.69	$0.06	$323.07
2014	$0.09	$14.32	$0.12	$21.81	$0.15	$32.65
2015	$0.10	$14.74	$0.15	$21.17	$0.18	$29.73
2016	$0.11	$16.17	$0.18	$22.49	$0.22	$33.11
2017	$0.12	$17.26	$0.19	$23.26	$0.23	$34.28
2018	$0.12	$11.65	$0.20	$18.20	$0.24	$27.02
2019	$0.12	$12.11	$0.20	$19.48	$0.24	$29.75
2020	$0.12	$19.53	$0.20	$29.69	$0.24	$42.36
2021	$0.12	$27.63	$0.20	$36.53	$0.24	$47.13
2022	$0.12	$25.79	$0.20	$35.54	$0.24	$46.56
2023	$0.12	$17.70	$0.20	$25.56	$0.24	$34.09
2024	$0.12	$16.26	$0.20	$23.63	$0.24	$33.91
2025	$0.12	$16.12	$0.20	$22.55	$0.24	$31.09
2026	$0.12	$17.62	$0.20	$23.94	$0.24	$34.54
2027	$0.12	$18.30	$0.20	$24.30	$0.24	$35.32
2028	$0.12	$11.81	$0.20	$18.36	$0.24	$27.18
2029	$0.12	$12.61	$0.20	$19.98	$0.24	$30.26
2030	$0.12	$19.47	$0.20	$29.62	$0.24	$42.30
2031	$0.12	$27.55	$0.20	$36.44	$0.24	$47.05
2032	$0.12	$26.11	$0.20	$35.86	$0.24	$46.88
2033	$0.12	$17.52	$0.20	$25.38	$0.24	$33.91
2034	$0.12	$16.39	$0.20	$23.76	$0.24	$34.03
2035	$0.12	$15.83	$0.20	$22.25	$0.24	$30.79
2036	$0.12	$17.39	$0.20	$23.72	$0.24	$34.32
2037	$0.12	$17.29	$0.20	$23.29	$0.24	$34.31
2038	$0.12	$10.79	$0.20	$17.33	$0.24	$26.15
2039	$0.12	$10.00	$0.20	$15.15	$0.24	$23.63
2040	$0.12	$7.73	$0.20	$11.78	$0.24	$18.30
2041	$0.12	$6.17	$0.19	$8.38	$0.23	$14.23
2042	$0.10	$6.43	$0.17	$7.35	$0.21	$11.01
2043	$0.08	$2.58	$0.15	$2.83	$0.18	$4.33
2044	$0.03	$2.88	$0.07	$2.88	$0.09	$2.88
2045	$0.02	$1.74	$0.05	$1.74	$0.06	$1.74
2046	$0.01	$1.68	$0.02	$1.68	$0.02	$1.68
2047	$0.00	$2.48	$0.00	$2.48	$0.01	$2.48
2048	$0.00	$0.65	$0.00	$0.65	$0.00	$0.65
PV 3%	$1.97	$510.10	$3.21	$778.32	$3.91	$1.218.35
Annualized 3%	$0.10	$25.27	$0.16	$38.55	$0.20	$60.35
PV 7%	$0.99	$340.26	$1.60	$533.65	$1.95	$842.29
Annualized 7%	$0.08	$25.63	$0.13	$40.19	$0.16	$63.44

Source: U.S. EPA Analysis, 2006.

Table E3A-7: Time Profile of Benefits and Costs for Existing Phase III Manufacturer 50+ MGD Facilities (millions; 2004$)

Year	"Manufacturers 50+ MGD I-only Everywhere"		"Manufacturers 50+ MGD I&E Everywhere"	
	Monetized Benefits	Total Cost (excl. O&G)	Monetized Benefits	Total Cost (excl. O&G)
2007	$0.00	$3.59	$0.00	$5.26
2008	$0.00	$9.76	$0.00	$15.66
2009	$0.00	$14.07	$0.00	$23.41
2010	$0.01	$121.55	$0.01	$61.10
2011	$0.03	$43.23	$0.08	$171.40
2012	$0.19	$56.68	$0.38	$68.41
2013	$0.44	$32.44	$0.92	$120.46
2014	$1.06	$16.01	$2.06	$31.63
2015	$1.32	$18.66	$2.51	$29.05
2016	$1.42	$14.28	$2.70	$22.80
2017	$1.48	$16.65	$2.81	$26.89
2018	$1.50	$12.83	$2.83	$22.18
2019	$1.50	$16.57	$2.84	$28.48
2020	$1.50	$30.44	$2.84	$49.49
2021	$1.50	$42.55	$2.84	$105.53
2022	$1.50	$22.30	$2.84	$34.05
2023	$1.50	$32.83	$2.84	$70.06
2024	$1.50	$18.30	$2.84	$33.62
2025	$1.50	$20.05	$2.84	$30.43
2026	$1.50	$15.74	$2.84	$24.25
2027	$1.50	$17.69	$2.84	$27.93
2028	$1.50	$12.99	$2.84	$22.34
2029	$1.50	$17.07	$2.84	$28.99
2030	$1.50	$30.38	$2.84	$49.42
2031	$1.50	$42.47	$2.84	$105.45
2032	$1.50	$22.62	$2.84	$34.37
2033	$1.50	$32.65	$2.84	$69.88
2034	$1.50	$18.43	$2.84	$33.74
2035	$1.50	$19.75	$2.84	$30.13
2036	$1.50	$15.52	$2.84	$24.03
2037	$1.50	$16.68	$2.84	$26.91
2038	$1.50	$11.97	$2.84	$21.32
2039	$1.50	$12.36	$2.84	$20.70
2040	$1.49	$9.30	$2.82	$15.47
2041	$1.47	$5.30	$2.76	$8.88
2042	$1.31	$6.57	$2.45	$9.31
2043	$1.06	$2.10	$1.91	$2.67
2044	$0.44	$2.88	$0.78	$2.88
2045	$0.18	$1.74	$0.32	$1.74
2046	$0.08	$1.68	$0.14	$1.68
2047	$0.02	$2.48	$0.03	$2.48
2048	$0.00	$0.65	$0.00	$0.65
PV 3%	$24.63	$580.11	$46.64	$1.005.88
Annualized 3%	$1.26	$28.73	$2.38	$49.82
PV 7%	$12.44	$386.74	$23.61	$654.94
Annualized 7%	$1.00	$29.13	$1.90	$49.33

Source: U.S. EPA Analysis, 2006.

E3A-2 INCREMENTAL ANALYSIS OF BENEFITS AND SOCIAL COSTS

EPA conducted an incremental analysis of benefits and social costs to determine as increasingly more costly options are considered, by what amount do benefits, costs, and net benefits change from option to option. Table E3A-8, below, reports this analysis for the eight supplemental options evaluated. For a description of this analysis, see *Section E3-3* of *Chapter E3*.

Table E3A-8: Incremental Benefit-Cost Analysis for Existing Phase III Facilities (millions; 2004$)

Option[a]	Net Benefits Based on Use Benefits Only[b]			Incremental Net Benefits[c]		
	Low	Mean	High	Low	Mean	High
			3% discount rate			
Electric Generators 2-50 MGD						
I-only Everywhere	-$2.2	-$2.2	-$2.2	n/a	n/a	n/a
I&E like Phase II	-$3.2	-$3.2	-$3.1	$4.9	$4.9	$4.9
I&E Everywhere	-$8.0	-$8.0	-$8.0	-$5.8	-$5.8	-$5.8
Manufacturers 2-50 MGD						
I-only Everywhere	-$21.5	-$21.4	-$21.3	-$18.3	-$18.3	-$18.2
I&E like Phase II	-$34.7	-$34.6	-$34.5	$21.8	$21.8	$21.7
I&E Everywhere	-$56.5	-$56.4	-$56.2	-$35.0	-$35.0	-$34.9
Manufacturers 50+ MGD						
I-only Everywhere	-$24.2	-$23.7	-$22.7	$10.5	$10.9	$11.8
I&E Everywhere	-$44.6	-$43.7	-$42.0	-$20.3	-$20.0	-$19.3
			7% discount rate			
Electric Generators 2-50 MGD						
I-only Everywhere	-$2.1	-$2.1	-$2.1	n/a	n/a	n/a
I&E like Phase II	-$3.0	-$3.0	-$3.0	$5.7	$5.7	$5.7
I&E Everywhere	-$8.8	-$8.8	-$8.7	-$6.6	-$6.6	-$6.6
Manufacturers 2-50 MGD						
I-only Everywhere	-$22.5	-$22.4	-$22.4	-$19.5	-$19.4	-$19.4
I&E like Phase II	-$37.0	-$36.9	-$36.9	$23.2	$23.2	$23.2
I&E Everywhere	-$60.2	-$60.2	-$60.1	-$37.8	-$37.7	-$37.7
Manufacturers 50+ MGD						
I-only Everywhere	-$25.4	-$25.0	-$24.2	$11.6	$11.9	$12.7
I&E Everywhere	-$45.0	-$44.3	-$43.0	-$19.6	-$19.3	-$18.8

[a] Options are presented in order of increasing applicability, based on the number of facilities regulated.

[b] Net benefits are computed by subtracting total annualized costs from total annual use benefits. The net benefits presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits.

[c] Incremental net benefits are equal to the difference between net benefits of a given option and the net benefits of the previous less stringent option.

Source: U.S. EPA Analysis, 2006.

E3A-3 BREAK-EVEN ANALYSIS OF POTENTIAL NON-USE BENEFITS

EPA conducted a break-even analysis for each option to determine the per household value and per age-1 equivalent value of non-use benefits needed for total annual benefits to equal total annual costs. Table E3A-9 and Table E3A-10, following pages, present results at the national level (discounted at 3 and 7%, respectively). Table E3A-11 and Table E3A-12 present regional results. See *Section E3-3* of *Chapter E3* for details of this analysis.

Table E3A-9: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Cost for Existing Phase III Facilities - Break-Even Analysis (2004$, discounted at 3%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction in I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent ($)[b]
Electric Generators 2-50 MGD							
I-only Everywhere	$0.01	$2.2	$2.2	33,016,327	$0.07	802,000	$2.77
I&E like Phase II	$0.02	$3.2	$3.2	15,242,880	$0.21	863,000	$3.66
I&E Everywhere	$0.03	$8.1	$8.0	13,639,187	$0.59	2,610,000	$3.08
Manufacturers 2-50 MGD							
I-only Everywhere	$0.10	$21.5	$21.4	0	n/a	4,720,000	$4.54
I&E like Phase II	$0.16	$34.8	$34.6	13,639,187	$2.54	8,040,000	$4.31
I&E Everywhere	$0.20	$56.6	$56.4	33,016,327	$1.71	9,340,000	$6.04
Manufacturers 50+ MGD							
I-only Everywhere	$1.26	$25.0	$23.7	15,242,880	$1.56	39,400,000	$0.60
I&E Everywhere	$2.38	$46.1	$43.7	0	n/a	103,000,000	$0.42

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

Source: U.S. EPA Analysis, 2006.

Table E3A-10: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Cost for Existing Phase III Facilities - Break-Even Analysis (2004$, discounted at 7%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction in I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent ($)[b]
Electric Generators 2-50 MGD							
I-only Everywhere	$0.01	$2.1	$2.1	0	n/a	802,000	$2.65
I&E like Phase II	$0.01	$3.0	$3.0	0	n/a	863,000	$3.48
I&E Everywhere	$0.02	$8.8	$8.8	0	n/a	2,610,000	$3.35
Manufacturers 2-50 MGD							
I-only Everywhere	$0.08	$22.5	$22.4	0	n/a	4,720,000	$4.75
I&E like Phase II	$0.13	$37.1	$36.9	0	n/a	8,040,000	$4.60
I&E Everywhere	$0.16	$60.3	$60.2	0	n/a	9,340,000	$6.44
Manufacturers 50+ MGD							
I-only Everywhere	$1.00	$26.0	$25.0	0	n/a	39,400,000	$0.63
I&E Everywhere	$1.90	$46.2	$44.3	0	n/a	103,000,000	$0.43

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

Source: U.S. EPA Analysis, 2006.

Table E3A-11: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 3%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
"Electric Generators 2-50 MGD I-only Everywhere" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.1	$0.0	$0.1	1,078,126	$0.12	26,600	$4.92
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.5	$0.0	$0.5	2,545,871	$0.18	303,000	$1.55
Inland	$1.5	$0.0	$1.5	5,501,774	$0.28	473,000	$3.21
National Total	**$2.2**	**$0.0**	**$2.2**	**9,125,771**	**$0.24**	**802,000**	**$2.77**
"Electric Generators 2-50 MGD I&E like Phase II" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.3	$0.0	$0.3	1,078,126	$0.30	26,600	$12.29
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.8	$0.0	$0.8	2,545,871	$0.30	327,000	$2.35
Inland	$1.9	$0.0	$1.9	5,840,778	$0.33	509,000	$3.76
National Total	**$3.2**	**$0.0**	**$3.2**	**9,464,776**	**$0.33**	**863,000**	**$3.66**
"Electric Generators 2-50 MGD I&E Everywhere" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.4	$0.0	$0.4	6,388,407	$0.06	1,480,000	$0.28
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.9	$0.0	$0.9	2,545,871	$0.34	331,000	$2.59
Inland	$6.6	$0.0	$6.6	6,321,161	$1.04	802,000	$8.19
National Total	**$8.1**	**$0.0**	**$8.0**	**15,255,439**	**$0.53**	**2,610,000**	**$3.08**
"Manufacturers 2-50 MGD I-only Everywhere" Option							
California	$0.7	$0.0	$0.7	804,176	$0.88	10,300	$69.02
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.5	$0.0	$0.5	5,275,611	$0.09	150,000	$3.08
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.6	$0.0	$0.6	34,907	$16.58	543,000	$1.07
Great Lakes	$8.4	$0.0	$8.4	3,689,094	$2.28	698,000	$12.07
Inland	$10.3	$0.0	$10.3	21,228,706	$0.48	3,320,000	$3.09
National Total	**$21.5**	**$0.1**	**$21.4**	**31,032,495**	**$0.69**	**4,720,000**	**$4.54**

Table E3A-11: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 3%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
"Manufacturers 2-50 MGD I&E like Phase II" Option							
California	$1.4	$0.0	$1.4	804,176	$1.69	481,000	$2.82
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$1.1	$0.0	$1.1	5,275,611	$0.21	2,310,000	$0.48
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$4.5	$0.1	$4.5	34,907	$128.36	855,000	$5.24
Great Lakes	$10.1	$0.0	$10.0	3,689,094	$2.72	732,000	$13.72
Inland	$16.2	$0.0	$16.1	23,255,379	$0.69	3,660,000	$4.41
National Total	**$34.8**	**$0.2**	**$34.6**	**33,059,167**	**$1.05**	**8,040,000**	**$4.31**
"Manufacturers 2-50 MGD I&E Everywhere" Option							
California	$1.4	$0.0	$1.4	804,176	$1.70	534,000	$2.56
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$1.1	$0.0	$1.1	5,275,611	$0.21	2,310,000	$0.48
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$4.5	$0.1	$4.5	34,907	$128.36	855,000	$5.24
Great Lakes	$10.1	$0.0	$10.0	3,689,094	$2.72	764,000	$13.14
Inland	$37.5	$0.1	$37.4	23,482,894	$1.59	4,880,000	$7.67
National Total	**$56.6**	**$0.2**	**$56.4**	**33,286,682**	**$1.69**	**9,340,000**	**$6.04**
"Manufacturers 50+ MGD I-only Everywhere" Option							
California	$0.2	$0.0	$0.2	1,221,712	$0.14	10,200	$16.35
North Atlantic	$0.4	$0.0	$0.4	0	n/a	0	n/a
Mid-Atlantic	$0.8	$0.0	$0.7	5,171,002	$0.14	1,000,000	$0.72
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.9	$0.8	$0.2	1,315,491	$0.15	10,400,000	$0.02
Great Lakes	$4.4	$0.3	$4.1	5,434,405	$0.75	11,700,000	$0.35
Inland	$18.0	$0.2	$17.8	11,669,888	$1.52	16,200,000	$1.10
National Total	**$25.0**	**$1.3**	**$23.7**	**24,812,498**	**$0.96**	**39,400,000**	**$0.60**
"Manufacturers 50+ MGD I&E Everywhere" Option							
California	$0.4	$0.0	$0.4	1,221,712	$0.31	474,000	$0.79
North Atlantic	$2.0	$0.0	$2.0	3,171,400	$0.64	910,000	$2.22
Mid-Atlantic	$1.2	$0.1	$1.1	5,899,941	$0.19	44,500,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$4.4	$1.4	$3.0	1,570,063	$1.94	19,400,000	$0.16
Great Lakes	$9.7	$0.4	$9.3	7,300,769	$1.27	13,400,000	$0.69
Inland	$27.5	$0.4	$27.1	16,438,931	$1.65	24,600,000	$1.10
National Total	**$46.1**	**$2.4**	**$43.7**	**35,602,817**	**$1.23**	**103,000,000**	**$0.42**

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

[c] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

[d] Positive non-zero value less than $50,000.

Source: U.S. EPA Analysis, 2006.

Table E3A-12: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 7%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
"Electric Generators 2-50 MGD I-only Everywhere" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.1	$0.0	$0.1	1,078,126	$0.11	26,600	$4.45
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.5	$0.0	$0.5	2,545,871	$0.18	303,000	$1.49
Inland	$1.5	$0.0	$1.5	5,501,774	$0.26	473,000	$3.07
National Total	**$2.1**	**$0.0**	**$2.1**	**9,125,771**	**$0.23**	**802,000**	**$2.65**
"Electric Generators 2-50 MGD I&E like Phase II" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.3	$0.0	$0.3	1,078,126	$0.28	26,600	$11.51
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.7	$0.0	$0.7	2,545,871	$0.29	327,000	$2.23
Inland	$1.8	$0.0	$1.8	5,840,778	$0.31	509,000	$3.58
National Total	**$3.0**	**$0.0**	**$3.0**	**9,464,776**	**$0.32**	**863,000**	**$3.48**
"Electric Generators 2-50 MGD I&E Everywhere" Option							
California	$0.0	$0.0	$0.0	0	n/a	0	n/a
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.4	$0.0	$0.4	6,388,407	$0.06	1,480,000	$0.26
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.0	$0.0	$0.0	0	n/a	0	n/a
Great Lakes	$0.8	$0.0	$0.8	2,545,871	$0.42	331,000	$2.44
Inland	$7.4	$0.0	$7.4	6,321,161	$1.16	802,000	$9.18
National Total	**$8.8**	**$0.0**	**$8.8**	**15,255,439**	**$0.57**	**2,610,000**	**$3.35**
"Manufacturers 2-50 MGD I-only Everywhere" Option							
California	$0.7	$0.0	$0.7	804,176	$0.84	10,300	$65.26
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$0.5	$0.0	$0.5	5,275,611	$0.09	150,000	$3.09
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.6	$0.0	$0.6	34,907	$16.92	543,000	$1.09
Great Lakes	$10.1	$0.0	$10.1	3,689,094	$2.74	698,000	$14.50
Inland	$9.7	$0.0	$9.6	21,228,706	$0.45	3,320,000	$2.90
National Total	**$22.5**	**$0.1**	**$22.4**	**31,032,495**	**$0.72**	**4,720,000**	**$4.75**

Table E3A-12: Estimated Value of Non-Use Benefits Required for Total Benefits to Equal Total Social Costs for Existing Phase III Facilities - Break-Even Analysis by Regions (2004$, discounted at 7%)

Option	Total Social Costs (millions)	Mean Value of Use Benefits (millions)	Non-Use Benefits Necessary to Break Even[a] (millions)	Number of Households	Break-Even WTP per Household ($)	Reduction of I&E Losses (Age-1 Equivalents)	Break-Even Value per Age-1 Equivalent[b] ($)
"Manufacturers 2-50 MGD I&E like Phase II" Option							
California	$1.3	$0.0	$1.3	804,176	$1.56	481,000	$2.60
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$1.1	$0.0	$1.1	5,275,611	$0.20	2,310,000	$0.46
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$5.6	$0.0	$5.6	34,907	$160.15	855,000	$6.54
Great Lakes	$11.7	$0.0	$11.7	3,689,094	$3.18	732,000	$16.02
Inland	$15.9	$0.0	$15.9	23,255,379	$0.68	3,660,000	$4.34
National Total	**$37.1**	**$0.1**	**$36.9**	**33,059,167**	**$1.12**	**8,040,000**	**$4.60**
"Manufacturers 2-50 MGD I&E Everywhere" Option							
California	$1.3	$0.0	$1.3	804,176	$1.57	534,000	$2.36
North Atlantic	$0.0	$0.0	$0.0	0	n/a	0	n/a
Mid-Atlantic	$1.1	$0.0	$1.1	5,275,611	$0.20	2,310,000	$0.46
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$5.6	$0.0	$5.6	34,907	$160.15	855,000	$6.54
Great Lakes	$11.7	$0.0	$11.7	3,689,094	$3.18	764,000	$15.35
Inland	$38.7	$0.1	$38.7	23,482,894	$1.65	4,880,000	$7.92
National Total	**$60.3**	**$0.2**	**$60.2**	**33,286,682**	**$1.81**	**9,340,000**	**$6.44**
"Manufacturers 50+ MGD I-only Everywhere" Option							
California	$0.2	$0.0	$0.2	1,221,712	$0.14	10,200	$16.90
North Atlantic	$0.4	$0.0	$0.4	0	n/a	0	n/a
Mid-Atlantic	$0.7	$0.0	$0.7	5,171,002	$0.13	1,000,000	$0.70
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$0.9	$0.6	$0.4	1,315,491	$0.27	10,400,000	$0.03
Great Lakes	$4.7	$0.2	$4.5	5,434,405	$0.83	11,700,000	$0.38
Inland	$18.7	$0.2	$18.5	11,669,888	$1.59	16,200,000	$1.14
National Total	**$26.0**	**$1.0**	**$25.0**	**24,812,498**	**$1.01**	**39,400,000**	**$0.63**
"Manufacturers 50+ MGD I&E Everywhere" Option							
California	$0.4	$0.0	$0.4	1,221,712	$0.32	474,000	$0.83
North Atlantic	$2.0	$0.0	$2.0	3,171,400	$0.62	910,000	$2.15
Mid-Atlantic	$1.2	$0.1	$1.1	5,899,941	$0.18	44,500,000	$0.02
South Atlantic[c]	$0.0	$0.0	$0.0	0	$0.00	0	$0.00
Gulf of Mexico	$4.4	$1.1	$3.3	1,570,063	$2.11	19,400,000	$0.17
Great Lakes	$9.8	$0.4	$9.5	7,300,769	$1.30	13,400,000	$0.71
Inland	$27.6	$0.3	$27.3	16,438,931	$1.66	24,600,000	$1.11
National Total	**$46.2**	**$1.9**	**$44.3**	**35,602,817**	**$1.24**	**103,000,000**	**$0.43**

[a] The non-use benefits category in this table may include some categories of use values that were not taken into account by the recreation and commercial fishing analyses.

[b] The non-use value per age-1 equivalent reported in the table includes the value placed on the fish's contribution to non-use ecological services (e.g., population, health, sustainability, and overall ecosystem health).

[c] No benefits or costs are expected in the South Atlantic region because all potentially regulated facilities in this region already meet the national categorical requirements in the baseline and therefore would not be required to install technologies to comply with this option.

[d] Positive non-zero value less than $50,000.

Source: U.S. EPA Analysis, 2006.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 2006. *Regional Analysis for the Final Section 316(b) Phase III Existing Facilities Rule*. EPA-821-R-06-002. June 2006.