NATURAL RESOURCES JOURNAL

Volume 39
Issue 3 *Summer 1999*

Summer 1999

Beyond Benefit-Cost Analysis: Institutional Transaction Costs and Regulation of Water Quality

Dale B. Thompson

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ABSTRACT

Environmental policies are significantly affected by political, administrative, and legal institutions. These institutions also have very substantial transaction costs associated with them. Benefit-Cost Analysis, as traditionally practiced, pays little attention to these transaction costs. This article presents a cost-effectiveness framework for carefully considering the institutional transaction costs of policies. This article then performs a comparison of two water quality policies: a non-tradeable effluent limit permit policy and an effluent charges policy. This comparison demonstrates that these institutional transaction costs indeed are significant. However, while it is important to consider these costs, they remain very difficult to estimate, and additional refinements are necessary.

Ever since the presidency of Ronald Reagan, Benefit-Cost Analysis (BCA) has played a significant role in environmental regulations. Under Executive Orders 12,291[1] (by Reagan) and 12,866[2] (by President William Clinton), the Environmental Protection Agency (EPA) is required to perform BCA whenever it implements an environmental regulation. Concerning the regulation of water quality, the 104th Congress attempted to make the role of BCA even more significant. Based on the principles of the "Contract with America," the House of Representatives passed a bill for reauthorizing the Clean Water Act (CWA).[3] This bill, along with another bill passed by the House,[4] would have required more than the use of BCA

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* Visiting Assistant Professor, Department of Economics and Department of Agricultural and Applied Economics, Virginia Tech; J.D. 1998, Ph.D. 1998, Stanford University. I would like to thank Barton H. Thompson, Jr., Timothy F. Bresnahan, A. Mitchell Polinsky, Roger G. Noll, George Shepherd, and Susan K. Snyder for their extremely helpful comments and critiques. I would also like to thank a number of people from the United States Environmental Protection Agency, including David Arent, George Denning, Marvin Rubin, and Steven Dressing; Richard Langford from Hoescht-Celanese; and Allan Ward from RMT Hydroscience. This research has been supported by a grant from the John Olin Program in Law and Economics at Stanford Law School. All errors remain the responsibility of the author.

1. Exec. Order No. 12,291, 3 C.F.R. 127 (1982) *revoked by* Exec. Order No. 12,866, § 11, 3 C.F.R. 638 (1994).
2. *See* Exec. Order No. 12,866, 3 C.F.R. 638 (1994), *reprinted in* 5 U.S.C. § 601 at 557-61 (1994).
3. Clean Water Act Amendments of 1995, H.R. 961, 104th Cong. (1995).
4. H.R. 9, 104th Cong. (1995).

in implementing water quality regulations; these regulations would have to be justified by this BCA.[5] However, these House bills were not enacted. The 105th Congress has also failed to reauthorize the CWA, and so the next Congress will also have to face the question on the role of BCA in water quality regulation.

A number of critics have decried the use of BCA in environmental regulations.[6] These critiques suggest that BCA is not acceptable because it does not seem possible to compare seemingly quantifiable costs[7] with non-quantifiable benefits of these policies. Many also object to BCA's lack of consideration in equity issues.

In addition to these critiques, BCA is also deficient from an economic perspective. As it is generally practiced,[8] BCA fails to consider the costs of the institutions that support public policies. In this article, these costs are labeled *institutional transaction costs*, and they include the costs of enacting a policy by the legislature, implementing that policy by an administrative agency, and enforcing that policy by the agency and the courts.

In the context of environmental policies, these costs are frequently extremely significant. By not considering them, BCA gives an incomplete view of the social costs of these policies. This may lead to an erroneous conclusion in comparing the economic impacts of different policies.

In this article, a framework is described that would allow policy makers to go beyond BCA by enabling them to properly consider institutional transaction costs. Through this framework, we can begin to construct estimates of these costs to determine their significance.

This article then offers an example of using this framework in a comparison of point-source water quality policies and compares a technology-based nontradeable effluent limit permit policy such as is used in the United States under the existing CWA, with an effluent charges policy such as was used by the Federal Republic of Germany. This comparison suggests that we can begin to assess the relevance of institu-

5. For further discussion, *see* Cass R. Sunstein, *Congress, Constitutional Moments, and the Cost-Benefit State*, 48 STAN. L. REV. 247 (1996).

6. *See, e.g.*, William B. Rodgers, *Benefits, Costs, and Risks: Oversight of Health and Environmental Decisionmaking*, 4 HARV. ENVTL. L. REV. 191 (1980); Duncan Kennedy, *Cost-Benefit Analysis of Entitlement Problems: A Critique*, 33 STAN. L. REV. 387 (1981); Thomas O. McGarity, *Regulatory Analysis and Regulatory Reform*, 65 TEX. L. REV. 1243 (1987); Robert R. Kuehn, *The Environmental Justice Implications of Quantitative Risk Assessment*, 1996 U. ILL. L. REV. 103, 116-39 (1996).

7. As will be seen in the rest of this article, many transaction costs associated with these policies are also difficult to quantify.

8. *See, e.g.*, A. ALLAN SCHMID, BENEFIT-COST ANALYSIS: A POLITICAL ECONOMY APPROACH (1989).

tional transaction costs in environmental policies. However, significant uncertainties remain in many of the estimates, and this suggests that substantial further research is necessary. Nevertheless, these estimates suggest that institutional transaction costs are extremely significant in water quality policies. Therefore, Congress should go beyond BCA and more closely examine the consequences of institutional transaction costs during the process of reauthorization of the Clean Water Act.

I. AN INSTITUTIONAL TRANSACTION COST FRAMEWORK

In a previous article, the author developed a framework for comparing environmental policies that enabled consideration of institutional transaction costs.[9] This framework resulted from the integration of two threads of literature in law and economics. The first thread is concerned with optimal penalties and expenditure on enforcement. It is represented by A. Mitchell Polinsky and Steven Shavell's "Enforcement Costs and the Optimal Magnitude and Probability of Fines."[10] In this paper, Polinsky and Shavell add a wealth constraint to the imposition of penalties. They then analyze the effects on social welfare of different penalties and enforcement costs. Under certain conditions, they can determine socially optimal penalties and enforcement costs.

The second thread is concerned with the decision by a legislature to enact a piece of regulation in the form of a rule versus in the form of a standard. A rule provides bright-line distinctions to clearly identify whether a party is in compliance with the regulation, whereas a standard provides criteria to weigh to determine whether a party is in compliance. This thread is represented by Louis Kaplow's "Rules versus Standards: An Economic Analysis."[11] In his paper, Kaplow notes that there is a significant tradeoff between rules and standards written by legislatures. The determination of whether a rule or a standard is socially efficient depends on whether the social costs of drafting a rule are greater than the social costs of interpreting a standard, given the particular nature of the problem addressed by the policy.

In the author's earlier article, these two literatures were integrated to develop a comparative policy analysis framework that enabled us to consider the transaction costs of institutions that support policies.[12] To

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9. *See* Dale B. Thompson, *The Institutional-Transaction-Cost Framework for Public Policy Analysis*, (April 14, 1998) (Olin School of Business at Washington University Working Paper on file with the University of New Mexico School of Law Library).

10. A. Mitchell Polinsky & Steven Shavell, *Enforcement Costs and the Optimal Magnitude and Probability of Fines*, 35 J.L. & ECON. 133 (1992).

11. Louis Kaplow, *Rules versus Standards: an Economic Analysis*, 42 DUKE L.J. 557 (1992).

12. *See e.g.*, Thompson, *supra* note 9.

simplify the analysis, a cost-effectiveness framework was created. Because of the integration of law and economic theories, this framework is not susceptible to the many critiques of BCA related to the difficulties of measuring the benefits of these policies.

This is accomplished by assuming that in comparing policies, variables are adjusted so that the policies achieve the same result. For instance, consider the case where we compare one policy for reducing nitrogen oxide emissions by regulating electric utilities versus another that regulated automobiles. Assume that the first policy reduced emissions by 200 tons per year. To achieve equivalence, we then could adjust the requirements for emissions equipment and for the inspection of automobiles, until we achieve the same reductions of 200 tons per year.

Now, because these policies achieve the same outcome, the "benefits" of these policies are equivalent. In a comparative setting, these equivalent benefits will cancel each other out of consideration.[13] What remains in comparing the policies is to examine the costs of each, and determine which achieves the specific result at the lowest cost.

The costs of the policy include those of complying with the regulation by the regulated party, along with the institutional transaction costs. In environmental policies, compliance with regulations leads to what are generally known as "abatement costs." These are considered by BCA, but institutional costs generally are not. To further simplify the analysis, the institutional transaction costs are decomposed into four components: Enactment Costs, Implementation Costs, Detection Costs, and Prosecution Costs. Enactment costs are those associated with enacting a policy by the legislature; implementation costs are those associated with implementing a policy by an administrative agency; detection costs are those of detecting violations of a policy; and prosecution costs are those of dealing with violators of a policy or parties who challenge a policy in courts.

Then, rather than comparing the total cost of one policy with another, we will first compare policies over each individual cost component. When the policies entail the same costs for a particular component, they will cancel each other out, and need not be estimated. When the policies differ, we must construct estimates of their differences. The framework also provides suggestions on the construction of these estimates.

After we have estimates for the differences between the policies across each cost component, we combine them to determine which policy

13. However, if an analyst is determined to compare two policies with different results, adjustments to the framework can be done to enable this. This will, however, require the contentious estimation of differential benefits between the policies.

is more cost-effective. At this point, we can also conduct sensitivity analysis to examine the effects of different assumptions on our conclusion.

II. A COMPARISON OF TWO POINT-SOURCE WATER QUALITY POLICIES

A sample comparison will best demonstrate how to use the framework described above. This section will compare two different regulatory structures to reduce surface water pollution by point sources adopted in the United States and in the Federal Republic of Germany (FRG) during the 1970s. These two structures are a technology-based nontradeable-effluent-limit-permit (NELP) system and an effluent charges system. This comparison will consider the effects of these structures with respect to one industry, textile mills.[14]

Many economists have recommended economic-incentive-based systems like an effluent charge system rather than performance-based systems like a nontradeable permit system.[15] Similar to BCA in general, these economists have failed to consider the effects of institutional transaction costs (ITC) on the desirability of incentive-based systems. In this comparison, it can be seen that ITC are indeed very significant in these policies, and should not be ignored. The comparison will begin with a description of the relevant institutional features of these systems.

A. Technology-Based Nontradeable-Effluent-Limit-Permit System

Under the 1972 CWA and the 1977 amendments to it, the United States Environmental Protection Agency (EPA) was charged with the duty of determining effluent-limit-permit levels for a variety of pollutants, for each of more than 50 industries.[16] These levels were to be represented in terms of concentration of conventional pollutants such as biochemical oxygen demand, total suspended solids, pH, and toxic pollutants.[17] Further, these levels would be based upon the correct operation and maintenance of technological guidelines known as "best available technology" or

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14. This industry was chosen because the author had good access to the history of regulations for this industry.

15. *See, e.g.*, ALLEN V. KNEESE & CHARLES L. SCHULTZE, POLLUTION, PRICES, AND PUBLIC POLICY (1975); FREDERICK R. ANDERSON ET AL., ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES (1977); ROBERT N. STAVINS, PROJECT 88. HARNESSING MARKET FORCES TO PROTECT OUR ENVIRONMENT: INITIATIVES FOR OUR NEW PRESIDENT (1988).

16. *See* ROBERT PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY, 894-95, 912 (1992).

17. *See* JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES, 929-30 (2d ed. 1991).

"BAT."[18] The EPA would also determine what technologies and operating procedures would meet the BAT requirements. The process of determining the BAT classifications and the associated effluent-limitation guidelines for almost all of these industries took from 1973 to 1990.[19] These guidelines can be challenged in courts when they are announced, and they almost always are.[20] During these procedures, the actions of the administrative agency are examined to see whether it complied with its mandate. One of the most frequent sources of contention is the economic analyses that were done in support of the selection of particular technologies as the basis for the effluent limit guidelines.

After this implementation process, the NELP system operates by applying these BAT guidelines to National Pollutant Discharge Elimination System (NPDES) permits issued by the EPA and participating state agencies. Before any point source may discharge effluent into a water body, it must obtain one of these permits.[21] These permits are generally valid for five years.[22] The conditions of these permits are generally in terms of a total amount of conventional and toxic pollutants. These total amounts are found by multiplying the NELP concentration guidelines by the amount of discharge flow allowed by the agency issuing the permit. In determining the amount of discharge flow, the agency could consider the site-specific effects such as "hot spots" for pollutant levels. A permit is issued when the agency is assured that a facility will be able to comply with the terms of the permit based on the existence and operation of relevant control technologies.[23] These technologies do not necessarily have to be the ones upon which the effluent guidelines are based. Individual facilities may choose their own particular abatement technique as long as they comply with the levels listed in their permits.[24]

After the permit is issued, the individual facility is required to monitor its discharges for the different listed pollutants and submit monthly Discharge Monitoring Reports.[25] These reports are supplemented by an annual audit of the facility's discharges and practices by the

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18. These guidelines actually have many more technological classifications with their respective acronyms. However, for our purposes, the most significant of these classifications, "BAT," will suffice.

19. *See* PERCIVAL ET AL., *supra* note 16, at 894, 912.

20. *See id.* at 896-97.

21. *See* SAX ET AL., *supra* note 17, at 928.

22. *See id.*

23. Interview with Richard Langford, Regulatory Affairs Manager, Hoescht-Celanese, in Narrows, Va. (Mar. 25, 1996).

24. *See id.*

25. *See* Wesley A. Magat & W. Kip Viscusi, *Effectiveness of the EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards*, 33 J.L. & ECON. 331, 337 (1990).

regulating agency. If a facility is consistently violating the levels in its permits, enforcement steps are taken by the regulating agency.[26] The agency has the power to fine the facility, or revoke the permit. However, these steps are infrequently taken. The more common action is to send an informal notice of violation letter (NOV).[27] If the violations continue, the normal response is for the agency to contact the facility to determine what steps they are taking to alleviate the problem, and to work with the facility in getting it back into compliance.[28] This process may go on for several years.

Instead of cooperating with the agency, a facility may also challenge the levels in its permits in court. Appeals to courts also frequently result from the imposition of more formal penalties by the agency.[29]

B. Effluent Charge System

The FRG initiated and operated an effluent charge system during the 1970s and 1980s. Gardner Brown and Ralph Johnson wrote about this system in "Pollution Control by Effluent Changes: It Works in the Federal Republic of Germany, Why Not in the U.S."[30] The following discussion derives completely from interpretation of this paper.

In 1976, the Effluent Charge Law (ECL) was passed in the FRG.[31] The effluent charge system mandated by this law went into effect after 1979.[32] Under this system, discharge permits for point sources describe the process of calculating the charges paid by each facility.[33] These charges are based on the expected discharge flows and concentrations of suspended solids, biochemical oxygen demand, and other toxic chemicals.[34]

The permit also includes references to federal minimum standards for the concentrations of these pollutants. Under the ECL, these minimum standards are based on determination of performance under best practicable technology.[35] These determinations are done under the provisions of another federal water law.[36] For the purposes of this comparison, it will be

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26. *See id.* at 337-38.
27. *See id.*
28. *See* Langford, *supra* note 23.
29. *See* Magat & Viscusi, *supra* note 25, at 338-39.
30. Gardner Brown & Ralph Johnson, *Pollution Control by Effluent Changes: It Works in the Federal Republic of Germany, Why Not in the U.S.*, 24 NAT. RESOURCES J. 929 (1984).
31. *See id.* at 933.
32. *See id.* at 944.
33. *See id.* at 933-34.
34. *See id.* at 934.
35. *See id.* at 933.
36. *See id.*

assumed that these minimum standards are not based on technology.[37] Rather, they are based on "safe" levels of discharges. The determination of safe levels of discharge is the first step in the determination of technology-based effluent limitations. After safe levels are determined, different technologies are examined to see which one is best and whether it is economically feasible to achieve these levels using these technologies. This assumption essentially means that the determination of these minimum standards does not include these later steps.

The importance of these minimum standards derives from their effect on the total amount of charges paid by the facility. When the expected concentrations of all of the relevant pollutants are below these minimum standards, the total charges bill for the individual facility is reduced by 50 percent.[38] For purposes of this article, it will be assumed that these charges are reduced instead by 25 percent.[39]

The permit also requires monitoring of the discharges by the facilities themselves.[40] If actual discharges are consistently above the expected levels in the permits, the amount the facility owes will be adjusted accordingly.[41] State agencies also occasionally audit the facilities' discharges and their monitoring practices.[42]

The facilities are expected to pay their charges, with one exception. There is a "hardship clause" in the ECL.[43] Under this clause, individual facilities or entire industries may apply for an exemption to the federal Minister of the Interior for part or all of the charges bill.[44] They need to show that payment of their charges bill presents a particular hardship.[45] This enforcement option increases the political desirability of this system.[46]

Thus, under the modified effluent charges system, the amount of fees paid by an individual facility depends on the following: the per unit

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37. This assumption is to further differentiate these systems, thereby sharpening this comparison. One can also argue that because these are already determined under a different law, their marginal costs in the ECL are zero. Meanwhile, we could also use the framework to identify the tradeoffs between the charges system using technology-based minimum standards, versus the modified charges system.

38. *See id.* at 935-36.

39. Combined with other assumptions made, a 50 percent reduction in charges leads to a situation where there is no substitution of abatement activities by low-cost firms for activities by high-cost firms. This lack of substitution defeats the point of having an effluent charges system. Hence, a reduction of charges that is less is considered.

40. *See* Brown & Johnson, *supra* note 30, at 934.

41. *See id.* at 937.

42. *See id.* at 948-49.

43. *See id.* at 937.

44. *See id.*

45. *See id.*

46. *See id.*

charges rate, the quantity of discharges, whether the discharges are at or below the "minimum standard," the reduction multiplier for facilities meeting the minimum standard, and whether that facility qualifies for an exemption under the hardship clause.

C. Comparing the Technology-Based NELP System with the Effluent Charges System for the Textile Mill Industry

To compare a permits system with an effluent charges system, we will first specify the policy outcome that each system will achieve. We will then compare the permits system with the charges system across each of the different cost components of the ITC framework, individually. These components are compliance costs, enactment costs, agency implementation costs, detection costs, and prosecution costs. We will then collect these individual comparisons and see which policy is a more cost effective means towards reaching our goal.

1. Determining the Policy Outcome for the Textile Mill Industry under Both Systems

The industry we will examine is the textile mill industry. Textile mills do a variety of activities:

1. receiving and preparing fibers
2. transforming fibers into yarn, thread or webbing
3. converting the yarn and web into fabric or related products, and
4. producing transitional products or final consumer products such as thread, yarn, bolt fabric, hosiery, towels, sheets, or carpet.[47]

There are approximately 250 large, direct-discharging textile mills in the United States.[48] Most of these are in the Mid-Atlantic and southern regions of the country.[49] These firms discharge a variety of toxic, conventional, and non-conventional pollutants.[50] Toxic pollutants include 17 organic and 11 metallic products; conventional pollutants include the biochemical oxygen demand, total suspended solids, oil and grease, and pH; and

47. *See* UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, PROPOSED EFFLUENT GUIDELINES: RULEMAKING FOR THE TEXTILE MILLS POINT SOURCE CATEGORY (1979) [hereinafter PROPOSED GUIDELINES].

48. Telephone Interview with Allan Ward, Environmental Engineer, RMT Hydroscience, (July 12, 1996).

49. *See* PROPOSED GUIDELINES, *supra* note 47.

50. *See id.*

nonconventional pollutants include chemical oxygen demand and color.[51] In total, the industry produces approximately $40 billion in product each year (as of 1980).[52]

The policy goal that we will try to achieve will be the reduction of biodegradeable materials effluent by textile mills under the effluent guidelines from the permit system. Table 1 shows the biochemical oxygen demand (BOD) effluent limitation guidelines developed by the EPA for textile mills, along with prior median values.[53] From table 1, it can be seen that the amount of reduction of BOD, which is called for by the effluent limitations, is very substantial. The total amount of influent product wastewater flows for the industry is approximately three-quarters of a billion pounds of product per year.[54] Complying with these guidelines, total annual effluent of biodegradeable material is equal to approximately three-quarters of a million pounds.[55] Thus, average effluent of biodegradeable material for an individual direct-discharging mill would be approximately 3,000 pounds per year.

As was discussed above, because this ITC framework is a cost-effectiveness framework, for the purposes of this comparison we need to theoretically achieve the same policy outcome under both systems. To do this, we will implicitly adjust the dollar amount of the per-unit charges rate until total discharges by the industry are equal to the amount allowed under the permits system. For our purposes, we will not concern ourselves with the effects of discharges on "hot spots;" we will only be concerned with total quantity of effluent of biodegradeable material, which in this case is 750,000 pounds per year.

2. *Compliance Costs*

The first component to examine is compliance costs. These are the costs normally estimated under BCA. These are important, but we will see that institutional transaction costs are also significant.

In order to comply under both systems, mills will first undertake some capital investment in abatement technologies. Since mills are free to choose their technology under both systems, it will be assumed that each mill initially chooses the same abatement technology. Under the technology-based NELP system, the EPA predicted that direct-discharging textile mills would have to invest approximately $48 million initially to

51. *See id.*

52. *See id.*

53. All data in this table comes from the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE TEXTILE MILLS POINT SOURCE CATEGORY (PROPOSED) 7, 72 (1979).

54. *See* Ward, *supra* note 48.

55. *See id.*

comply with the levels in their permits.[56] According to the author's assumption, they would invest the same amount under an effluent charges system.

In addition to initial investments, there are continuing compliance costs. There is a difference between the two systems. Under the NELP system, all firms must reduce their discharges. The effluent charges system will allow firms with lower compliance costs to effectively substitute their additional compliance activities for those of firms with higher compliance costs. Under the effluent charges system, low cost firms will reduce discharges beyond what they would under NELP, while high cost firms will discharge more. These additional quantities of the high cost firms are equivalent to the further reductions undertaken by the low cost firms.[57] This will result in some savings of compliance costs, depending on their distribution. Consequently, to compute these savings from a charges system, we need to know the distribution of compliance costs.

From analysis of abatement cost surveys,[58] and discussions with consultants on abatement technologies for the textile mill industry,[59] the following are accurate statistics for the distribution of compliance costs for the textile mill industry:

1. Average annual continuing compliance cost expenditures are approximately $500 thousand per mill.
2. Standard deviation of annual continuing compliance cost is approximately $100 thousand.

Additionally, from discussions with industry consultants,[60] average marginal abatement costs are such that if a firm wished to reduce its effluent of biodegradeable material an additional 50 percent from the amount in its permit, it would cost approximately an additional 25 percent

56. *See* PROPOSED GUIDELINES, *supra* note 47.

57. For example, consider two firms, HC and LC. Firm HC's marginal cost of removing one pound of BOD is $10 for the first pound, $20 for the second pound, $30 for the third pound, and $40 for the fourth pound. Firm LC's marginal cost of removing one pound of BOD is $3 for the first pound, $6 for the second pound, $10 for the third pound, and $18 for the fourth pound. Under an NELP system, both firms might be required to remove two pounds of BOD, for a net total of four pounds removed. Under an effluent charges system with the charges set at $11, HC would remove only one pound, while LC would remove three pounds, again for a net total of four pounds removed. In this sense, firm LC has substituted its additional compliance activity of removing one more pound for firm HC's reduction of its activity by the same amount.

58. *See* U.S. CENSUS BUREAU, POLLUTION ABATEMENT COSTS AND EXPENDITURES SURVEY: CURRENT INDUSTRIAL REPORTS, SERIES MA200 10 (1993).

59. *See* Ward, *supra* note 48.

60. *See id.*

of its total compliance costs. Meanwhile, if a firm wished to increase its effluent by 50 percent (pollute more), it would save approximately 25 percent of its total annual compliance costs. This is because there are large fixed costs associated with continuing compliance costs.

To calculate the savings in compliance costs under a charges system then, the following assumptions will be made:

1. Compliance costs are distributed uniformly around the mean of average compliance costs of $500 thousand. The bounds of the uniform distribution will be two standard deviations away from the mean: $300 thousand to $700 thousand.
2. Each facility emits the same amount of discharge flow.
3. Each facility could take steps so that it would emit 1,500 pounds, 3,000 pounds (the average amount), or 4,500 pounds of biodegradeable material per year.
4. Compliance costs for firms that emit 1,500 pounds would be 1.25 times their average costs; compliance costs for firms that emit 4,500 pounds would be 0.75 times their average compliance costs. This is in accordance with the average marginal compliance costs discussed above.
5. The time discount rate is 10 percent. All comparisons will be done in terms of dollars current to the time that the policies are first operational.

Once these assumptions are made, we can then calculate the number of mills that will substitute their low-cost compliance activities for activities of high-cost firms, and the tax rate. Under these assumptions, there will be substitution of compliance activities by the twenty-one lowest cost firms for the twenty-one highest cost firms. The full tax rate will be approximately $74 per pound (which will be reduced by 25 percent for those emitting 1,500 or 3,000 pounds per year). Savings in compliance costs for the charges system will be approximately $1.925 million per year (approximately $92 thousand per substituting firm). When discounted and summed over an infinite time horizon, this will represent a total of $19.250 million.[61]

3. *Enactment Costs*

We now turn to estimation of the ITC. The first component of these is enactment costs. We will compare the social costs of enacting one policy

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61. One might also be concerned with possible dynamic compliance cost savings. However, estimation of dynamic compliance cost reductions of one policy versus another is extremely speculative. For clarity, this estimation will not be discussed here.

versus those of enacting the other policy. We will see that the enactment costs of environmental policies are indeed extremely significant and should be considered in comparisons.

The process of enactment includes two steps: the selection of instrument, and then the mechanics of drafting and voting on the legislation implementing the chosen instrument. The first step is the same: to be enacted, each would need to be chosen out of the same portfolio of instruments. But differences will exist for the second step.

In this case then, enactment includes social losses during the process of drafting and voting on a particular policy from opportunity costs of the legislature's time and from lobbying expenditures by interest groups such as the textile mill industry itself and environmental groups. It seems that it took the U.S. Congress about the same amount of time to pass the CWA as it did for the Bundestag to pass the ECL.[62] Consequently, the variables representing the opportunity cost of the legislature will be equivalent under the two systems, and these will cancel each other out.

Differences in enactment costs will therefore depend entirely on differences in lobbying expenditures. Whether lobbying costs should even be considered is a contentious topic. We will first examine the social costs of lobbying by the textile mill industry and then by environmental interest groups.

a. Lobbying by the Textile Mill Industry

To determine lobbying expenditures by the textile mill industry, we will assume that because the industry is financially better off in one system versus the other, the industry will spend money lobbying against the latter.[63] We first estimate the difference in the financial effect on the textile mill industry from one system versus the other. We will then estimate the percentage of this difference that the textile mill industry would be willing to spend in lobbying against the less favored system.

To determine the financial difference between one system and the other, we need to know the total amount of compliance cost expenditures under both, and the total tax bill paid by the industry under the charges system. Annual compliance cost expenditures under the NELP system by the textile mill industry will be approximately $125 million.[64] Total discounted compliance cost expenditures are then $1.25 billion. The

62. *See* PERCIVAL ET AL., *supra* note 16, at 873-76; SAX ET AL., *supra* note 17, at 932-34.

63. It might seem odd that we are treating this industry as a "monolith," where the only relevant variable is overall industry effect. However, to construct consistent estimates, this is necessary unless we have information on the differential lobbying efforts of individual firms in the industry.

64. There are 250 mills spending on average $500,000 each.

industry would compare this with expected total compliance expenditures under the charges system. The difference in compliance costs will be $19.25 million.

We also need to calculate the total tax payment for the industry under the charges system. Multiplying the tax rate times the amount of biodegradeable material effluent, we find that those emitting 1,500 pounds per year would pay $83 thousand, those emitting 3,000 pounds would pay $166.5 thousand, and those emitting 4,500 pounds would pay $333 thousand. These are very high charges.

There are alternative charges schedules that could be used. One possibility would be to use a combination of subsidies and charges, so that those emitting 1,500 pounds are subsidized. In this case, those emitting 1,500 pounds would receive $83 thousand, those emitting 3,000 pounds would pay nothing, and those emitting 4,500 pounds would pay $166.5 thousand. The net annual tax bill for the industry would be about $3.5 million. The total discounted tax bill would be $35 million.

However, the current state of finances for the federal and state governments would probably preclude any program where the government would begin large subsidies that could possibly increase to a much higher level as more mills took advantage of them. Instead, a more likely schedule of charges would be for those emitting 1,500 pounds to pay nothing, those emitting 3,000 to pay $83 thousand, and those emitting 4,500 to pay $250 thousand. In this case, total annual tax payments under the charges system will be $22.4 million. The total discounted tax bill for the industry under this plausible charges schedule would then be $224 million. For the purposes of this comparison, we will assume that this charges schedule would be the one used.

To compare the financial impacts, we need to subtract the total compliance cost savings under a charges system from the total tax bill. Thus, a charges system will be more costly to the textile mill industry by 205 million discounted dollars ($224 minus $19 million).

The next step is to calculate how much of this financial difference the industry would spend in lobbying against a charges system. Part of the problem with including lobbying costs in an estimate of the different social costs of a policy is the high degree of variance in lobbying expenditures. Lobbying expenditures on some policies will be extremely high, while they may be very low for others. Exactly what distinguishes between a policy where expenditures will be high and one where they will be low is unclear. Some factors that might affect the propensity to engage in lobbying efforts can include the expected probability of success of these efforts, the degree of lobbying engaged by opposing parties, and whether there is an industry-wide organization that can mobilize resources for these efforts. Also, this relationship can be nonlinear when the estimated percentage depends on the value of the financial stakes. These many factors suggest the extreme difficulty in estimating the percentage of financial stakes spent on lobbying. Very little has been done to determine this percentage. However, some conservative estimates can be made. To do this, one can look at lobbying expenditures by agriculture on the North American Free Trade Agreement (NAFTA).[65] This episode was chosen because data on both the net effects on the industry and lobbying expenditures were available.[66] It is generally accepted that lobbying expenditures by agriculture on NAFTA were fairly low with respect to the financial consequences of the agreement.[67] The total difference in net exports and net imports expected by the agreement was $650 million.[68] Of these differences, perhaps 10 percent can be considered as profits or losses by the industry.[69] Comparing these total expected gains and losses with actual and pledged expenditures by the agriculture industry on lobbying (about $1 million), we find that the agriculture industry spent somewhere between one and two percent of the total expected financial gains/losses from NAFTA on lobbying. After considering the NAFTA study, 1.5 percent is a reasonable estimate for this framework. Using a conservative estimate, we find that lobbying expenditures by the textile mill industry would be approximately $3.1 million.

Note that these lobbying expenditures would have been higher if the proposed effluent charges system did not allow firms to reduce their charges by 25 percent if they were at or below the maximum standards. This reduction of the charges bill significantly reduces the total amount that the whole industry has to pay under a charges system, which in turn significantly reduces the amount that they spend on lobbying. Note too that this saving in enactment costs has a tradeoff: the 25 percent reduction feature of this charges system significantly reduces the amount of substitution of compliance by lower cost firms for higher cost firms. This then increases the total cost of compliance for the industry.

65. *See* David Orden, *Agricultural Interest Groups and the North American Free Trade Agreement*, *in* THE POLITICAL ECONOMY OF AMERICAN TRADE POLICY 335 (Anne O. Krueger ed., 1996).

66. The author is not aware of other instances where both of these variables are estimated, and would appreciate any references if they are available.

67. Interview with David Orden, Professor of Agricultural and Applied Economics, Virginia Tech, in Blacksburg, Va. (July 11, 1996).

68. *See* Orden, *supra* note 65 at 339.

69. *See id.*

b. Lobbying by Environmental Groups

There is also evidence that some environmental groups would lobby against an effluent charge system.[70] These groups may not like a charges system because it does not stigmatize pollution.[71] These groups feel that a charges system would give mills the right to pollute the environment further just by paying a little more money. They feel that these mills would take advantage of this system by polluting much more and just raising prices. They instead want policy instruments that tell mills they have to reduce emissions as much as possible, or ones that outlaw pollution above a certain level. They want performance standards like nontradeable permits. Because they help stigmatize pollution, environmental groups will support a nontradeable permit system.

The question for the policy analyst then is how much environmental groups would spend to lobby against a charges system. However, their lobbying effort would be done in the context of a charges system for all point sources. Lobbying expenditures with respect to the textile mill industry could be considered as a fraction of total lobbying expenditures against a full charges system for all industries. To determine total lobbying expenditures by environmental groups, one estimate would be that five environmental groups would assign a team of four people each to spend one year to fight a charges system for point sources. If the average opportunity cost of an environmental interest group team member is $100 thousand per year, the total social loss from lobbying by the environmental groups is then $2 million. For the textile mill industry, dividing this total by the number of major industries affected (50), the social loss from lobbying against a charges system for the textile mill industry is $40 thousand.

4. Agency Implementation Costs

The next ITC is agency implementation costs. This is the cost that must be undertaken before those who must comply with the policy may do so. For environmental policies, this process frequently involves the researching and drafting of complex regulations, and is consequently very time consuming and expensive. Comparisons of environmental policies, thus, should also consider differences in implementation costs.

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70. Some groups, such as the Environmental Defense Fund or the National Resources Defense Council, might support this system. However, for the purposes of this comparison, it will be assumed that they would not spend resources in lobbying for this system.

71. *See* STEPHEN KELMAN, WHAT PRICE INCENTIVES? ECONOMISTS AND THE ENVIRONMENT 44-53 (1981). However, some groups would support a charges system, such as the Environmental Defense Fund or the National Resources Defense Council.

To compare implementation costs between a technology-based NELP system and an effluent charges system, we will first determine what steps the implementing agency has to take with each. To implement the technology-based NELP system, the EPA first determined what actual water pollutant emissions levels were for a variety of sources. It then determined what amount of emission reductions would be required to achieve safe levels of pollutants in most water bodies. The calculations for BOD are represented in table 1, which shows the BAT effluent limitation guidelines for various categories of textile mills.[72] These guidelines are the permit levels for NELP. They took approximately two years to determine, and were published in 1974.[73]

After these guidelines were determined, the EPA then had to examine a variety of technologies used by textile mills to achieve these emissions reductions. It had to first understand exactly what these technologies were, how they operated, and how much emissions reduction they would generate. Next they would choose which technologies would become the standards for textile mills. After this, the EPA conducted economic analyses to support their choice of these technologies. This process took another five years for textile mills, ending in 1979.[74]

In contrast, under the modified effluent charges system under consideration here, the implementing agency would only have to determine the maximum concentration standards to qualify for reduction of charges by 50 percent. This is what the EPA did in its first step when it published the effluent limitation guidelines. Consequently, in comparing the two systems, this initial step is canceled out. What remains is the social loss from determining the technologies and supporting this choice, upon which the effluent limitation guidelines are based.

A good estimate of the cost of doing these additional steps by the EPA is $1 million per year.[75] These expenses by the EPA are social losses because the resources used to do these studies could have been used in a productive capacity elsewhere. Since these steps took an additional five

72. *See* Table 1.

73. *See* UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES NEW SOURCE PERFORMANCE STANDARDS FOR THE TEXTILE POINT SOURCE CATEGORY, 1974 (calculation from comparing starting and ending dates).

74. *See* RICHARD E. SELTZER ET AL., ECONOMIC IMPACT ANALYSIS OF PROPOSED EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORMANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE TEXTILE MILLS POINT SOURCE CATEGORY (1979) (calculation from comparing starting and ending dates).

75. Telephone Interview with George Denning, Economist, Office of Water, Office of Science and Technology, Engineering & Analysis Division, U.S. EPA Policy Division (Apr. 9, 1996).

years, the additional social implementation cost of the permit system is $5 million.[76]

5. *Detection Costs*

The cost of detecting violations of environmental policies is frequently significant. However, in this case, the two systems involve essentially identical detection costs. Both systems will have similar self-monitoring requirements, with both requiring monthly discharge monitoring reports. Both also will include yearly audits of effluent and measurement procedures. Consequently, detection costs under the NELP system will be equal to detection costs under a charges system.

6. *Prosecution Costs*

The last ITC is prosecution costs, which are the costs of dealing with facilities that might bring challenges to the execution of these systems, along with the costs of inducing violators of these policies to comply with them. Once again, we see that these costs are very significant and should be included in comparisons of environmental policies.

An effluent charge system will have very little prosecution costs associated with it. As long as facilities report their emissions correctly, and pay their charges, there will be no reason for the administrative agency to begin prosecution procedures against them. Some facilities may withhold their payment in the hope of challenging the authority and/or methodology of the administrative agency in setting the charges rate. However, as will be argued below, their chances of winning will be extremely slim. Faced with stiff penalties if they lose, including possible revocation of their permit, all facilities will pay their charges properly or file for exemptions under the hardship clause.

Under normal conditions, it can be assumed that 21 textile mills file for exemptions under the hardship clause each year. We will assume that a committee of three will spend one month examining these 21 claims, and that the opportunity cost of each person on the committee will be $100 thousand per year. Consequently, the yearly social cost of examining these hardship clause claims will be $25 thousand. The discounted total will be $250 thousand dollars.

Meanwhile, the technology-based NELP system will have very high prosecution costs. Under the discharge permits system administered by EPA and the states, approximately five percent of facilities engage in

76. Recall that this difference would not occur if the charges system used technology-based guidelines to determine which facilities would have their charges reduced by 25%, which is how the FRG charges system operated.

"significant noncompliance" of their permits.[77] If these facilities do not remedy their violations within a few months, the state or federal environmental agency responsible for administration of their permit will initiate legal proceedings. Shortly thereafter, they will be visited by regulatory agency staff to determine what steps the facilities were taking to reduce their discharges. Under the threat of legal proceedings, most would work with the EPA to improve their performance.

The prosecution costs associated with these inducement procedures are the opportunity costs of the regulators who carry them out. These opportunity costs will be calculated in two ways. First, there are ten federal EPA enforcement regional offices, each with about ten professionals working on enforcement of water permits for all industries.[78] There are also about 40 states with their own enforcement agencies working on water permits, again with about ten professionals each. They spend about two-thirds of their time in these inducement procedures. About one-half of their cases are relevant to violations of the effluent guidelines portion of the permits. After you divide these total enforcement expenditures on inducement for all industries by the number of major industries regulated (50), you find that approximately three person-years per year are devoted to these inducement procedures. At an opportunity cost of $100 thousand per person, one estimate of the opportunity cost of these inducement procedures is approximately $300 thousand per year.

Another way to estimate the opportunity cost of these procedures is to analyze the amount of resources generally devoted to each case. Typically, you will have about three people working a total of about three weeks per case.[79] A five percent level of significant violations translates into 13 cases of violations for the textile mill industry per year. This means that two and a quarter person-years are devoted to these inducement procedures each year. At an opportunity cost of $100 thousand per person, this new estimate of the opportunity cost of these inducement procedures is approximately $225 thousand per year, which is fairly close to the first estimate. This will represent a total of $2.25 million including all discounted years.

In addition to the opportunity costs of inducement procedures, there are also prosecution costs associated with defending the effluent guidelines themselves in court. When the guidelines are initially released, some of the affected firms will challenge the EPA's methodology behind

77. Telephone Interview with David Arent, Environmental Scientist, Water Protection Division, U.S. EPA Enforcement Division, Philadelphia Regional Office (July 11, 1996).

78. *See id.*

79. There is great variance to this average, with each case differing in many aspects from others. *See id.*

these guidelines in court. These challenges have a much higher likelihood of success than litigation over effluent charges.

Permit levels are based on the determination of "best available technology" by the EPA. The nature of a choice of a particular technology over alternatives to achieve a certain reduction of pollution means that courts may feel that they have the ability to determine whether the agency has done enough to justify its choice. The CWA statute also suggests, somewhat cryptically, the requirements for a technology chosen as a standard through its terminology of BAT.[80] This terminology gives the court some guidance for reviewing the EPA's choice of technology. Moreover, the courts will be less likely to show deference because the choice of the particular technology is one step away from the policy choice of how much pollution to allow.

Because all of these factors imply less deference be given to the choice of technology by the EPA, the standard of review for technology-based permits then will be "hard look review" of the agency's action, under *Overton Park*.[81] Under hard look review, the court will closely scrutinize the agency's choice of a particular technology, to see whether it has carefully considered alternatives. This more difficult standard of review means that prosecutions of violations of permits will involve investigations of the propriety of the standards themselves, not just the factual question of whether a mill is complying with permit levels. Technology-based permits therefore have quite high prosecution costs.

Under the actual ECL, the minimum standards used to determine whether a facility would qualify for a percentage reduction were based on technological standards. However, these standards were determined previously under a different law,[82] and hence might not be grounds for challenges to the ECL. Regardless, in this modified effluent-charges system, these minimum standards are not based on technological standards, and are therefore definitely not available as grounds to challenge the charges system.

Instead, facilities challenging the charges system would need to question the particular choice of the charges rate. However, charges rates are more arbitrary by nature—the EPA has to determine exactly where to draw the line across the wide spectrum of possible rates. While any other amount could be chosen, in the example of this comparison a rate of $74 is chosen. The goal for rates might be defined, as it was in the CWA, to make waters fishable and swimmable.[83] This is a much more vague goal than the

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80. *See* SAX ET AL., *supra* note 17, at 929-30.
81. *See* Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 415-16 (1971).
82. *See* Brown & Johnson, *supra* note 30, at 933.
83. 33 U.S.C. § 1251(a)(2) (1994).

definition of BAT, and therefore gives less guidance to courts to review permits. Additionally, the levels of permits are a direct policy choice by the agency. All of these factors mean that the courts will likely give a great deal of deference to the EPA's choice for effluent charges, as under *Chevron*.[84] This standard of administrative discretion means that prosecutions of violations of effluent charges will involve only the factual determination of whether the emissions were properly reported and whether the charges were paid. The inability to challenge the basis for the agency's decision on charges should lead to no actual court cases.

Indeed, our experience with technology-based permits shows how costly the prosecution costs of these can be. Many cases have ended up in lengthy appeals processes.[85] During these appeals, the entire agency decision process is analyzed to determine whether the EPA properly applied the factors directed by Congress. In particular, the economic analyses supporting the choice of standards by the EPA have been closely scrutinized.[86]

To estimate the opportunity cost of these appeals, we will approximate how much time each side spends during an appeal. Based on experience with the recent appeal of the Organic Chemicals and Plastics and Synthetic Fibers (OCPSF) effluent guidelines, a good estimate of how much time the government will spend is four person-years.[87] A good estimate of how much time the industry would spend during an appeal would be the same amount of time as the government, in this case, four person-years. We also want to estimate the amount of court resources used during this process. An appellate court typically consists of a three-judge panel. There will also be one or more clerks working on each case. The OCPSF industry litigation lasted from 1988–1990.[88] During this two and one-half year period, a reasonable estimate of total time spent by clerks and judges on the case would be three months. The total amount of resources used during this appellate process would be about eight and one-quarter person-years. Using the same rate of $100 thousand per person-year, the opportunity cost of this appellate process would be $825 thousand.

84. *See* Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837, 865 (1984).

85. *See* PERCIVAL ET AL., *supra* note 16, at 896-97.

86. Telephone Interview with Marvin Rubin, Chief, Energy Branch, Office of Water, Office of Science & Technology, Engineering & Analysis Division, U.S. EPA Policy Division (July 10, 1996).

87. *See id.*

88. *See id.*

7. Summary

Table 2 summarizes these comparisons of the technology-based NELP system with the effluent charges system for each of the cost components of the ITC framework. From this table, we see that under these assumptions an effluent charges system is a more cost effective system to reduce discharges of BOD by textile mills. This is true regardless of how much dynamic improvement is expected.

However, these results are somewhat sensitive to our rough estimate of the percentage spent by the industry to lobby against a charges system. If we allow the industry to spend more than 1.5 percent on lobbying, our results may change. In fact, if the level of expenditure by the industry increases to 13.2 percent, our conclusion will be reversed, the performance-based NELP would be more cost-effective than the incentive-based effluent charges system. Thus, we can see from our conclusion that an effluent charges system is somewhat sensitive to our rough estimate of lobbying expenditure levels.

IV. CONCLUSION

Environmental policies are significantly affected by political, administrative, and legal institutions. These institutions also have very substantial transaction costs associated with them. Benefit-Cost Analysis, as traditionally practiced, pays little attention to these transaction costs. In using BCA, an analyst will carefully compare the compliance costs of policies. However, in a comparison of the full range of effects of policies, it may be critical to also consider institutional transaction costs.

This consideration is particularly important when the institutional settings of the policies being compared are substantially different. For instance, one policy may place a much larger burden on the regulated parties, and these parties may respond with intense lobbying against that policy. Another policy may require the implementing agency to conduct extremely careful research in developing complex regulations. There can also be significant differences in the ease of enforcing the policies, or the ease of defending the policies in court. When these institutional differences arise, we must take a closer look at the transaction costs associated with these institutions.

This article presents a cost-effectiveness framework for carefully comparing both the compliance costs and the institutional transaction costs of policies. To better illustrate how to use this framework, a comparison of an NELP policy with an effluent charges policy was performed. Traditional BCA would suggest that an effluent charges policy is clearly preferable because it has substantial compliance cost advantages over an NELP policy.

In the comparison performed here, consideration of institutional transaction costs does not lead to a different conclusion.

However, this result does not imply that effluent charges are necessarily more cost-effective than NELP. What was most apparent from this comparison was that these institutional transaction costs are significant. Furthermore, it is difficult to estimate these costs, and additional refinements are necessary. Indeed, one of the more difficult-to-estimate institutional transaction costs was expected lobbying expenditures. This comparison used a very small estimate of these expenditures. If the true level of lobbying expenditures was moderately higher, we would reach the opposite conclusion—NELP would be more cost-effective than effluent charges. This possibility suggests that the conclusion reached is sensitive to underlying assumptions. Thus, more research must be conducted on refining the estimation of these institutional transaction costs.

Nevertheless, the structure of this framework does aid analysis of the differences between policies. Even with imprecise estimates, an analyst can more clearly identify the institutional features that lead to significant cost differences.

Consequently, in the legislation reauthorizing the CWA, Congress could perhaps expand the definition of Benefit-Cost Analysis to explicitly include institutional transaction costs. While analysis of abatement costs is important, differences in institutional settings should also be considered by the EPA during rulemaking. Furthermore, in authorizing more specific policy initiatives, such as enabling the use of permit markets to achieve reduction in air pollution, legislators themselves would want to be cognizant of these institutional transaction costs as well. Recognition of the significance of these costs along with additional refinements of their estimates will result in more informed decision making by Congress.

Type of Textile Mill	Median Values of BOD before Implementation (in kg pollutant/kkg of product)	BAT Effluent Limitation Guidelines	Percentage Reduction
Wool Scouring	11.7	0.9	92%
Wool Finishing	283.6	8.9	97%
Woven Fabric Finishing			
Simple Processing	78.4	1.6	98%
Complex Processing	86.7	2.9	97%
Complex Processing Plus Desizing	113.4	3.3	97%
Knit Fabric Finishing			
Simple Processing	122.4	2.5	98%
Complex Processing	122.4	2.3	98%
Hosiery Products	69.2	3.1	96%
Carpet Finishing	46.7	2.2	95%
Stock & Yarn Finishing	100.1	1.4	99%
Nonwoven Manufacturing	40.1	1.9	95%
Felted Fabric Processing	212.7	13.4	94%

Table 1: BOD Guidelines for Textile Mills

Cost Component and Description	Higher Cost for Technology-Based NELP System	Higher Cost for Effluent Charges System
Compliance Costs	$19.25 million [Note: Total Discounted Compliance Costs are $1.25 billion]	
Enactment Costs		
Additional Lobbying by Textile Mill Industry		$3.1 million
Additional Lobbying by Environmental Groups		$0.04 million
Implementation Costs	[Note: calculation of effluent guidelines used under both systems costs $2 million]	
Determination of Best Available Technologies	$5 million	
Detection Costs	no difference	
Prosecution Costs		
Determination of Hardship Clause Requests		$0.25 million
Inducement Costs	$2.25 million	
Court Costs	$0.825 million	
Higher Total Cost for Technology Based NELP System	$23.9 million	

Table 2: Comparison of NELP and Effluent Charges Systems