SECTION 4

DESCRIPTION OF THE CWT EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS AND COMPLIANCE COST ANALYSIS

EPA is proposing effluent limitations guidelines and standards to limit the discharge of pollutants into navigable waters of the United States by new and existing facilities that receive industrial waste from off-site for treatment or recovery. The Agency is proposing controls both for facilities that discharge pollutants directly into surface water and for facilities that discharge pollutants indirectly by sending them via the sewer system to a POTW. This section describes the control options examined by the Agency for each subcategory of the CWT industry and the combined regulatory option the Agency is proposing.

4.1 CONTROLS FOR EACH SUBCATEGORY OF THE CWT INDUSTRY

For the CWT industry, the Agency is proposing effluent limitations guidelines and standards for direct dischargers based on Best Practicable Control Technology Currently Available (BPT), Best Conventional Pollutant Control Technology (BCT), Best Available Technology Economically Achievable (BAT), and New Source Performance Standards (NSPS) based on the best available control technology that can be demonstrated. For indirect discharging CWT facilities, EPA is proposing Pretreatment Standards for Existing Sources

(PSES), and Pretreatment Standards for New Sources (PSNS). These technologies are described below.[1]

The Agency has identified three subcategories within the CWT industry, which are defined in terms of the type of waste received for treatment or recovery. After a thorough examination of the industry, EPA determined that the type of waste accepted for treatment or recovery was the only factor of primary significance for subcategorization and that it encompassed many of the other subcategorization factors (e.g., type of treatment processes used, nature of wastewater generated). EPA's proposed subcategories are as follows:

- metals subcategory: facilities that treat, recover, or treat and recover metal from metal-bearing waste, wastewater, or used material received from off-site
- oils subcategory: facilities that treat, recover, or treat and recover oil from oily waste, wastewater, or used material received from off-site
- organics subcategory: facilities that treat, recover, or treat and recover organics, from other organic waste, wastewater, or used material received from off-site

In the course of selecting the control technologies to establish as BPT, the Agency evaluated a number of control options for each subcategory of the CWT industry. The following section describes the control options examined for each subcategory. Note that in numbering the control options, higher numbers do not necessarily imply greater stringency.

4.1.1 Metals Subcategory

The Agency examined the following three control options to reduce the discharge of pollutants from the metals subcategory of the CWT industry (facilities that treat, recover, or

[1]These descriptions are based on the descriptions of the technology basis for the CWT effluent limitations guidelines and standards as contained in the preamble to the proposed rule.

treat and recover metal from metal-bearing waste, wastewater, or used material received from off-site):[2]

- *Option 2*: selective metals precipitation, liquid-solid separation, secondary precipitation, and liquid-solid separation
- *Option 3*: selective metals precipitation, liquid-solid separation, secondary precipitation, liquid-solid separation, tertiary precipitation, and clarification
- *Option 4*: batch precipitation, liquid-solid separation, secondary precipitation, and sand filtration

The Agency is proposing Option 4 as BPT.

For metal-bearing waste that includes concentrated cyanide streams, cyanide destruction is assumed to take place prior to metals treatment. For this subset of the metals subcategory, the Agency evaluated three alternative control technologies:

- *Cyanide Option 1*: alkaline chlorination
- *Cyanide Option 2*: alkaline chlorination at specific operating conditions
- *Cyanide Option 3*: confidential cyanide destruction

EPA is proposing Cyanide Option 2, alkaline chlorination at specific operating conditions, for this subset.

[2]Note that the numbering does not indicate the stringency of the limitations. To maintain a logical cross-reference with the previous public and confidential rulemaking records, EPA did not sequentially renumber the options currently under consideration.

4.1.2 Oils Subcategory

The Agency examined the following four control options to reduce the discharge of pollutants from the oils subcategory of the CWT industry:

- *Option 8*: dissolved air flotation (DAF)
- *Option 8v*: air stripping with emissions control and DAF
- *Option 9*: secondary gravity separation and DAF
- *Option 9v*: air stripping with emissions control, secondary gravity separation, and DAF

EPA is proposing BPT, BCT, PSNS, NSPS, and BAT controls based on Option 9 for direct discharging facilities in the oils subcategory and PSES controls based on Option 8 for indirect discharging facilities in the oils subcategory. EPA is proposing Option 8 for indirect dischargers because it is less costly than Option 9 and would result in fewer adverse economic impacts.

4.1.3 Organics Subcategory

The Agency examined the following two control options to reduce the discharge of pollutants from the organics subcategory of the CWT industry:

- *Option 3*: equalization, air stripping with air emissions control, and biological treatment
- *Option 4*: equalization and biological treatment

EPA is proposing controls based on Option 4 for the organics subcategory.

4.2 COSTS OF CONTROLS

Based on the information received by EPA from the technical questionnaire, a detailed monitoring questionnaire, and site visits, the Agency has estimated the costs of complying with each control options. The costs of complying with a control option are assumed to affect the cost of treating waste in a single subcategory. (For example, the costs of complying with Metals Option 4 are assumed to affect metals recovery and metals treatment operations only.)

In estimating the costs of implementing the proposed control options, the Agency made the conservative assumption that each facility would incur the full costs of installing all the technology upon which the proposed limits are based, unless that facility already had these controls in place. This assumption may lead to an overstatement of costs, because facilities have other potential ways of achieving compliance, and some of these may be less costly for particular facilities. Because the Agency cannot anticipate which facilities will choose to use different approaches (such as pollution prevention or off-site transfer), facilities that currently do not have adequate treatment in place are assumed to incur the costs of purchasing, installing, and operating those controls.

Costs of compliance fall into five broad categories:

- costs of capital equipment required, including installation costs;
- annual O&M costs, including costs of additional labor, energy, and materials;
- costs of additional land required, if any;
- costs of modifying the facility's RCRA permit, if any; and
- costs of monitoring controls and recordkeeping.

The O&M and monitoring compliance costs associated with a control option are ongoing costs that will vary with the level of throughput at the facility and will therefore increase the facility's variable costs of operating each process. The capital, land, and RCRA-modification costs are one-time, lump-sum expenditures. These costs are annualized over the expected life of the capital equipment (to represent the annual cost of financing the lump sum cost). The total annual after-tax treatment costs for a given control option are computed by summing the annual O&M and monitoring compliance costs and the annualized capital, land, and RCRA-modification costs, after accounting for the tax savings associated with the costs. Section 4.2.1 describes the computation of the after-tax annualized costs.

4.2.1 Computing the Annualized Cost of Compliance

EPA employs a cost annualization model to compute the annualized cost of the capital and other lump-sum costs of the regulation. The cost annualization model incorporates several financial assumptions, including the type of depreciation schedule the facility will use, the timing of the initial investment and the start of operation for the newly installed controls, and tax savings afforded the firm under federal and state tax laws. These assumptions are examined in greater detail below.

4.2.1.1 Purpose of Cost Annualization

The capital costs associated with the regulation are one-time expenses. However, the lump-sum expenditures are too large for most CWT facilities to finance out of current revenues. They will probably be paid for by equity or debt financing. The Agency employs a cost annualization model that estimates the annual cost associated with incurring these lump-sum expenses.

4.2.1.2 Depreciation and Taxes

Depreciation is the allocation of an asset's cost over a period of time longer than one year. The cost annualization model uses a modified accelerated cost recovery system (MACRS) of depreciation. This system of depreciation assumes a 150 percent double-declining balance method through 8 years, with straight line thereafter, and a 1-year period between construction and start-up. MACRS offers companies an advantage by allowing them the ability to write off greater portions of an investment in early years, when the time value of money is greater.

A business cannot begin to depreciate a capital investment before it goes into operation. Approximately 1 year would be required to build and install most of the equipment considered in the regulatory package. Thus, the cost annualization model assumes a 1-year delay from the initial capital expenditure to operation. In addition, the indirect discharging facilities have 3 years to begin complying with the regulation. The depreciable life of the equipment is 20 years.

In the cost annualization model, the MACRS is used to calculate the portion of the capital costs that can be written off or depreciated each year. Tax laws permit companies to deduct capital depreciation as an expense and also to deduct annual costs from revenues prior to computing the tax they owe. To compute a company's after-tax annualized costs, the model calculates the present value of these expenses, discounted based on each company's individual real weighted average cost of capital (WACC).

Estimating the Firm's WACC. The Agency requested firms' WACC in the 1991 Waste Treatment Industry Questionnaire. For firms providing this information, the questionnaire value was used. For most of the firms owning NOA facilities, little or no

company financial information is available. For these firms, the Agency assumes a WACC of 7 percent.

For firms with adequate data that did not provide this information on the questionnaire, EPA estimated the weighted average cost of equity and (after-tax) debt based on the following formula:

$$WACC = W_d(1 - t) \bullet K_d + We \bullet K_e$$

where

WACC	=	weighted average cost of capital,
W_d	=	weighting factor on debt,
t	=	marginal effective state and federal corporate tax rate,
K_d	=	cost of debt or interest rate
W_e	=	weighting factor on equity, and
K_e	=	cost (required rate of return) on equity.

This formula implicitly assumes that investments in pollution control equipment are similar in risk to other projects and that the method of financing for control equipment is similar to other investments by the company.

To estimate the WACC, values for K_d and K_e were estimated. Marginal costs of capital, not historical average costs are appropriate hurdle rates for new investments (Bowlin et al., 1990); however, data are available only for historical costs. EPA estimates the cost of debt for companies owning CWT facilities based on the average bond yields reported by Standard and Poors (S&P) (1993). Assuming that companies owning CWT facilities are in average financial condition at baseline, the Agency used yields for corporate bonds rated BBB and adjusted the cost of debt downward to reflect tax savings because debt interest is deductible.

To estimate the cost of equity capital, the Agency used the Capital Asset Pricing Model, which can be expressed:

$$K_e = R_f + \beta(R_m - R_f)$$

where

Ke	=	cost of equity capital,
Rf	=	risk free rate of return,
β	=	beta, a measure of the relative risk of the equity asset, and
$(R_m - R_f)$	=	the market risk premium.

For the risk-free rate of return, EPA used the average rate of return on long-term treasury bonds, 7.52 percent (U.S. Department of Commerce, 1991). EPA assumed the risk premium is 6 percent, its average historical value (Ibbotson and Associates, 1993) and used the average beta value for companies with bonds rated BBB to B, 1.41 percent. Weighting factors were estimated based on actual capital structure for the firms, reflecting an assumption that the firms' actual capital structure approximates their optimal capital structure.

Estimating the After-Tax Annualized Costs of Controls. EPA used the reported or estimated WACC to compute the present value of the tax shield that results from these expenses, including the deductions allowed on depreciation and the noncapital costs, as described above. EPA then subtracted the present value of the tax shield from the present value of the 20-year stream of lump-sum and annual compliance costs. Finally, the resulting present value was annualized over 20 years, also at the individual company's reported or estimated WACC.

This annualized after-tax cost is the facility's estimated additional treatment cost per year required to comply with the control option, which is in turn used to compute the increase in its per-gallon cost of treatment, which in turn shifts the market supply of CWT services

upward. Because indirect discharging facilities are given extra time to comply with the regulation, their present value cost of compliance is effectively lower. (Because of the time value of money, future expenditures are worth less than present expenditures.)

4.2.2 Costs for Facilities with Both Commercial and Noncommercial Operations

Some CWT facilities treat waste that was generated by a production process at another facility owned by the same company. Because they do not receive payment from outside the company, they are referred to as noncommercial facilities. Noncommercial CWT operations are regarded by owner-companies as cost centers, providing a service to the entire company (similar to a centralized accounting or personnel department). In some cases, facilities that treat waste from within the company also provide this service to outside customers on a commercial basis. Only the commercial share of the facility's CWT flows are part of the market for CWT services. For facilities that perform both commercial and noncommercial CWT, compliance costs were modified to assign a share of the costs proportional to the share of the operation that is commercial. For example, if 90 percent of the waste treated at a given facility were noncommercial and 10 percent were commercial, only 10 percent of their compliance costs would be included in the market model, because only 10 percent of their CWT waste is accepted through a marketed transaction. The other 90 percent are assumed to be absorbed by the noncommercial operations as a cost of doing business, which is borne by the company as a whole. On the 1991 Waste Treatment Industry Questionnaire, EPA requested the quantities of waste accepted from off-site generators under the same ownership and the quantities from of-site facilities not under the same ownership. These data were used to compute the commercial share of CWT operations. Eighteen facilities indicated that their CWT operations were at least in part noncommercial. All of the oil recovery facilities identified through the NOA were assumed to be entirely commercial.

4.2.3 Compliance Costs Associated with RCRA Permit Modification

In addition to the costs of purchasing, installing, operating, maintaining, and monitoring pollution control equipment, some facilities will incur additional costs associated with modifying their RCRA permit. These facilities, which are permitted under RCRA to store, treat, recycle, or dispose of hazardous waste, must modify their RCRA permit to reflect the new pollution control equipment and operations at the facility that result from the CWT regulation. These costs, which are one-time costs, were estimated based on questionnaire responses and were annualized as described above. EPA estimates that 76 CWT facilities will incur the costs of modifying their RCRA permits as part of complying with the proposed regulation.

4.2.4 Compliance Costs for the Control Options

Tables 4-1 through 4-4 show the total compliance costs for each control option for each subcategory. These include, as described above, the costs of purchasing, installing, operating, maintaining, and monitoring new control equipment, as well as costs for modifying RCRA permits (for facilities permitted under RCRA).

Table 4-1 shows the costs that would be incurred by CWT facilities in the metals subcategory to comply with the control options EPA considered for that subcategory. The first column of the costs shows the lump-sum capital and land costs under each control option. These costs are sufficiently large that CWT facilities would generally not be able to meet them without borrowing or selling stock. It is clear from comparing the three options that Option 4 requires substantially less investment in capital and land than Options 2 and 3.

TABLE 4-1. COMPLIANCE COSTS FOR THE METALS SUBCATEGORY (10^6 $1997)

Costs	Total Capital and Land Costs	Total Annualized Costs Before Tax Savings	Total After-Tax Annualized Costs
BPT/BAT Costs			
Option 2	13.0	13.7	8.28
Option 3	14.3	14.2	8.60
Option 4	3.2	2.8	1.72
PSES Costs			
Option 2	24.3	27.5	14.7
Option 3	28.0	29.0	15.5
Option 4	8.0	7.9	4.23
Total Costs			
Option 2	37.3	41.2	23.0
Option 3	42.3	43.2	24.1
Option 4	11.2	10.8	6.0

Thus, companies owning CWT facilities would incur lower capital availability requirements under Option 4. The second column of costs shows the total annualized costs of the regulation, not accounting for tax savings of the facilities. This column includes annualized capital and land costs, plus annual O&M and monitoring costs; it approximates the cost of the regulation to society. Again, for both direct and indirect dischargers, the costs of Option 4 are much lower than the costs of Options 2 and 3. The third column of costs shows the total annualized costs after accounting for tax savings for deductions and depreciation. Once again, the costs of Option 4 are by far the lowest of the three control options. CWT facilities that discharge metal pollutants directly to surface water would face increased annual after-tax costs of $1.7 million under Option 4, while their costs would exceed $8 million

TABLE 4-2. COMPLIANCE COSTS FOR THE OILS SUBCATEGORY (10^6 $1997)[a]

Costs	Total Capital and Land Costs	Total Annualized Costs Before Tax Savings	Total After-Tax Annualized Costs
BPT/BAT Costs			
Option 8	0.94	0.48	0.31
Option 9	0.94	0.48	0.31
PSES Costs			
Option 8	18.5	13.2	7.35
Option 9	43.8	18.9	10.7
Total Costs			
Option 8	19.5	13.7	7.7
Option 9	44.8	19.4	11.0

[a] Costs are scaled up to reflect the estimated universe of oils facilities.

TABLE 4-3. COMPLIANCE COSTS FOR THE ORGANICS SUBCATEGORY (10^6 $1997)[a]

Costs	Total Capital and Land Costs	Total Annualized Costs Before Tax Savings	Total After-Tax Annualized Costs
BPT/BAT Costs			
Option 3	0.60	0.41	0.26
Option 4	0.08	0.22	0.14
PSES Costs			
Option 3	13.7	3.70	2.12
Option 4	11.2	2.88	1.66
Total Costs			
Option 3	14.3	4.11	2.38
Option 4	11.3	3.10	1.80

[a] Costs are scaled up to reflect the estimated universe of oils facilities.

TABLE 4-4. RCRA PERMIT MODIFICATION COSTS (10^6 $1997)[a]

Costs	Total Lump-Sum Costs	Total Annualized Costs Before Tax Savings	Total After-Tax Annualized Costs
BPT/BAT Costs	0.34	0.04	0.03
PSES Costs	2.56	0.26	0.17
Total Costs	2.90	0.30	0.20

[a] Costs are scaled up to reflect the estimated universe of CWT facilities.

under both Options 2 and 3. Indirect dischargers would incur costs of approximately $4.2 million under Option 4, while their costs would exceed $14 million under Option 2 and $15 million under Option 3.

Table 4-2 shows the costs that would be incurred by CWT facilities discharging wastes from oils treatment or recovery to comply with the control options considered by EPA. Once again, the first column shows the lump-sum capital and land costs associated with the control options, the second column shows the annualized costs of the control options, before accounting for tax savings afforded the CWTs, and the third column shows the after-tax annualized costs of complying with the control options. For direct dischargers, the costs of Options 8 and 9 are estimated to be the same. For indirect dischargers, both the lump-sum capital and land costs and the annualized costs of Option 8 are less than Option 9. The Agency is proposing Option 9 for direct discharging oils facilities, because those controls are believed to be more effective in removing pollutants from facilities' wastewater discharges. For indirect discharging oils facilities, the Agency is proposing Option 8, because its costs are lower and it is estimated to be more economically achievable.

Costs estimated to be incurred by CWT facilities in the organics subcategory to comply with the control options under consideration are shown in Table 4-3. Again, the first

column shows the lump-sum capital and land costs, the second column the total annualized costs before tax savings are accounted for, and the third column the costs of compliance after accounting for tax savings. Option 4 costs are less than Option 3 costs for both direct and indirect dischargers, whether one considers lump-sum capital and land costs or annualized costs.

As described above, approximately 37 percent of CWT facilities are permitted under RCRA to store, treat, recycle, or dispose of hazardous waste. Because they would be required to install capital equipment at their facility to comply with the control options, and because they might change the operation of RCRA permitted units as a result of the control options, such facilities would be required to modify their RCRA permits to comply with the CWT control options. In the 1991 Waste Treatment Industry Questionnaire, EPA requested information on permit modifications obtained by questionnaire facilities. Based on the responses, EPA has estimated the costs that would be incurred by RCRA-permitted facilities to obtain the needed RCRA permit modifications. The permit modifications are one-time costs, but they are substantial enough that EPA has assumed they would be financed, rather than paid for out of current revenues. The first column of Table 4-4 reflects the lump-sum permit modification costs. The second column shows the annualized value of the costs, before accounting for tax savings. The third column shows the annualized RCRA permit modification costs, after accounting for tax savings.

Commercial CWT facilities incurring these costs will respond by changing their production behavior. This will change market quantities and, in interaction with market demand, market prices. The changed market quantities and prices for CWT services will in turn change the revenues and production behavior of all market CWT facilities, including those that do not incur compliance costs (because they are zero dischargers or because their treatment already complies with the standards set in the regulation). Such facilities will experience higher revenues with no change in their costs, so their profits will increase. The

following sections describe the methodologies used to assess the impacts of these costs on commercial CWT facilities and on companies owning CWT facilities, including both commercial or noncommercial CWT facilities.

4.2.5 Compliance Costs of Combined Regulatory Option

Many of the facilities in the CWT industry have operations in more than one subcategory. Therefore, the overall impact of the regulation on such facilities can only be properly assessed by summing the costs they incur in each of the subcategories. Similarly, the Agency evaluates the total cost of the proposed rule on the industry by combining the costs of the proposed control option for each subcategory to create a combined regulatory option. Table 4-5 shows the total compliance costs of the combined regulatory option proposed by the Agency. As described above, the combined regulatory option comprises Metals 4, Oils 9, and Organics 4 for direct discharging CWT facilities and Metals 4, Oils 8, and Organics 4 for indirect discharging CWT facilities. RCRA permit modification costs are included as appropriate.

TABLE 4-5. COSTS OF COMPLYING WITH THE COMBINED REGULATORY OPTION (10^3 $1997)[a]

Costs	Total Lump-Sum Costs	Total Annualized Costs Before Tax Savings	Total After-Tax Annualized Costs[b]
BPT/BAT Costs	4.56	3.56	2.20
PSES Costs	40.5	24.3	13.4
Total Costs	45.1	27.9	15.6

[a] Costs are scaled up to reflect the estimated universe of CWT facilities.
[b] Costs include the cost of modifying RCRA permits where appropriate.

For the CWT industry as a whole, EPA estimates that the total lump-sum costs, which include one-time capital, land, and RCRA permit modification costs, would be approximately $45 million. Annualized costs to the industry, after accounting for tax savings afforded CWT facilities due to depreciation and cost deductibility, are estimated to be approximately $15.6 million. While both the lump-sum costs and the annualized costs are relatively low in absolute terms, for some CWT facilities, the costs could be substantial relative to baseline revenues for their CWT operations. The Agency has therefore conducted a thorough examination of the potential economic impacts and benefits of the regulation. The following sections describe the methodology used for these analyses and the results of the analyses.

4.3 REFERENCES

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SECTION 5
ECONOMIC IMPACT ANALYSIS METHODOLOGY

EPA analyzed the economic impacts of the effluent limitations guidelines and standards by comparing the baseline conditions of CWT facilities, companies, and markets with conditions projected to exist with the regulation in place. This section describes the analytical methods used to project the with-regulation conditions and estimate these measures of economic impact and defines the measures of economic impact.

The effluent limitations guidelines and standards will directly increase the costs and reduce the pollutant discharges of CWT facilities that discharge directly or indirectly to surface water. Faced with increased costs resulting from the regulation, companies owning CWT facilities have two basic choices:

- Comply with the regulation and incur the costs: The CWT facility would adjust its operations to maximize profits under the new market conditions that result as all CWT facilities adjust to the regulation.
- Cease CWT operations: The facility might close completely or cease its CWT operations so that the facility is no longer subject to the guidelines or standards.

Economic reasoning argues that owner companies will choose between these responses based on an assessment of the benefits and costs of the facility to the company under each choice. For commercial CWT facilities, the benefits to the company of its CWT operations are the revenues from the CWT operations. Costs to the company include the payments made to the factors of production (e.g., labor and materials) plus the opportunity costs of self-owned resources (e.g., the land and capital equipment). With the regulation in place, these costs will

include the costs of complying with the effluent limitations guidelines and standards. The company will compare the with-regulation revenues of its CWT operations with the with-regulation costs of its CWT operations and will continue to offer a particular CWT service as long as its revenues from that operation exceed its costs for that operation.

The Agency also estimated impacts on the markets for CWT services. Because generators have the option of developing on-site treatment or using pollution prevention techniques to reduce the quantity of waste they generate and send off-site, some of them may reduce the amount of waste they send to CWTs when the price of CWT services increases. In economic terms, this means that the demand for CWT services is not perfectly inelastic (unresponsive to price). Thus, CWT operators will be unable to pass all the costs of complying with the regulation along to their customers. The increased costs of CWT operations resulting from the effluent limitations guidelines and standards are expected to result in higher prices for commercial CWT services and lower quantities of waste treated at commercial CWTs.

The owner of a noncommercial CWT accrues benefits other than revenues from the operation of its facility. Noncommercial CWT operations are typically treated as a "cost center" by the company, similar to centralized personnel or accounting services. Clearly, however, companies have chosen to develop the capacity to manage their wastes in a centralized manner because they perceive the benefits of captive treatment to exceed the costs. These benefits may include lower expected future liability costs, more control over the costs and scheduling of treatment, and certainty that treatment capacity exists for their wastes. Owners of noncommercial CWT facilities are assumed to absorb the increased costs of CWT operations and to continue treating the same quantity of off-site waste as they were without the effluent limitations in place. Similarly, the small number of contract CWT facilities, which accept waste from a limited number of customers, are assumed to continue treating the same quantity of waste as before and to pass along the entire costs of complying with the regulation to their customers.

As described in Section 3, four CWT facilities were identified as being either strictly noncommercial (receiving waste only from other off-site facilities owned by the same company) or contract noncommercial (accepting waste on a contract basis from a limited set of facilities owned by other companies). These facilities treat off-site waste at cost as a service to the generating facilities and do not change the quantity of waste they treat in response to market forces. The impact of the proposed effluent limitations guidelines and standards on these facilities was measured by examining changes in company profits resulting from the effluent limitations guidelines and standards, assuming that the company absorbs all the costs of compliance (so that the company's costs increase while their revenues are unchanged).

In addition to the strictly commercial and noncommercial facilities, there are a few facilities that accept waste on both a commercial and a noncommercial basis. These facilities are believed to be basically noncommercial facilities that have some unused treatment capacity on-site. Rather than let the capacity sit idle, these facilities choose to accept some waste from unrelated generators. The Agency's analysis of these facilities combined the approaches used for the commercial and noncommercial facilities. EPA included their commercial quantity treated in the market analysis and allocated the cost of complying with the regulation proportionally to the commercial and noncommercial quantities treated. The company is assumed to require a somewhat higher price of treatment to continue accepting the commercial share of the waste, but it is assumed to absorb the cost of compliance fully for their noncommercial share of waste treated.

5.1 OVERVIEW OF ANALYTIC METHODOLOGY

Depending on the commercial status of the facilities, the Agency employed different methods to estimate the economic impacts of the proposed effluent limitations guidelines and standards on the CWT industry. The impacts on commercial CWTs were estimated using a mathematical model that integrated facility and market responses for each geographical

region. Impacts on noncommercial and contract CWTs were estimated by looking at changes in the profitability of the company owning the CWT. Impacts on companies owning CWTs were estimated using the measures described in Section 3.1.6. The rest of this section describes the approach used to estimate impacts on commercial CWT facilities and CWT markets.

The Agency employed an integrated facility-market economic impact model to project the impact of the effluent limitations guidelines and standards on commercial CWTs. As described in Section 3, the markets for CWT services are regional. This market characterization is based on responses to the 1991 Waste Treatment Industry Questionnaire and is consistent with the theory of economic geography, which predicts that markets for goods that are heavy or difficult to transport will tend to be local (Hoover, 1975). Separate economic impact analysis models were developed for each of six CWT market regions, which were assumed to be independent of one another.

These models combine baseline characterizations of the CWT facilities (e.g., quantities treated in each CWT operation, costs and revenues of each CWT operation, employment) with characterizations of the market structure for each CWT market and estimated costs of compliance. Using a mathematical simulation of facilities' decisionmaking and market interactions, EPA estimated the changes in quantities treated in each CWT operation in response to the facilities' compliance costs. Aggregating across facilities in each market, the model estimates changes in market supply, changes in market price and quantity, and changes in consumer and producer surplus. An iterative solution algorithm seeks a set of prices and quantities at which all markets and all facilities are in equilibrium.

The model projects equilibrium changes in market prices and quantities and facility quantities accepted at individual CWT treatment or recovery operations. Changes in the quantity of CWT services offered would result in changes in the quantity of inputs used to

produce these services (most importantly, labor). Thus, the Agency projects changes in employment at CWT facilities. These changes in employment result in impacts in the communities where CWT facilities are located, as the local labor markets adjust to changes in CWT demand for labor. Changes in CWT revenues and costs result in changes in revenues and costs of the companies owning the CWT facilities and, thus, changes in their profits. Estimation of company impacts is discussed in Section 6. Section 5.2 describes in greater detail the methods used to estimate market and facility impacts of the effluent limitations guidelines and standards.

5.2 MODELING MARKET AND FACILITY IMPACTS

As described above, impacts of the effluent limitations guidelines and standards on affected markets and facilities were estimated using an integrated mathematical simulation model that estimates the responses of markets and facilities to the costs of complying with the regulation. The model integrates market and facility responses so that the estimated changes in facility quantity, market quantity, and market price are consistent. The models used are "comparative static" models. Comparative static models start with the baseline state of the facilities and markets, and by simulating the responses of facilities to their increased costs and the interactions of the facilities in the markets, they project the with-regulation state of the facilities and markets. No attempt was made to simulate the adjustment path from the baseline to the with-regulation state realistically. Similarly, no attempt was made to project other changes that might affect CWT markets and facilities between now and when the regulation is promulgated. Thus, the analysis strictly focuses on changes in CWT facilities, markets, and companies as a result of the regulation. Strictly speaking, it is a "with and without" regulation analysis, not a "before and after regulation" analysis. The mathematical workings of the model are described in greater detail in Appendix D.

5.2.1 Defining the Markets for CWT Services

Each regional economic impact estimation model includes markets for up to ten specific types of CWT service. In general, five broad types of CWT service are offered: metals recovery, metals treatment, oils recovery, oils treatment, and organics treatment. Within several broad categories, the cost per gallon of waste treated varies widely. This is believed to reflect differences in the characteristics of the waste being treated, which requires somewhat different treatments methods. Thus, within those broad types of treatment or recovery, the CWT services offered are further broken down to reflect differences in cost of treatment. The twelve possible types of CWT services within each regional market, delineated based on type of waste and cost of treatment, are

- metals recovery—low-cost,
- metals recovery—medium-cost,
- metals recovery—high-cost,
- metals treatment—low-cost,
- metals treatment—medium-cost,
- metals treatment—high-cost,
- oils recovery—low-cost,
- oils recovery—medium-cost,
- oils recovery—high-cost,
- oils treatment,
- organics treatment—low-cost, and
- organics treatment—high-cost.

The actual number of markets for specific types of CWT services within each CWT region ranges from seven to ten. Market structures are defined as either monopolistic (one CWT facility offering the service in the region), duopolistic (two CWTs offering the service within the region), or perfectly competitive (three or more CWTs offering the service within the region). EPA developed market models that simulated facility and market behavior in response to the effluent limitations guidelines and standards.

These models, illustrated in Figure 5-1, estimate a facility's quantity of waste accepted for treatment given the market price and the facility's costs of treatment. Aggregating across all the facilities in a market yields the market quantity of CWT services supplied at the market price. The interaction of market supply and demand may result in price changes, which may, in turn, prompt further facility quantity adjustments. For example, if at a given price the quantity of waste CWTs are willing to treat is less than the quantity of waste generators want to send off-site for treatment, CWTs will find that they can charge higher prices for their services. As the price of the CWT service increases, some generators reduce the quantity they send off-site, and some CWTs are willing to increase the quantity of waste they accept. Equilibrium is achieved when all the markets and facilities are simultaneously satisfied with quantity and price. Sections 5.2.2 and 5.2.3 describe the Agency's model of baseline conditions at market CWT operations and the Agency's model of facility adjustments in their CWT operations in response to the costs of complying with the effluent limitations guidelines and standards.

5.2.2 Modeling Facility Baseline Conditions

In general, costs of production may be either fixed or variable, unavoidable or avoidable. Fixed costs include all costs that do not vary with the quantity produced. Variable costs include all costs that do vary with quantity treated. Fixed costs include many types of overhead costs and debt service costs. Variable costs include costs of most inputs

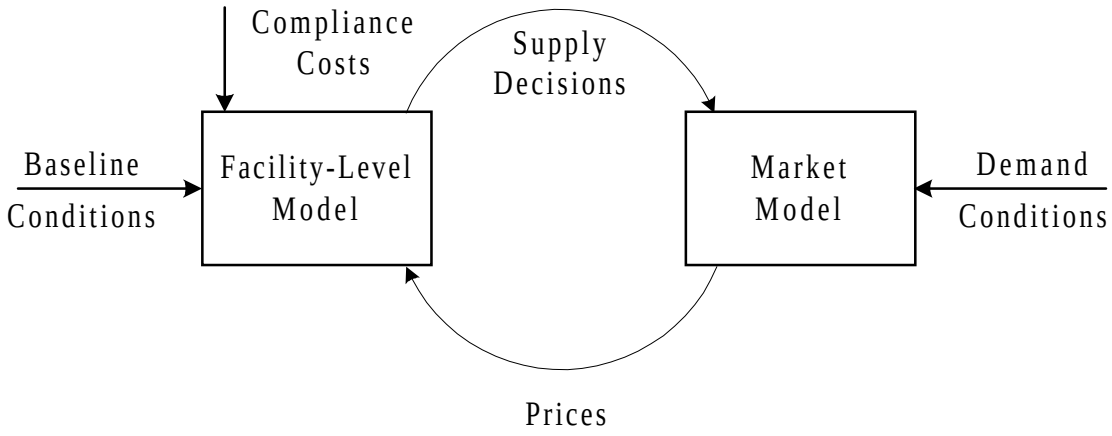


Figure 5-1. Integrated Facility-Market Economic Model

(e.g., labor, materials, energy), which vary as the quantity treated varies. The individual CWT processes at each facility were assumed to be characterized by constant average variable costs (AVC). Average variable cost is defined as the variable cost per unit of output—in this case, the per-gallon costs of treatment or recovery. That is, facility per-gallon costs of treatment or recovery in each operation were assumed to be constant up to the facility's capacity in each treatment or recovery operation. Graphically (see Figure 5-2a), the AVC curve is shaped like a backward "L." It is horizontal up to capacity, at which quantity it becomes vertical. Although EPA believes that there is substantial unused capacity in the CWT industry, this analysis assumes for computational simplicity that, in general, facilities are operating at or near capacity at baseline. Marginal costs are defined as the additional costs incurred for an additional unit of output (in this case, the additional costs of treating an additional gallon of incoming waste). Because the per-gallon variable costs are assumed to be constant, marginal cost equals average variable cost.

At baseline, facilities maximize their profits from a CWT operation by treating every gallon for which the additional revenue received (marginal revenue or MR) exceeds the marginal cost (MC), and no gallons for which the MC exceeds MR. This point is shown at

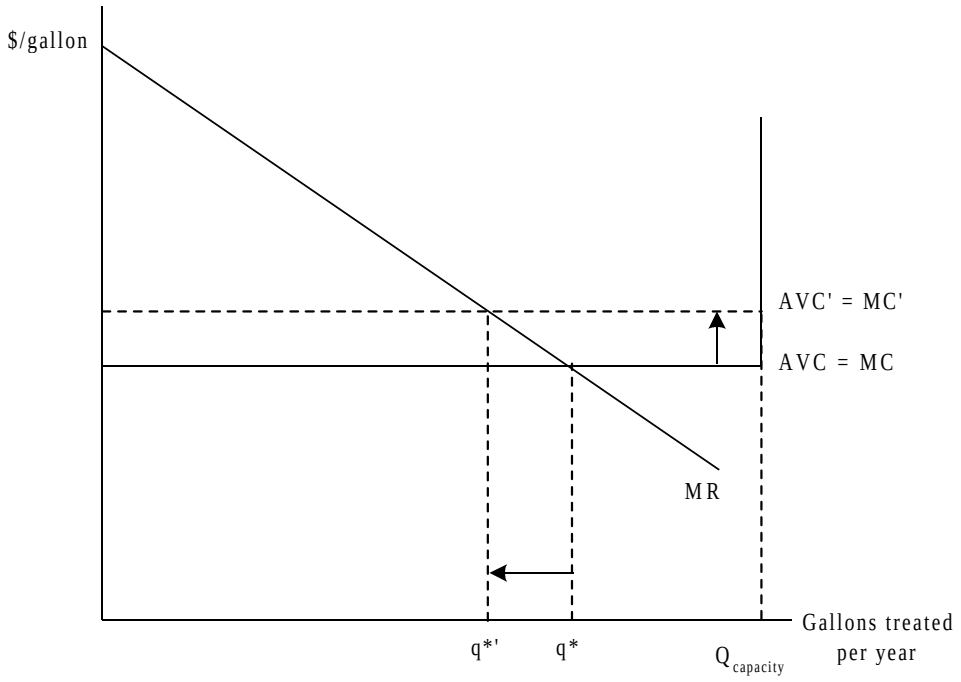
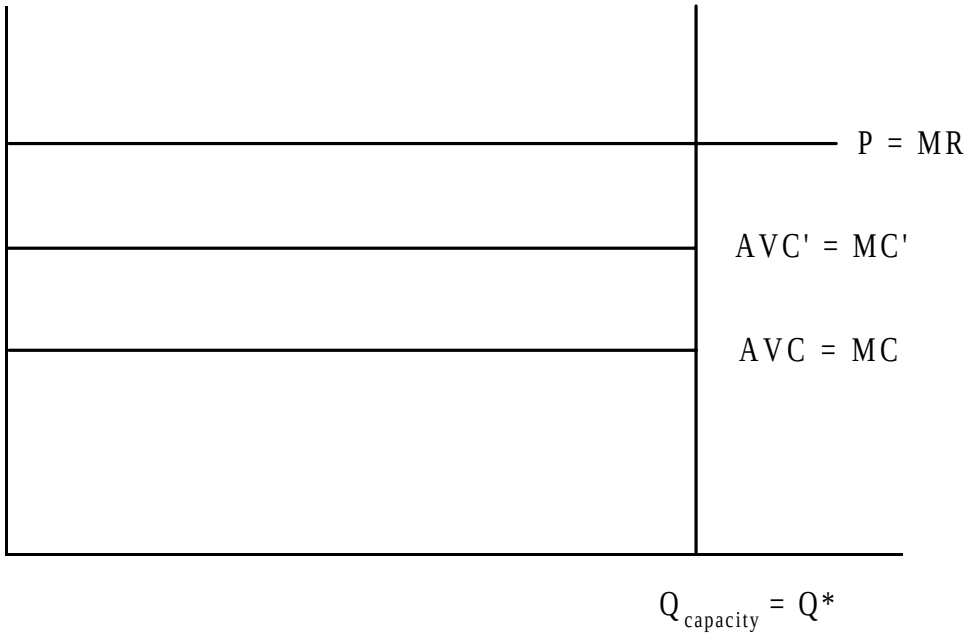


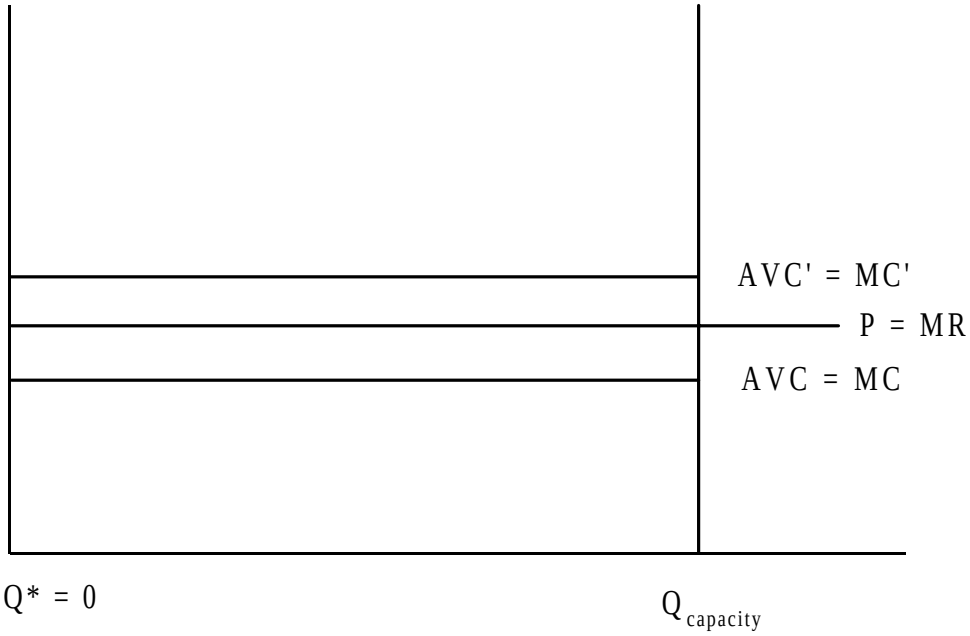
Figure 5-2a. Effects of Compliance on Imperfectly Competitive Markets

quantity q* in Figure 5-2a. Figure 5-2a shows CWT services in an imperfectly competitive market. These facilities face downward-sloping demand and MR curves. Treating an additional gallon of waste requires charging a lower per-gallon price, both for that gallon and for all the others treated.

In perfectly competitive markets (illustrated in Figure 5-2b), facilities can treat as much as they wish without affecting the price they receive. In this case, the market price is the facility's MR. Facilities offer their CWT service as long as the market price exceeds their costs. In perfectly competitive CWT service markets, facilities are assumed, in general, to operate at capacity. That is, they cannot increase the amount of waste that they treat in response to a price increase.



if P > MC', facility continues to operate at capacity



if P < MC', facility shuts down this CWT operation

Figure 5-2b. Effects of Compliance on Competitive Supplier

5.2.3 Adjustments in Response to the Variable Costs of Complying with the Effluent Limitations Guidelines and Standards

Complying with the effluent limitations guidelines and standards will increase the cost of performing CWT operations. After annualizing the capital costs and accounting for depreciation and other tax savings, EPA divided the after-tax total annualized cost of controls for each type of waste treatment (metals, oils, or organics) by the total quantity of wastewater treated to find the incremental per-gallon cost associated with compliance. This additional cost of treatment increases the CWT's MC as shown in Figure 5-2, shifting the MC curve from MC to MC'. The facilities must now compare this new higher cost of treating each additional gallon of waste with the additional revenues they will get for treating an additional gallon (MR for imperfectly competitive facilities, MR=P for competitive ones). CWTs will continue to treat waste for which MR > MC'. They will not treat any waste for which MC' > MR. In each CWT market, these adjustments will result in a decrease in supply, as shown in Figure 5-3.

The interaction of the reduced with-regulation supply, shown by supply curve S_2, with demand for CWT services that declines as price increases results in an increase in the market price (from P_1 to P_2) of CWT services and a decline in the quantity (from Q_1 to Q_2) of waste treated at CWTs, as illustrated in Figure 5-3. As the market prices adjust upward in response to reductions in the supply of CWT services, facilities continue to evaluate how much off-site waste to accept for treatment or recovery, which in turn affects market supply. Equilibrium is achieved when a set of prices and quantities satisfies both suppliers and demanders.

As noted above, Appendix D provides a detailed description of the mathematical workings of the model in estimating the facility-specific and market adjustments in response to the effluent limitations guidelines and standards.

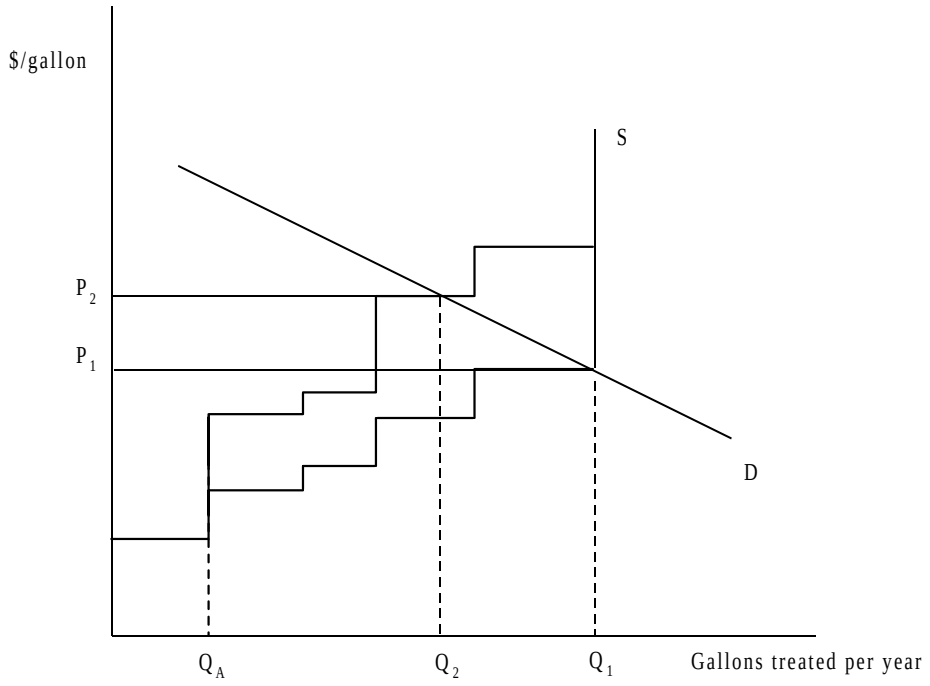


Figure 5-3. Market Adjustments in Response to the CWT Effluent Limitations Guidelines and Standards

5.3 MEASURES OF ECONOMIC IMPACTS

The integrated economic impact analysis model simultaneously estimates several different measures of economic impact. These are changes in market prices and quantities of CWT services, changes in facility-level quantities, costs, and revenues, closures of individual CWT operations, closures of CWT facilities, and changes in employment at CWT facilities.

5.3.1 Changes in Market Prices and Quantities

In each of the individual markets for a CWT service, the market model estimates the change in price and total quantity treated with the regulation in effect. The model

simultaneously estimates changes in facility quantity treated and changes in market quantity treated so that the estimates are consistent.

5.3.2 Facility Impacts

The economic impact model estimates impacts to each CWT operation at each facility as a result of the costs of complying with the effluent limitation guidelines and standards. For facilities in competitive CWT markets, the cost increase may result in the closure of a CWT operation, although the highest-cost operation that does not close with the regulation in effect may experience some reduction in quantity treated without closing its CWT operation. For facilities operating in monopoly or duopoly markets, the cost increase may result in a decrease in the quantity of waste treated at a given facility.

Facilities decide whether to close a CWT operation by comparing the revenues earned by the operation with the costs incurred. At the with-regulation equilibrium price, facilities will close a CWT operation if the per-gallon cost of treatment for the operation (including compliance costs) exceeds the per-gallon revenue received (defined as a process closure). If all the CWT operations close at a CWT facility, this is defined as a facility closure. Data from the 1991 Waste Treatment Industry Questionnaire indicated that many CWT facilities have other, nonregulated activities on-site, including other waste treatment operations and/or manufacturing operations. These operations are assumed to be unaffected by the regulation. Although the facility may remain open and may continue these other operations, it is considered closed for the purposes of the CWT economic impact analysis if all the affected CWT operations at the facility are projected to close.

It should be noted that some facilities offering their services in CWT markets do not incur costs due to the regulation. These may be zero dischargers or facilities whose treatment already achieves the standard set by the regulation. For these facilities, the regulation is expected to result in increased profits, because the price of their service is rising, but their

costs are unchanged. In Figure 5-3, the lowest cost facility, which treats quantity Q_A, is such a facility. Its costs are not changed as a result of the regulation, but market price adjusts upward from P_1 to P_2. Facility profits on this CWT operation are increased by the amount $(P_1 - P_2) \bullet Q_A$. Because of the assumption that facilities are operating at or near capacity, facilities facing increased profitability of CWT operations do not increase the quantity of waste they accept. If in fact they are operating below capacity, these facilities could potentially increase not only profitability but also market share, by accepting more waste.

The economic impact model also estimates changes in facility CWT employment proportional to the change in the quantity of waste accepted for treatment or recovery at the facility.

5.3.3 Inputs to the Company-Level Analysis

The economic impact of the regulation on companies owning CWT facilities is assessed by examining changes in company profitability resulting from the regulation. The facility-specific changes in revenues and costs resulting from compliance were aggregated to the parent-company level. These changes, predicted by the market model, serve as inputs into the analysis of the company-level impacts. Changes in facility revenues and costs result in changes in parent-company revenues and costs, and thus in parent-company profits. In addition, the acquisition of new capital equipment and the financing arrangements estimated to be made for purchasing the new capital equipment result in changes in parent-company assets and liabilities. These data were used to estimate the impacts of compliance with the regulation on the parent companies owning CWT facilities. This analysis is discussed in Section 6.

5.3.4 Inputs into the Community Impacts Analysis

Communities in which commercial CWT facilities are located may be affected because of changes in employment that may occur at these facilities. If facilities decide to decrease the quantity of waste they accept for treatment or recovery in response to the regulatory options, the labor needed to run their CWT operations is assumed to decrease proportionally. Thus, the market model estimates market-related changes in employment at each commercial CWT facility. Overall, CWT employment is projected to decline because of market adjustments to the regulation.

In addition to market-related changes in employment, the Agency has estimated changes in CWT employment required to operate the controls associated with the effluent limitations guidelines and standards. These changes in employment are combined with the market-related changes in employment as an input into the analysis of total employment changes in communities where CWTs are located.

5.4 REFERENCES

Hoover, Edgar M. 1975. *An Introduction to Regional Economics*. 2nd Ed. New York: Alfred A. Knopf.

SECTION 6

ESTIMATED ECONOMIC IMPACTS OF THE CWT EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

This chapter describes the results of the analysis of market, facility, and company impacts resulting from the Agency's proposed regulatory option:

- *Regulatory Option 1*: Metals Option 4, Oils Option 8—Indirects, Oils Option 9—Directs, Organics Option 4

6.1 RESULTS OF THE MARKET ANALYSIS

The economic model described in Section 5 estimated the changes in market prices and changes in quantities of CWT treatment and recovery services provided as a result of regulation. It also estimated equilibrium revenues, costs, profits, and quantities accepted at the facility level as a result of complying with EPA's proposed regulatory options.

6.1.1 Market Impacts

The market impacts of the proposed effluent limitations guidelines and standards, if promulgated, would include changes in market prices and quantities in affected CWT markets. As discussed above, the facilities, in deciding how to respond to the O&M compliance costs, modify the amount of CWT services they offer, resulting in a decrease in market supply in most CWT markets. The market model simultaneously finds the solution for the with-regulation equilibrium market price and quantity and the with-regulation facility

quantities in each market. Table 6-1 shows the percentage changes in prices and quantities for each of the CWT processes analyzed in the market model. These results reflect national changes in quantity and the quantity-weighted average price change across the regions. A price or quantity change in any given region may therefore be lower or higher than reflected in this table.

TABLE 6-1. MARKET IMPACTS OF BPT/BAT AND PSES CONTROLS

Market	Percentage Change in Price	Percentage Change in Quantity
Regulatory Option 1		
Metals Recovery—Medium Cost	21.4%	-6.76%
Metals Recovery—Low Cost	0.61%	-0.54%
Metals Wastewater Treatment—High Cost	5.79%	-5.14%
Metals Wastewater Treatment—Medium Cost	1.67%	-0.88%
Metals Wastewater Treatment—Low Cost	4.82%	-3.50%
Oils Recovery—High Cost	24.8%	-10.4%
Oils Recovery—Medium Cost	3.02%	-1.45%
Oils Recovery—Low Cost	8.17%	-3.69%
Oils Wastewater Treatment	0.42%	-0.13%
Organics Wastewater Treatment—High Cost	11.8%	-6.03%
Organics Wastewater Treatment—Low Cost	1.47%	-0.74%

Most of the analytical inputs and results shown in this report are reported separately for BPT/BAT controls and for PSES controls. For the market impacts, however, this is not appropriate. Market-level impacts cannot be broken into impacts of BPT/BAT controls and impacts of PSES controls. Because many regional markets include both facilities that are

direct dischargers and facilities that are indirect dischargers, and because the Agency is expecting to promulgate both types of controls simultaneously, market impacts must be analyzed and reported based on the combined effects of the BPT/BAT and PSES controls analyzed together.

Under each broad market category, some regional submarkets are virtually unaffected by the regulation and others incur significant changes in price and quantity. In all cases, the market prices of broad types of CWT services are projected to increase and the quantity of waste treated in CWT processes is projected to fall. Thus, one of the expected features of the guidelines is a reduction in the absolute quantity of wastes commercially treated, in addition to an improvement in the level of treatment.

Demanders of CWT services may have decreased the quantity of CWT services demanded either by generating less waste (pollution prevention) or by substituting other waste management options not affected by this regulation for CWT services. These other waste management options include on-site waste treatment and off-site waste disposal by such means as underground injection or incineration. The Agency has assumed that demand is moderately responsive to changes in price; that is, that a 1 percent change in price results in a 0.5 percent to 1.5 percent change in quantity demanded.[1] If demand in some CWT markets is less responsive to changes in price than was assumed for this analysis, price increases would be greater than estimated and quantity decreases would be smaller than estimated. The converse would be true if demand is more responsive to price than assumed.

[1]See Appendix E for a detailed discussion and sensitivity analysis of demand elasticities in waste treatment markets.

6.1.2 Facility Impacts

In addition to the changes in prices and quantities experienced by affected markets for CWT services, complying with the costs of the control options results in impacts on CWT facilities. Facilities adjust the quantities of waste accepted for treatment in each treatment process to maximize their profits with the regulation in effect. At the same time, the cost per gallon treated and the price received per gallon treated also change. Thus, CWT facilities experience changes in revenues and costs as a results of the effluent limitations guidelines and standards. Changes in facility revenues and costs resulting from the market and facility responses to the effluent limitations guidelines and standards combine to result in changes in facility profitability. This can be expressed

$$\pi = TR - TC$$

$$d\pi = dTR - dTC ,$$

where

π = Total Profit

TR = Total Revenue

TC = Total Cost

In some cases, facilities may experience increased profitability for some processes. This occurs when process revenues increase by more than process costs. Approximately 22 percent of facilities in the CWT industry are zero dischargers and thus incur no costs as a result of the regulation. If the zero discharging facilities provide services in markets where some other CWT facilities incur costs, they are likely to be able to charge higher prices for their services and thus experience increased profits. In some other cases, facilities experience cost increases that are smaller than their revenue increases. Their profits will also rise. Other facilities will incur costs exceeding their increase in revenues and will experience reduced profitability for some processes. In cases in which projected with-regulation costs per gallon

treated for certain processes are higher than the with-regulation market price, CWT processes at some facilities may become unprofitable and are projected to close down. Table 6-2 shows the process closures expected to occur as a result of the regulation, broken down by the discharge status of the facilities.

TABLE 6-2. PROCESS CLOSURES AT CWT FACILITIES, BY DISCHARGE STATUS[a]

Discharge Status	Process Closures	Percentage
Direct dischargers	1	4.17%
Indirect dischargers	15	5.55%
Zero dischargers	0	0.0%

[a] Data are scaled up to account for the entire universe of CWT facilities.

As described above, when the with-regulation cost per gallon treated exceeds the with-regulation price received per gallon of a given treatment or recovery process, that CWT treatment or recovery process is projected to close. In cases where this occurs in every process at a CWT facility, that facility is said to close. (Note: the facility may have other operations on site, either manufacturing or waste management operations, but if the CWT operations covered by this regulation are all closed, EPA's economic analysis considers that CWT facility to have closed.) Table 6-3 shows the facility closures expected to occur as a result of the regulation, broken down by the discharge status of the facilities.

TABLE 6-3. FACILITY CLOSURES OF CWT FACILITIES, BY DISCHARGE STATUS[a]

Discharge Status	Facility Closures	Percentage
Direct dischargers	2	18.2%
Indirect dischargers	13	8.9%
Zero dischargers	0	0.0%

[a] Data are scaled up to account for the entire universe of CWT facilities.

6.1.3 Employment Impacts

Changes in employment evaluated in this analysis result from two effects:

- Changes in the quantity of CWT services produced require changes in the quantity of labor used.
- Labor is required to operate the controls on which the control options and combined regulatory options are based.

To estimate the changes in employment at CWT facilities from changes in the quantity of CWT services, the Agency used data provided in the questionnaire about hours of full-time and part-time employment associated with CWT operations. These data were used to compute the number of full-time equivalent employees associated with each gallon treated at each CWT facility at baseline. The percent change in facility employment resulting from market adjustments is equal to the percent change in the quantity of waste treated at each CWT facility as a result of the regulation. Table 6-4 shows the estimated changes in employment resulting from market adjustments in the CWT industry (that is, not including the second effect noted above), by the discharge status of CWT facilities. These employment losses are further broken down into losses resulting from process closures and losses

TABLE 6-4. JOB LOSSES RESULTING FROM MARKET ADJUSTMENTS, BY DISCHARGE STATUS[a]

	Job Losses Due to Process Closures		Job Losses Due to Facility Closures		Total Job Losses	
Discharge Status	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
Direct dischargers	<1	<0.01%	33	11.0%	40	13.3%
Indirect dischargers	43	1.26%	233	6.83%	298	8.90%
Zero dischargers	0	0.00%	0	0.00%	0	0.0%

[a] Data are scaled up to account for the entire universe of CWT facilities. Percentages are compared to pre-compliance employment by discharge status.

resulting from facility closures. There are additional employment losses at facilities experiencing no process closures. These losses are included in the total.

Several points should be made about these employment impacts. At present, EPA has only national estimates of the labor requirements to operate the controls (the second effect noted above). EPA estimates that, to operate the controls, 97 full-time equivalent employees would be required nationwide. This represents approximately 29 percent of the estimated job losses due to market adjustments to the regulation. It is not certain (although it appears likely) that the skills required to operate the pollution control equipment are the same as those required to operate the capital equipment the CWT had in place at baseline. Thus, nearly one-third of the displaced CWT employees could be retained in the industry to operate the controls. However, the employment gains associated with the controls may not completely offset the job losses from production decreases at a given plant. For example, if all the CWT operations at a facility are shut down, no employees would be required to operate control equipment because it would not be installed. Thus, the fact that complying

with the regulation could require additional CWT employment nationwide may not protect an individual employee from displacement due to the regulation.

6.1.4 Financial Impacts on Companies Owning CWT Facilities

Costs of compliance for each control option were estimated on a facility level. In some cases, a parent company owns a single facility, so facility costs equal company costs. In many cases however, a company owns multiple facilities, each incurring different costs. Company financial impacts were estimated for the 106 companies (out of a total of 164 companies) for which baseline profit data are available. Facility costs were applied to companies as follows: for companies owning noncommercial facilities, company costs were increased by the amount of the estimated compliance costs. For companies owning commercial CWT facilities, company costs were adjusted to reflect their facilities' market responses to the regulation. For each company, baseline parent company sales were adjusted to take into account changes in total revenue occurring at any of their facilities resulting from changes in market prices of CWT services. Similarly, baseline parent company net income was adjusted to allow for any facility-level changes in earnings. Parent company assets were adjusted to reflect purchases of capital equipment and land to comply with the regulation. These adjusted company financial variables were then examined to assess the impacts of the regulation on companies owning CWT facilities.

Profit margin is defined as company net income divided by company revenues. Table 6-5 shows the number of companies whose profit margins are estimated to decline, increase, or stay the same as a result of the regulation, grouped by company size. The table shows that 62 percent of the companies making up the two smallest size groups saw their profit margins decline. Less than one-third of the companies in the $20 million to

TABLE 6-5. CHANGES IN COMPANY PROFIT MARGINS, BY COMPANY SIZE CATEGORY

Company Revenues (per year)	Number of Firms	Profit Margin Increased	Profit Margin Unchanged	Profit Margin Decreased
Less than $6 million	56	20	2	34
$6 million to $20 million	20	6	1	13
$20 million to $50 million	7	5	0	2
$50 million to $500 million	14	6	0	8
Over $500 million	10	5	0	5

$50 million group had decreased profit margins, while between 50 percent and 60 percent of companies in the two largest groups saw profit margins decline.

Table 6-6 shows median profit margins of companies prior to regulation and with regulation, grouped by company size. Four of the five size categories showed slight declines in median profit margin with only the largest size category showing no change. For companies with sales of less than $6 million per year, median profit margin decreased from 30.70 percent to 29.50 percent. (Note that for this size category, lack of published company data caused EPA to use facility-level data to represent company data for many companies. These data may not accurately reflect the financial status of the companies owning the facilities.)

TABLE 6-6. ESTIMATED MEDIAN PROFIT MARGIN BY SIZE CATEGORY

Company Revenues (per year)	Baseline Median Profit Margin (%)	With-Regulation Median Profit Margin (%)
Less than $6 million	30.70%	29.50%
$6 million to $20 million	6.71%	6.33%
$20 million to $50 million	2.08%	2.05%
$50 million to $500 million	1.63%	1.30%
Over $500 million	8.76%	8.76%

Return on assets (ROA) is defined as profits divided by total assets. It is a measure of how profitably the firm is using its capital stock. Table 6-7 shows the number of firms projected to experience increased, decreased, and unchanged ROA as a result of the regulation. Fifty-seven percent of firms for which asset data are available are projected to experience declines in their ROA due to the regulation, while 37 percent are projected to experience increases. Three firms, or 6 percent of the firms for which data are available are projected to experience no change in their ROA.

Table 6-8 presents median return on assets (ROA) both with and without regulation for all companies sorted by size. ROA is computed by dividing net income by total assets. Total assets with regulation include capital expenditures required for compliance. For three of the five size categories, the median ROA decreased as a result of regulation. The median ROA for small companies increased from 7.93 percent to 9.64 percent. All other size categories show very small changes projected in median ROA.

TABLE 6-7. CHANGES IN COMPANY RETURN ON ASSETS, BY COMPANY SIZE CATEGORY

Company Revenues (per year)	Number of Firms	ROA Increased	ROA Unchanged	ROA Decreased
Less than $6 million	15	6	2	7
$6 million to $20 million	14	6	1	7
$20 million to $50 million	4	2	0	2
$50 million to $500 million	8	2	0	6
Over $500 million	8	2	0	6

TABLE 6-8. CHANGE IN MEDIAN RETURN ON ASSETS

Company Revenues (per year)	Baseline Median ROA (%)	With-Regulation Median ROA (%)
Less than $6 million	7.93%	9.64%
$6 million to $20 million	10.70%	10.10%
$20 million to $50 million	10.4%	10.5%
$50 million to $500 million	3.22%	3.05%
Over $500 million	11.24%	11.23%

The seemingly illogical result that many companies experience an increase in profit margin and ROA as a result of regulation can be explained as follows: While the regulation causes prices to increase for the entire industry, not all companies must bear the higher costs of complying with the regulation. Facilities that are already in compliance prior to regulation

benefit from higher prices without incurring any additional costs, as do zero-dischargers. For example, out of 44 companies owning zero-discharging facilities, 31 are projected to experience increased profits, and the remaining 13 are projected to experience no change in profits as a result of the regulation. Thus, a substantial share of the industry is projected to experience improved financial status as a result of the regulation.

The changes in revenues and profits are based on outputs from the market model based on the final market price. EPA notes that use of the market price in competitive markets that use a step supply function may overstate post-compliance revenues, particularly for those facilities at the bottom of the supply curve. EPA plans to investigate this issue before issuing the final rule. EPA also notes that (as discussed in the preamble) assigning facilities to different market structures may overestimate or underestimate impacts in the market model, which would likewise have an effect on the firm analysis. Finally, EPA notes that profit margin, as measured in this analysis, is not the same as total profit. In fact, in the monopoly market model, profit margin will always go up as costs go up (this is a well-known result from economic theory) but total profits will always go down because the increased mark-up is more than offset by the decreased volume of sales. In competitive markets, profits for low-cost firms may go up, particularly if compliance costs fall more heavily on their competitors, but total industry profit would be expected to fall. EPA has not analyzed the effects of the rule on total profits.

6.2 SUMMARY

Complying with the proposed CWT effluent limitations guidelines and standards will increase the cost of waste treatment and recovery operations at CWT facilities. CWT facilities incurring costs of compliance will require a higher price to accept waste for treatment and recovery, thus decreasing the supply of CWT services. Market prices for CWT

treatment and recovery services are estimated to increase, and the quantity of waste sent to CWTs are estimated to decline. CWTs are projected to close 16 treatment or recovery processes for which the with-regulation costs exceed the with-regulation price so that they are unprofitable to operate. Fifteen CWT facilities, at which all CWT processes are projected to become unprofitable, are estimated to close. Nationwide, employment at CWTs may fall by approximately 240 full time equivalent employees. Thus, the impacts of the regulation on some CWT facilities and individual employees are projected to be severe. Overall, however, incomes for many CWT facilities and many companies that own CWTs are estimated to increase. These facilities and companies either incur no costs or incur low costs of compliance, and enjoy the benefit of the increased market prices resulting from the regulation.

This section has examined the direct impacts of the CWT effluent limitations guidelines and standards on the CWT facilities, employees, and owner companies. The following section examines indirect impacts of the guidelines and standards, including impacts on the communities in which the CWT facilities are located; environmental justice impacts; and impacts on CWT customers, input suppliers, and inflation.