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# Financing Superfund: An Evaluation of Alternative Tax Mechanisms

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# Financing Superfund: An Evaluation of Alternative Tax Mechanisms

ABSTRACT

*Since the initial Superfund was created in 1980, it has become apparent that the ultimate cost of cleanup of hazardous wastes will reach into the billions of dollars. This paper considers a variety of tax mechanisms that could be employed to generate revenues for federally-funded cleanups of abandoned hazardous waste sites. These tax mechanisms are analyzed in the context of a number of goals that are considered socially desirable. The conclusion is that no single tax alternative emerges as superior and that, instead, the preferred option will depend on the relative importance placed on the different goals.*

## I. INTRODUCTION

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)[1] provided a $1.6 billion fund, referred to as Superfund, for the purpose of cleaning up the nation's abandoned hazardous waste sites. However, the intervening years have led to the realization that the original funding level is inadequate for the task at hand. Cleanup efforts to date suggest that the total cost ultimately incurred could be enormous, reaching into the billions of dollars. For example, the U.S. General Accounting Office (GAO) has put its upper estimate of federal spending at $39.1 billion.[2] The Office of Technology Assessment (OTA) has estimated that federal spending could exceed $100 billion.[3]

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1. 42 U.S.C. §§ 9601-9657 (1982).

2. GENERAL ACCOUNTING OFFICE, CLEANING UP HAZARDOUS WASTES; AN OVERVIEW OF SUPERFUND REAUTHORIZATION ISSUES, GAO/RCED-85-69, 17 (Mar. 29, 1985). It should be noted that this figure is based on conservative assumptions regarding EPA's ability to recover costs from responsible parties. To the extent that the EPA is able to recover additional costs from responsible parties, this figure would be reduced. *See id.* at 21. All figures are in undiscounted 1983 dollars.

3. OFFICE OF TECHNOLOGY ASSESSMENT, SUPERFUND STRATEGY, OTA-ITE-252-3 (Mar. 1985). Additionally, as reported by the General Accounting Office, the U.S. Environmental Protection Agency (EPA) has estimated that total federal spending could reach $22.7 billion. However, according to the U.S. GAO, assumptions made by EPA tended to bias EPA's estimates upward. *See* GENERAL ACCOUNTING OFFICE, *supra* note 2, at 18-20.

In addition to involving substantially greater cleanup costs than were initially anticipated, it has become apparent that considerable time will be involved as well. The U.S. Environmental Protection Agency (EPA) has estimated that the cleanup effort could be completed by 1999[4] while the GAO and OTA have projected completion dates of 2017[5] and 2035[6], respectively. Both total cleanup costs and the time period involved, have implications for the question of what the flow of funds over time should be. More importantly, the amount of funds required will have a substantial impact on the determination of the appropriate mechanism for financing Superfund.

This paper addresses the question of how the revenues for a continued Superfund could be generated. With respect to this issue a number of approaches have been proposed. The majority of these rely on some form of taxation and can be grouped into three principal categories: 1) feedstock taxes, 2) industry-wide revenue taxes, and 3) waste-end taxes. Additional sources of cleanup funding might include general tax revenues, interest earned on the balance in the fund, costs recovered from responsible parties, and fines.

The fact that so many different financing alternatives have been proposed reflects the variety of goals explicit or implicit in those alternatives. As discussed below, some of these goals conflict with one another in the context of any single tax alternative, thus complicating the selection process. The purpose of this paper is to examine the major tax alternatives that have been proposed and the goals that these alternatives are meant to achieve, and to evaluate each of the tax alternatives vis-a-vis those goals.

The remainder of the paper considers the relative effectiveness, in the context of specific goals, that each of the alternative tax mechanisms may have. Part II examines six alternative taxing mechanisms. In Part III, seven goals that the selected tax alternative might be expected to achieve are considered. Part IV consists of an evaluation of each of the tax alternatives vis-a-vis the goals, and Part V summarizes the results.

## II. ALTERNATIVE TAX SYSTEMS

Six alternative tax mechanisms that could be implemented to generate revenues for the Superfund are considered:[7] 1) a feedstock tax on the primary production inputs from the chemical and petroleum industries that result in the generation of hazardous wastes;[8] 2) a broad-based in-

4. GENERAL ACCOUNTING OFFICE, *supra* note 2, at 17.

5. *Id.*

6. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 4, at 3.

7. While these alternatives are treated separately here, it needs to be pointed out that a combination of these alternatives could be employed to finance Superfund.

8. A feedstock tax on 42 chemicals and petroleum provided the bulk of the $1.6 billion for the original Superfund. 26 U.S.C. §§4611-12, 4661-62 (1982).

dustry tax that could be imposed, for example, on the revenues of firms generating some minimum level of sales;[9] and 3) four versions of the waste-end tax, that is, a tax on the waste streams ultimately generated and disposed of.[10]

*Feedstock Tax*

CERCLA provided for the imposition of a feedstock tax on 42 different petrochemicals, ranging from $0.22 per ton to $4.87 per ton, and a tax of $0.79 per barrel on crude oil received at U.S. refineries or imported into the United States.[11] Tax rates for individual feedstocks were based on estimates of the percentage amount of all hazardous wastes generated and attributable to specific feedstocks. This measure was meant to serve as a proxy for the composition of wastes found at Superfund sites. These rates were then modified, where necessary, to avoid potential adverse economic impacts on specific industries.[12] The feedstock and petroleum taxes have provided the bulk of Superfund revenues, accounting for approximately 70 percent of total receipts in 1983.[13]

*Broad-Based Industry Tax*

A number of legislative proposals have embraced the idea of using some form of a broad-based industry tax to provide at least part of the financing for Superfund. Examples include the Superfund excise tax in S.51[14] and the excise tax in H.R. 2817.[15] The primary appeal of a broad-

9. Such a tax was proposed in the Senate's version of the 1985 Superfund reauthorization bill, S.51, SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS, A BILL TO EXTEND AND AMEND THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, AND FOR OTHER PURPOSES, REP. NO. 73, 99th Cong., 1st Sess. (Apr. 15, 1985), and an early version of the corresponding House bill, H.R. 2817, HOUSE COMMITTEE ON ENERGY AND COMMERCE, A BILL TO AMEND THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, AND FOR OTHER PURPOSES, H.R. REP. NO. 253, PARTS I, II, III, IV, AND V, 99th Cong., 1st Sess. (Aug. 1, 1985).

10. We assume that any hazardous waste generated that is subsequently recycled or recovered would be exempt from all four versions of the waste-end tax considered here and that the tax would only be imposed on the quantity of waste remaining after the application of waste reduction techniques such as dewatering.

11. 26 U.S.C. §§4611-12, 4661-62 (1982).

12. U.S. ENVIRONMENTAL PROTECTION AGENCY, THE FEASIBILITY AND DESIRABILITY OF ALTERNATIVE TAX SYSTEMS FOR SUPERFUND CERCLA SECTION 301(a)(1)(G) STUDY 2-5 (Dec. 1984).

13. LAZARRI AND GELB, PROPOSED TAX INCREASES AND THE U.S. PETROCHEMICAL INDUSTRY: AN ECONOMIC ANALYSIS, Congressional Research Service Report No. 85-81 E 7 (1985).

14. Specifically, S.51 called for the imposition of 8 percent tax on the sales of firms with revenues in excess of $5 million per year. S.51, SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS, A BILL TO EXTEND AND AMEND THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, AND FOR OTHER PURPOSES, REPORT NO. 73, 99th Cong., 1st Sess. (Apr. 15, 1985).

15. H.R. 2817 called for a broad-based industry tax sufficient to raise $900 million per year for the years 1986-1990. H.R. 2817, HOUSE COMMITTEE ON ENERGY AND COMMERCE, A BILL TO AMEND THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, AND FOR OTHER PURPOSES, H.R. REP. NO. 253, PARTS I, II, III, IV, AND V, 99th Cong., 1st Sess. (Aug. 1, 1985).

based tax stems from its ability to generate substantial amounts of revenue without imposing a great burden on any individual taxpayer. This could be achieved by keeping the tax rate very low and limiting the pool of potential taxpayers to firms with annual revenues or sales in excess of some minimum threshold amount.[16]

*Waste-End Taxes*

Hazardous waste generation, in and of itself, does not result in Superfund sites. Rather, it is the disposition of those wastes, that is, the treatment, storage, or disposal (TSD) option employed, as well as the quantity of wastes involved that may ultimately lead to adverse health effects, environmental damage, etc.[17] Consequently, waste-end taxes possess logical appeal as a means of financing Superfund activities. In particular, they can be used to manipulate the choice of specific TSD options by increasing the relative cost of specific options, for example, increase the per unit cost of landfill disposal of a hazardous waste relative to the per unit cost of incineration of the same waste. Additionally, the resulting increase in the price of TSD options that are taxed will provide an incentive for waste reduction efforts, and hence mitigate the potential for the creation of new Superfund sites. The extent to which a waste-end tax will, in fact, affect future waste generation rates and the use of specific treatment, storage and disposal practices employed depends on the specific form of the tax.[18] The forms of a waste-end tax considered here include: 1) a flat tax, 2) a tax differentiated on the basis of the TSD option employed, 3) a tax differentiated on the basis of the degree of hazard of the waste, and 4) a tax differentiated on the basis of the TSD option employed and the degree of hazard of the waste.

*1) Flat Tax*

The simplest waste-end tax is a flat tax per unit of waste treated, stored, or disposed. Such a tax is currently imposed under Section 4681 of CERCLA.[19] A flat waste-end tax does not distinguish between types of

16. For example, it has been estimated that a tax of 5.5 percent on the sales of firms whose net corporate receipts exceed $5 million annually could generate $1 billion in annual tax revenues, and that an 8 percent tax on the sales of firms in excess of $10 million would raise the price of most products by a few tenths of one cent. *See infra* note 54 and accompanying text.

17. Specific examples of adverse health and environmental effects include cancers resulting from exposure to hazardous wastes and the contamination of underground aquifers by hazardous wastes.

18. A number of states have instituted some form of a waste-end tax to finance state-directed cleanups of abandoned hazardous waste sites. For a discussion of states' experiences with waste-end taxes *see* U.S. GENERAL ACCOUNTING OFFICE, STATE EXPERIENCES WITH TAXES ON GENERATORS OR DISPOSERS OF HAZARDOUS WASTE, GAO/RCED-84-146 (May 4, 1984) and OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 4, at 46-48.

19. 26 U.S.C. § 4681 imposes a tax of $2.13 per dry weight ton of hazardous waste received at a qualified hazardous waste disposal facility.

wastes or TSD methods employed. Consequently, of the waste-end taxes considered here, it is assumed least effective in encouraging preferred shifts between TSD methods.[20] Additionally, there is little evidence to indicate that a flat waste-end tax set at relatively low rates ($2–$10 per ton) will encourage substantial reductions in the quantities of wastes generated.[21]

*2) Differentiation on the Basis of TSD Option Employed*

Depending upon the specific TSD option employed, the same waste stream can ultimately impose different levels of risk on society. For example, incineration of one metric ton of a hazardous waste is assumed to impose a smaller amount of risk on society than would landfill disposal of the same waste.[22] This variation in risk was recognized in the 1984 amendments to the Resource Conservation and Recovery Act of 1976 (RCRA)[23] which, in part, are designed to substantially reduce the extent to which landfills are employed as a means of permanent disposal.[24]

To the extent that one of the goals of the tax is to encourage a shift in the distribution of wastes between the various treatment and disposal methods available, a waste-end tax differentiated on the basis of the treatment or disposal method employed should be considered. By varying tax rates according to the degree of hazard associated with different TSD options, such a tax could be used to effectively eliminate any cost advantages that an undesirable, that is, more hazardous, option may currently possess.

*3) Differentiation on the Basis of Degree of Hazard*

A third type of waste-end tax, similar in concept to the one just described, is differentiated according to the degree of hazard associated with the waste in question, but is held constant across treatment and disposal options. Just as the same waste disposed of by different means can impose varying levels of risk on society according to the disposal option em-

20. A preferred shift refers to one which leads to the generation of less hazardous waste for a given production process, or results in the use of a safer, i.e., less risky, disposal option for a given waste stream. Because a flat waste-end tax does not distinguish between waste types or the type of TSD option employed, it does not alter the relative cost of the different options available. Consequently, by itself, it does not provide any economic incentive to prefer one option over another. Additionally, it does not appear to give the waste generator significant incentives to alter the production process in ways that might lead to the generation of different, less hazardous waste streams.

21. CONGRESSIONAL BUDGET OFFICE, HAZARDOUS WASTE MANAGEMENT: RECENT CHANGES AND POLICY ALTERNATIVES 70 (May 1985).

22. *Id.* at 39.

23. The Hazardous and Solid Waste Amendments of 1984, Pub. L. No. 616, 98th Cong., 2d Sess., 98 Stat. 3221, 46 U.S.C. §§ 6901-7000 (1984).

24. For a discussion of the 1984 RCRA amendments and their impact on the landfill disposal of hazardous wastes, *see* CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 36-58.

ployed, so can wastes that are treated or disposed of in the same manner but differ according to the inherent degree of hazard. Consequently, another option is to impose a higher tax on wastes with a greater degree of hazard, thus raising their cost of treatment, storage, or disposal relative to other wastes.

A tax differentiated on the basis of degree of hazard has the effect of discouraging the treatment, storage, or disposal of wastes that in and of themselves pose the greatest risk to society. To the extent that the risk associated with different wastes varies, *ceteris paribus*, a differentiated waste-end tax may be more efficient than, for example, a flat tax. However, because this option does not distinguish between the TSD options employed, its primary effect would, in all likelihood, be on quantities of waste generated rather than on the TSD option employed.

*4) Differentiation on the Basis of Degree of Hazard and Disposal Option Employed*

The fourth type of waste-end tax considered here is differentiated according to both the degree of hazard associated with the waste in question and the final disposition of that waste (that is, it is fully differentiated). In theory, this form of a waste-end tax would most accurately reflect the social cost associated with the ultimate disposition of a specific hazardous waste stream. This is because the waste in question and the TSD option employed work together to generate the level of risk imposed on society. However, because it would impose the difficulties associated with waste-end tax systems 2 and 3 previously discussed, this version of a waste-end tax is probably the most difficult to administer.

## III. GOALS OF THE TAX SYSTEM

In the process of reviewing various Superfund reauthorization proposals and studies of the relative effectiveness of different tax systems, a number of associated goals were identified which the tax selected might be expected to achieve.[25] Depending upon the source, individual goals have received varying degrees of emphasis. Our purpose is not to evaluate the relative importance of these goals but to assess, qualitatively, the degree to which a given tax system can be expected to achieve each of the goals identified. The following seven goals are considered: 1) administrative feasibility, 2) revenue generation, 3) incentives for waste reduction/use

25. *See* notes 2, 5, 11, 14, 15, and 23 for references to these studies. *See also* DR. WILLIAM NORDHAUS AND MANAGEMENT ANALYSIS CENTER, INC., SUPERFUND FINANCING: AN ANALYSIS OF CERCLA TAXES AND ALTERNATIVE REVENUE APPROACHES (1984). (Management Analysis Center, Inc., 2828 Pennsylvania Ave. N.W., Washington, D.C. 20007) [hereinafter cited as MANAGEMENT ANALYSIS CENTER].

of alternative TSD methods, 4) equity, 5) economic efficiency, 6) reduced potential for litigation, and 7) complementarity of the tax to the overall regulatory scheme.

As it becomes apparent below, in the context of a particular tax system, certain of these goals are mutually exclusive. For example, a tax that induces producers to reduce the amount of hazardous waste they generate will, all other things held constant, inevitably lead to a reduction in the quantity of tax revenues collected over time. Similarly, a tax that accurately reflects the social costs associated with the generation and treatment/disposal of individual waste streams, that is, is economically efficient,[26] will in all likelihood be much more administratively cumbersome than a flat (per unit) tax placed on a few major hazardous wastes. The implication of this fact is that a combination of the tax systems being considered here may be preferred to any single tax system.

*Administrative Feasibility*

A necessary feature of any tax employed is that it be administratively feasible. Specifically, we are concerned with how easily the tax can be implemented, that is, the tax base[27] identified and enforced. Ease of enforcement implies that potential taxpayers can be reasonably monitored to ensure that they are paying the amount of tax required. All of this suggests the need for a sufficiently complete data base, for example, quantities and types of waste generated, TSD option employed, quantities of feedstocks produced, annual revenues of affected firms, and degree of hazard associate with specific wastes.[28]

*Revenue Generation*

One of the primary functions of the Superfund tax is to generate revenues to finance the cleanup of existing Superfund sites.[29] Consequently, it is important to assess the magnitude of revenues that a specific tax could be expected to generate, as well as the stability of the revenue

26. For a discussion of social costs and efficiency in waste disposal *see infra* text at notes 41-43. *See also* Carlson, Johnson and Ulen, *An Economic Analysis of Illinois' New Hazardous Waste Law—P.A. 82-572*, 24 NAT. RES. J. 865 (1984).

27. The tax base refers to the individuals responsible for paying the tax.

28. Note that the type of data required is a function of the specific tax implemented. With respect to data availability, one of the primary factors affecting ease of implementation and enforcement will be the number of potential taxpayers, i.e., the tax base. In general, it can be assumed that all other things held constant, the smaller the tax base, the easier it will be to implement and enforce the tax. For example, in the case of hazardous waste generation there are far fewer producers of primary chemical feedstocks than there are generators of hazardous wastes. This suggests that, for example, a feedstock tax would more easily achieve the goal of administrative feasibility than would a waste-end tax imposed on generators of hazardous wastes.

29. Additionally, revenues from the fund have been earmarked for the removal of accidental spills of hazardous substances. 42 U.S.C. § 9631 (1982).

stream over time. While any one of the tax structures being considered here is capable of generating a substantial amount of revenues, it is shown below that there may be differences with respect to the stability of the revenue stream over time.

*Incentives for Waste Reduction/Use of Alternative TSD Methods*

The number of Superfund sites ultimately cleaned up will depend not only upon the results of past TSD practices and waste generation rates, but upon current and future practices and generation rates as well. Consequently, as a means of minimizing the long-run costs of the Superfund program, one of the goals of the tax employed should be to encourage both reductions in the quantities of waste generated that require treatment, storage, or disposal, and shifts to TSD options that are less likely to result in the creation of new Superfund sites.[30]

*Equity*

It needs to be noted from the outset that there is no clearly established or generally agreed upon outcome that is considered "equitable" vis-a-vis tax incidence. This is especially true with respect to financing the cleanup of Superfund sites. Rather, a number of outcomes could be considered equitable depending upon one's point of view. With respect to the question of who should pay the cost of federally funded cleanups, three views are considered here.

The first view is reflected in the current law which is based on the belief that equity will be served by requiring that those whose past actions are responsible for the creation of Superfund sites, that is, generators or disposers of hazardous wastes or producers of input (feedstocks) which lead to the creation of hazardous wastes, pay for their cleanup.[31] A second, related but not identical, view is that those who have benefited from presumably less expensive past disposal practices should pay.[32] In this case, both producers and consumers of goods whose production generates hazardous wastes would be liable for Superfund cleanup costs. A third view maintains that, because the problems currently faced were not foreseen at the time that the wastes were disposed of, equity would best be served by spreading the financial burden of cleanup costs across as large a group as possible.[33] While all of these approaches result in what could

30. It should be clear that to the extent that the tax employed depends upon the quantity of waste generated and disposed of, this goal conflicts with the goal of a stable revenue stream over time. Resolution of this conflict is a matter for policymakers and is not considered here. Suffice it to say that a conflict could theoretically be mitigated through the imposition of a tax rate structure that increases over time, thus compensating for any reduction in the tax base resulting from waste reduction efforts.

31. U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 14, at 3-3.

32. *Id. See also* MANAGEMENT ANALYSIS CENTER, *supra* note 27, at 49-50.

33. Note that this view could be cited in support of the argument for the imposition of a broad-based tax. *See* MANAGEMENT ANALYSIS CENTER, *supra* note 27, at 49-50, and 88-89.

be viewed as an "equitable" solution, each involves a different tax base and hence a different distribution of impacts of the tax.

In addition to the notions of equity outlined above, public finance theory distinguishes between two primary approaches to equity in the context of tax incidence: the benefits principle and the ability-to-pay principle.[34] According to the benefits principle, an individual should pay an amount of tax that reflects the benefit that they receive from the public service in question.[35] This might suggest that the Superfund tax burden should be borne by all those individuals who benefit from ensuing cleanups, that is, society at large. However, this conclusion ignores the fact that these cleanups are necessitated by past actions of specific individuals—generators and disposers of hazardous wastes. In fact, benefits accrued to generators of hazardous wastes in the form of relatively low disposal costs, and hence lower overall production costs than would be the case under the current set of regulations governing the disposal of hazardous wastes. Assuming that the disposal costs initially incurred did not reflect the full costs of production, the benefits principle might therefore be cited as justification for a tax paid by producers to fund cleanup costs.

The second approach to equity in the context of public finance theory is the ability-to-pay principle. This principle holds that individuals should pay taxes based on the amount of income that they receive.[36] This approach is illustrated by the notions of horizontal and vertical equity. Horizontal equity is achieved by making individuals with equal incomes pay equal amounts of tax.[37] Vertical equity requires that individuals with different incomes be charged different amounts of tax.[38]

According to the ability-to-pay principle, if we assume that any Superfund tax should be borne by the parties responsible for the creation of Superfund sites, horizontal equity would require that firms generating similar income streams be taxed at equal rates. Additionally, a firm's tax rate should be in proportion to its income stream in order to achieve vertical equity. The ability-to-pay principle could in turn be combined with, and modified according to, any one of the three "equitable" solutions discussed above.

*Economic Efficiency*

When production activities result in the imposition of costs on third parties, that is, individuals who are neither producers nor consumers of the good in question, a negative externality is said to exist.[39] To the extent

34. R. MUSGRAVE & P. MUSGRAVE, PUBLIC FINANCE IN THEORY AND PRACTICE 211 (1976).
35. *Id.* at 212-14.
36. *Id.* at 215-17.
37. *Id.* at 216.
38. *Id.*
39. R. JUST, D. HUETH, & A. SCHMITZ, APPLIED WELFARE ECONOMICS AND PUBLIC POLICY, 268-74 (1982). An example of a negative externality is the risk imposed on society by the landfill disposal of a hazardous waste. To the extent that the generator of the hazardous waste does not take account of the increased risk to society, society is bearing a cost for which it receives no benefit.

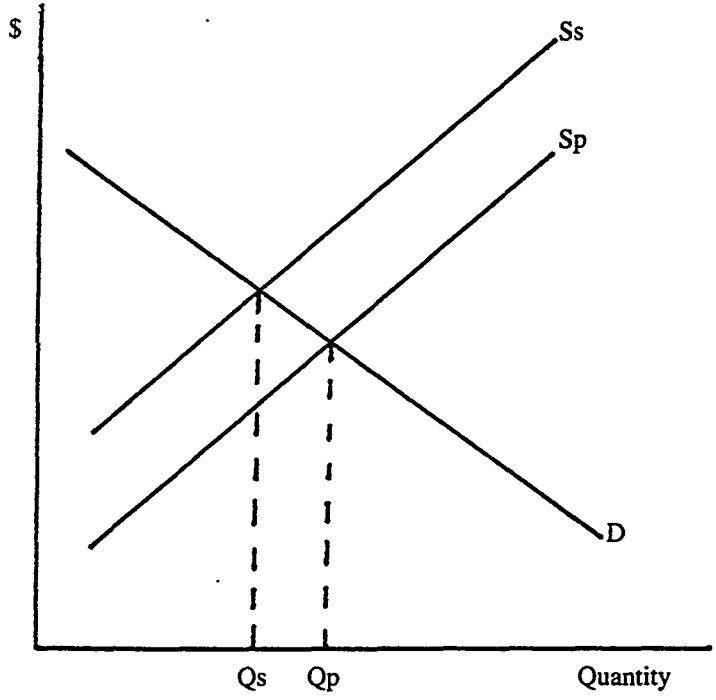


FIGURE 1

that such costs are not taken into account in the decision process the result will usually be to produce more of the good than is socially optimal. As an aid to understanding this concept consider Figure 1.

Figure 1 depicts the supply and demand schedules for a good, X, production of which results in the generation of a hazardous waste.[40] The supply curve, labelled Sp, reflects the private costs, that is, costs such as payment for productive inputs, incurred directly by the producer in the course of producing X. Considering only these private costs and the market demand for X, as indicated by the demand curve D, the equilibrium quantity of production is Qp.

However, because production of X results in the generation of a hazardous waste, there is a potential for additional costs to be imposed on society as a whole. These costs are a function of any risk that society may face as a result of the TSD option employed, and are assumed to be proportional to the total amount of risk involved. Assume that the waste is disposed in such a manner that a positive amount of risk is

40. For simplicity, X is assumed to be produced in a perfectly competitive market.

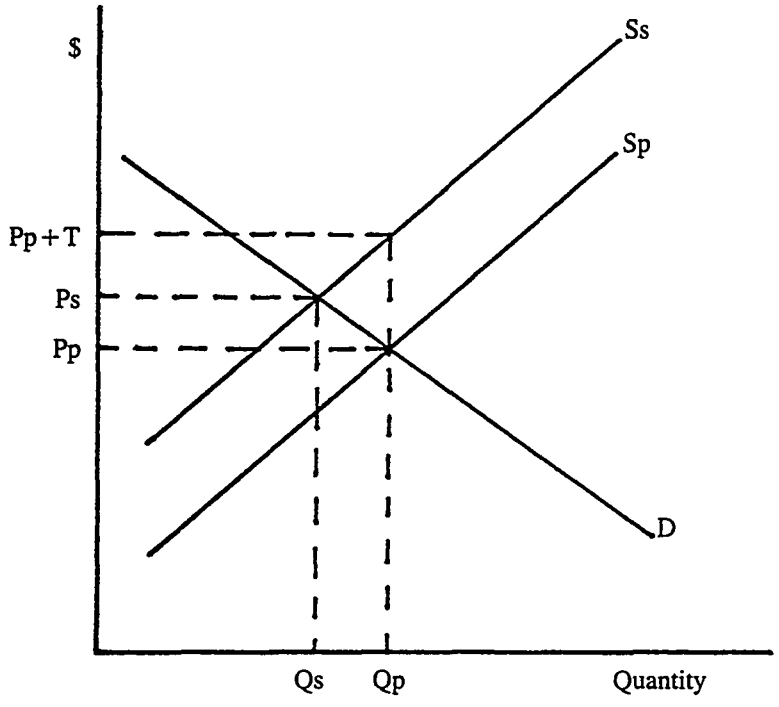


FIGURE 2

imposed on society. Taking account of these additional costs has the effect of shifting the supply curve up and to the left, such as Ss in Figure 1. (The greater the amount of risk involved, the greater this shift would be.) Ss reflects both the private and social costs of the production of X. Note that the new equilibrium quantity of output, Qs, is less than the equilibrium quantity resulting when only private production costs are taken into account.

The foregoing suggests that in those situations where a negative externality exists, policies should be pursued that will generate an upward shift of the supply curve, that is, lead to an "internalization of the externality." In this way, production levels will move toward the social optimum. Since the imposition of a tax on producers has the effect of shifting up the supply curve, taxes constitute a potential policy option.[41] Taxes, if properly designed, will also reflect the social cost associated with each level of output. Consider Figure 2.

The supply curve labeled Sp reflects the private costs of production,

41. JUST, HUETH, & SCHMITZ, *supra* note 41, at 275-76.

while the supply curve labeled Ss accounts for both private and social costs. The vertical difference between Ss and Sp, denoted by T in Figure 2, is therefore the per unit social cost of production. If, for simplicity, we assume that T is constant over the relevant range of output, then Ss is parallel to Sp. In the absence of intervention, equilibrium output will be Qp, clearly in excess of the social optimum Qs. However, if a tax equal to the amount of social cost, T, is imposed on producers, this will cause the supply curve Sp to shift up to, and coincide with, Ss. This is because producers will attempt to pass the tax on to consumers by raising the per unit price of their output by the amount T. As indicated in Figure 2, the ultimate effect of the imposition of a per unit tax of T, equal to the marginal social costs of production, is to generate the socially optimal level of output, Qs.

In the context of the Superfund cleanups, imposition of a tax on producers and disposers of hazardous wastes would provide revenues for cleanup operations while simultaneously encouraging the internalization of the social costs of waste generation and disposal. However, as the preceding discussion suggests, for maximum effect this tax should vary with individual waste streams; the tax rate being determined according to the amount of risk associated with each waste.

*Reduced Potential for Litigation*

An important but often overlooked aspect of government intervention in the market place is the likelihood that a specific law or regulation will precipitate legal action on the part of affected parties. Litigation involves costs to society and consequently should be taken into account in the assessment of the aggregate impacts of a proposed regulation or piece of legislation. Such costs include both the opportunity cost of human resources (lawyers, judges, etc.) and as in the case of Superfund, the delay in cleanup incurred while the legal dispute is settled.

In the context of tax proposals such as those considered here, the potential for litigation depends on a number of factors. These factors include: 1) how clearly the tax base is defined, that is, who is liable for the tax, and 2) the identification of activities and substances subject to the tax.

*Complementarity of the Tax to the Overall Regulatory Scheme*

While CERCLA and the Resource Conservation and Recovery Act of 1976 (RCRA)[42] are distinct pieces of legislation they nonetheless interact to a substantial degree. What differences do exist are primarily of a temporal origin, that is, RCRA is concerned with the disposition of newly

42. 42 U.S.C. §§ 6901-87 (1982).

created hazardous wastes,[43] while CERCLA is concerned with wastes previously disposed of.[44] Hence, it is important to take into account the effects of provisions in one piece of legislation on the goals of the other. To the extent that the provisions of CERCLA encourage the realization of the goals associated with RCRA, additional gains in social welfare may be realized.

## IV. ANALYSIS OF THE TAX ALTERNATIVES IN THE CONTEXT OF THE POLICY GOALS

In this section, each of the alternative tax mechanisms are examined and compared in the context of the seven goals identified above. For simplicity, the six tax alternatives are grouped together under the principal headings of feedstock taxes, broad-based industry taxes, and waste-end taxes. The instances are explicitly noted where the outcome of the analysis is dependent upon the specific form of a tax, for example, version of a waste-end tax.

### *Administrative Feasibility*

The bulk of the original Superfund revenues was provided by a feedstock tax on 42 primary chemicals and crude oil going to refineries or imported into the U.S.[45] Experience with the feedstock tax indicates that it embodies a high degree of administrative flexibility, that is, it has been relatively simple to administer and enforce. Approximately 600 firms contributed to the original Superfund via feedstock taxes. In fact, however, almost 50 percent of the current tax has been borne by ten major chemical and petroleum companies.[46] This relatively small tax base facilitates the monitoring of tax payments and potential tax liabilities.

A broad-based industry tax would affect a substantially larger tax base than would a feedstock tax similar to the one provided for in the original Superfund.[47] However, because a broad-based industry tax such as an excise tax on the sales of firms could utilize data already collected and reported for tax purposes, it should be fairly easy to administer. Additionally, in the absence of income tax evasion on the part of affected firms, enforcement should be relatively easy since payment of the tax could be incorporated into existing tax schedules filed by firms each year.[48]

Unlike feedstock taxes or a broad-based industry tax, a waste-end tax would impose substantial new data requirements. Depending upon the

43. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at xiii.
44. *Id.*
45. *See supra* text at note 13.
46. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 32.
47. *Id.* at 89.
48. MANAGEMENT ANALYSIS CENTER, *supra* note 27, at 96-99.

specific form of the waste-end tax, the agency charged with the responsiblity of collecting the tax would require data on the number and identity of potential taxpayers (true for any of the tax mechanisms considered here); the quantities of waste being treated, stored, or disposed; and the type(s) of treatment, storage, and disposal option(s) being utilized by each. Clearly, the amount of additional data required to successfully administer and enforce the tax will increase with the complexity of the waste-end tax. To the extent that this data is not readily available this factor may seriously undercut the administrative feasibility of a waste-end tax.[49]

*Revenue Generation*

Experience to date indicates that a feedstock tax is capable of generating substantial revenues (that is, $250 million per year[50]). However, while the revenue stream should be fairly stable if tax rates are kept relatively low, stability could be adversely affected to the extent that higher rates generate negative secondary impacts in affected markets. For example, substantial reductions in the quantity of feedstocks demanded could result from the increase in price brought on by the tax.[51] Given that the tax rates proposed thus far are a fixed dollar amount per unit of output this would lead to less tax revenues than the estimate of revenue when such quantity reductions are not accounted for.

Proponents of a broad-based industry tax have pointed to revenue generating capabilities as a prime argument in favor of its adoption. For example, the Congressional Budget Office has estimated that a tax of 5.5 percent on the sales of firms whose net corporate receipts exceed $5 million annually could generate $1 billion in annual tax revenues.[52] Additionally, it has been estimated that an 8 percent tax on the sales of firms in excess of $10 million would raise the price of most products by a few tenths of one cent.[53] This suggests that, to the extent that the tax does not undermine the stability of the tax base, the resulting revenue stream could be expected to remain fairly stable over time.

49. A great deal of this data is currently unavailable in a comprehensive format. To date, there is no sound estimate of the actual number of hazardous waste generators operating in the United States. More importantly, there is not a current data base that records the amount of hazardous waste generated or the disposition of that waste by TSD option employed. The EPA has undertaken efforts to estimate these figures. However, their efforts have met with considerable difficulties thus far and are not expected to generate reliable results in the near future. *See also* U.S. GENERAL ACCOUNTING OFFICE, *supra* note 20, and OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 4, at 46-48.

50. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 32.

51. This, in fact, is the argument that feedstock industries have made in the course of the debate over the reauthorization of Superfund. Studies that have been cited in support of the industries' point include MANAGEMENT ANALYSIS CENTER, *supra* note 27.

52. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 89.

53. MANAGEMENT ANALYSIS CENTER, IMPACT OF SUPERFUND EXCISE TAX ON SELECTED CONSUMER GOODS AND SERVICES 2 (Nov. 4, 1985).

The revenue generating capability of a waste-end tax as well as the stability of the resulting revenue stream will depend on the form of the waste-end tax in question. Recent studies indicate that, depending upon the form of the waste-end tax, between $0.3 billion and $2.7 billion could be generated in the first year.[54] However, it is important to note that in as much as a waste-end tax is successful in encouraging waste reduction and shifts to recycling and recovery of hazardous wastes, this will reduce the stability of the revenue stream over time. According to the studies we examined, depending on the form of the waste-end tax employed, annual revenues could be expected to decline by as much as 50 percent over a five-year period.[55]

*Incentives for Waste Reduction*

The economic effect of a feedstock tax is to increase the price of certain inputs to production processes. In the case of chemical feedstocks, the effect is to increase the price of inputs that are presumed to result in the generation of hazardous wastes. This increased price may induce a reduction in the quantity of the input employed in the production process and hence a reduction in the quantity of hazardous waste generated. However, a flat feedstock tax does not provide any direct incentive for waste reduction or shifts in waste management techniques employed, because the amount of the tax paid is not a function of either of these factors. Any reductions in waste generation that did result from the tax would instead be the result of shifts to lower-priced substitute inputs which lead to the generation of a smaller quantity of hazardous waste per unit of output. Consequently, the potential for waste reduction as a result of the imposition of a per unit feedstock tax appears to be low.

It was noted above that the impact of a broad-based tax on individual firms should be relatively small.[56] Additionally, the tax is in no way related to waste generation by specific firms or the type of TSD option employed. This suggests that a broad-based tax would have little effect on waste generation rates or the type of TSD option employed.

Of the tax alternatives considered here, waste-end taxes possess the greatest potential for encouraging waste reduction and shifts between waste management techniques. This derives from the fact that waste-end taxes provide a direct economic incentive for firms to reduce the quantity of waste they generate. Additionally, a tax based on the type of TSD option employed will create an incentive for shifts to relatively less costly TSD options. However, for a tax to have any measurable impact on the

54. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 72, and OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 4, at 46-48.

55. CONGRESSIONAL BUDGET OFFICE, *supra* note 23, at 72.

56. *See supra* text at note 55.

latter, it would have to be of sufficient magnitude to offset any price advantage that less desirable management techniques may currently possess.[57]

Of the various forms of a waste-end tax we have considered, a fully differentiated waste-end tax, that is, one differentiated on the basis of degree of hazard and TSD option employed, should have the greatest combined effect on waste generation rates and type of TSD option employed. Conversely, a flat waste-end tax can be expected to be less effective. However, it is important to bear in mind the trade-off between waste reduction and the stability of the revenue stream over time. This trade-off will be greatest with a fully differentiated waste-end tax and least with a flat waste-end tax. How policymakers view the relative importance of these two goals will determine which of the two approaches, in fact, is preferred.

*Equity*

Although a feedstock tax ostensibly places the burden of financing the cleanup of Superfund sites on those individuals responsible for their creation—generators and disposers of hazardous wastes—it is not clear that such a tax is, in fact, equitable. This assertion is based on the observation that there is not a clear match between the quantities of wastes attributable to the feedstocks taxed and wastes found at Superfund sites.[58] Additionally, depending on how much of the tax is passed on to specific consumers of the feedstock being taxed (that is, producers of intermediate and final goods who are in turn generators of wastes found at Superfund sites), the burden of Superfund financing borne by responsible parties may not be proportionate to the amount of Superfund costs they are responsible for. Finally, if feedstock producing industries suffer substantial adverse economic impacts as a result of imposition of the tax, justification for the tax on the basis of the ability-to-pay principle may be seriously eroded.

It has been noted above that a broad-based industry tax has the advantage of spreading the financial burden of cleanup across broad segments of industry with the result that the impact on individual firms is minimal.[59] To the extent that responsible parties cannot be identified and forced to pay the costs of cleanup, such a tax could then be thought of as equitable. Specifically, it is argued that a broad range of producers and consumers benefited from past disposal practices in the form of lower production costs and product prices. However, a tax on current producers

57. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 4, at 46.
58. U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 14, at 5-4, 5.
59. *See supra* text at note 54.

and consumers of those goods would not necessarily fall on the same individuals who realized past benefits. By spreading out the tax burden over as many taxpayers as possible, a broad-based tax would minimize the amount of inequity suffered by any one individual in the tax base.

Finally, waste-end taxes are frequently cited as an equitable means of financing Superfund cleanups. To the extent that wastes generated and disposed of end up at Superfund sites, responsible parties would, in fact, bear the cleanup costs. However, it is not certain that the amount of tax paid would equal the cleanup costs incurred. Additionally, there is the possibility that many hazardous wastes generated and disposed of will never require the expenditure of Superfund revenues. Consequently, it is not certain that a waste-end tax could be interpreted as being equitable in all instances.

*Economic Efficiency*

In the initial version of CERCLA, individual feedstock taxes were calculated on the basis of the percentage amount of hazardous wastes generated attributable to each feedstock.[60] While this may serve as a useful first approximation to the amount of the various constituents found at Superfund sites, the efficiency of this tax is questionable. First, it does not recognize the relationship between specific wastes and the amount of risk they pose. For example, two hazardous wastes, A and B, associated with different feedstocks may be generated in equal amounts but pose substantially different levels of risk when disposed in a landfill. Because each imposes a different marginal social cost per unit of waste disposed, the feedstocks should be taxed at different rates in an effort to achieve a socially efficient outcome. The implication is that any form of a feedstock tax that does not take into account the degree of hazard will in all likelihood fail to generate an economically efficient outcome.

The second source of uncertainty about the efficiency of any feedstock tax concerns the degree to which the tax is borne by the actual generators and disposers of the hazardous wastes associated with the feedstock taxed. To the extent that feedstock producers are unable to pass through the tax to the actual producers of the hazardous wastes, the incentive for waste reduction, etc., is lost. The upshot is that generators and disposers of hazardous wastes will not take all of the social costs of production into account in their decision making process.

A broad-based tax would not appear to create incentives for generators of hazardous wastes to reduce the quantity of wastes generated or shift to more reliable TSD options. This stems from the fact that the tax is not related to the generation or disposal of hazardous wastes. Additionally,

60. *See supra* text at note 14.

the tax rates proposed thus far are so small as to create little, if any, incentive for generators of hazardous wastes to alter their behavior. Consequently, a broad-based tax would appear to be least likely to achieve an efficient solution to the problem of cleaning up abandoned hazardous waste disposal sites.

Of the three types of taxes considered, waste-end taxes have the greatest potential for achieving an economically efficient solution to the problem of hazardous waste disposal and cleanup. As indicated above, efficiency requires that producers consider the full costs of production when deciding how much to produce. A waste-end tax induces this type of behavior and, in the process, may lead to a reduction in the number of potential future hazardous waste disposal sites requiring remedial action.

It is important to point out, however, that the form of the waste-end tax employed will have a substantial impact on the level of efficiency realized. Specifically, from a theoretical perspective, a waste-end tax differentiated on the basis of degree of hazard and TSD option employed could be expected to be the most efficient of the different waste-end taxes considered here, with respect to its effect on waste generation and disposal. On the other hand, if tax rates are set relatively low, a flat, per unit waste-end tax may be no more efficient than any other tax structures we have considered.[61]

*Potential for Litigation*

Experience to date indicates that a flat feedstock tax provides little potential for litigation by affected parties. The requirements as to who pays, and how much, are straightforward. This leaves little opportunity for dispute over tax liabilities. The same conclusion applies to broad-based taxes.

In the case of a waste-end tax, as the complexity of the tax increases, so does the potential for litigation contesting the tax. For example, there will be an incentive for firms producing wastes classified as most hazardous to contest this categorization in an effort to reduce their potential tax bill. This incentive will increase with the tax rate imposed. Litigation may take the form of suits contesting the validity of the test or criteria used to classify wastes according to degree of hazard. Additionally, suit could be brought on an individual basis for specific waste streams.

*Complementarity of the Tax to the Overall Regulatory Scheme*

Neither a feedstock tax nor a broad-based industry tax can be expected to appreciably affect the realization of goals associated with hazardous

61. The point here is that if the tax does not alter the behavior of the affected firms, i.e., there is not a shift in the selection of the TSD options they employ or the amount of waste generated, then the overall efficiency associated with the market has not been altered.

waste legislation such as RCRA. Clearly, because it is unrelated to hazardous waste generation and disposal, a broad-based industry tax would be relatively ineffectual in this respect. In the case of a feedstock tax, the impact on waste generation and disposal is indirect, at best, as indicated in the discussion of feedstock taxes and waste reduction efforts.[62]

Waste-end taxes, on the other hand, by their very nature act as a complement to the requirements of RCRA. This effect is strongest in the case of a waste-end tax differentiated according to the degree of hazard associated with the waste in question and the disposal technique employed. However, even in the case of a flat waste-end tax, establishing a tax that is large enough to affect the quantity of wastes disposed would facilitate the RCRA goal of reduced risk from hazardous waste generation and disposal.

## V. SUMMARY

Both the feedstock tax and the broad-based industry tax can be expected to be fairly easy to administer. Additionally, both tax mechanisms could generate a fairly substantial and constant revenue stream over time.[63] These conclusions are borne out by the experience with the current CERCLA feedstock tax and recent studies that have estimated the impact of the broad-based industry tax on industrial output and tax revenues.[64]

A waste-end tax is also capable of generating substantial revenues. However, to the extent that such a tax is successful in encouraging waste reduction and the use of lower-taxed TSD methods (as would be the case under waste-end tax options 2, 3, and 4), tax revenues could be expected to decline over time. Additionally, as the complexity of the waste-end tax increases, associated data requirements could severely limit the administrative feasibility of such an approach, especially in the near term.[65]

With respect to incentives for waste reduction and the use of alternative TSD options, waste-end taxes possess a clear advantage. Moreover, as the complexity of the waste-end tax increases, so does its ability to achieve this goal, *ceteris paribus*.[66] Feedstock taxes offer an indirect incentive for waste reduction efforts and have no impact on the TSD option employed. Finally, broad-based taxes would appear to be largely ineffective on both counts.

As noted in the discussion of equity vis-a-vis cleanup of abandoned

62. *See supra* text at notes 57-58.

63. In the case of feedstock taxes this assertion assumes that tax rates are not set too high.

64. *See supra* text at notes 54-55.

65. Of the waste-end taxes considered, the flat tax is the simplest and the fully differentiated tax is the most complex.

66. Note, however, that to the extent the incentive for waste reduction is positively related to the complexity of the tax structure employed, ease of administration, which is inversely related to the complexity of the tax structure, and the goal of waste reduction are inversely related.

hazardous waste sites,[67] identifying the equitable approach is no simple matter. In fact, a number of different approaches could be considered equitable depending on one's point of view. As such, none of the alternative tax mechanisms considered stands out as clearly more equitable than the others. Even a waste-end tax cannot be assumed clearly superior because there is not an established one-to-one relationship between those individuals who would pay the tax and those parties whose past actions are responsible for existing Superfund sites.

With respect to economic efficiency, assuming that the tax is set at the proper level, a fully differentiated waste-end tax creates the greatest incentives for efficient behavior by generators of hazardous wastes. However, it cannot be concluded that a more simple waste-end tax, that is, a flat tax, would be any more efficient than a feedstock tax, or even a broad-based tax for that matter. This latter conclusion reflects the minimal incentives for waste reduction and the use of alternative TSD options associated with a flat waste-end tax.

Of the three major types of tax mechanisms we have considered here, it would appear that waste-end taxes are most likely to be litigated. This results from the greater potential for disputes over the treatment or classification of specific waste streams. Feedstock taxes and broad-based taxes are, by contrast, rather straightforward in their application. On the other hand, waste-end taxes would probably most effectively complement the goals and objectives of RCRA. This results primarily from the ability of a waste-end tax to encourage waste reduction efforts as well as the use of socially preferred TSD options.

In summary, none of the alternative tax mechanisms we have examined here clearly dominates. Rather, the relative importance that society places on the various goals the tax is intended to achieve will determine which of the tax structures better serves society's interests. In fact, as was noted in the introduction to Part III, a combination of these taxes may prove most beneficial. These are questions, however, that must be left to policymakers.

67. *See supra* text at notes 32-40.