



# Economic Incentives

## Options For Environmental Protection



**ECONOMIC INCENTIVES:  
OPTIONS FOR ENVIRONMENTAL PROTECTION**

Report of the  
U.S. Environmental Protection Agency  
Economic Incentives Task Force

March 1991

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	vii
INTRODUCTION .....	CHAPTER 1
Why Pursue Economic Incentives .....	1-1
Traditional "Command-and-Control" Regulations .....	1-1
Use of Economic Incentives in the U.S .....	1-2
International Experience with Economic Incentives .....	1-2
Criteria for Evaluating Incentives .....	1-4
MUNICIPAL SOLID WASTE INCENTIVES .....	CHAPTER 2
Introduction .....	2-1
Volume Based Pricing of Municipal Waste Services .....	2-7
Incentives to Recycle Scrap Tires .....	2-13
Deposit/Refund System for Lead-Acid Batteries .....	2-18
Credit System or Deposit/Refund System for Used Oil.....	2-22
Other MSW Incentives .....	2-27
GLOBAL CLIMATE CHANGE INCENTIVES .....	CHAPTER 3
Introduction .....	3-1
Fee on Carbon Content in Fossil Fuels .....	3-4
International Trading of Greenhouse Gas Emission Rights .....	3-7
Incentives to Encourage Electricity Conservation .....	3-11
"Sipper/Guzzler" Rebate/Fee .....	3-17
WATER RESOURCE INCENTIVES .....	CHAPTER 4
Introduction .....	4-1
Changes in the Pricing of Water .....	4-6
Deposit/Refund or Tax/Rebate System for Pesticide Containers .....	4-10
Reduction of Federal Subsidies Encouraging Development in Coastal Areas .....	4-14

MULTI-MEDIA INCENTIVES ..... CHAPTER 5

Introduction .....5-1  
Fees on VOC Emissions from Major Stationary Sources ....5-5  
Market Incentives to Reduce Consumer and  
Commercial Use of Solvents .....5-10  
Deposit/Refund System for Chlorinated Solvents .....5-18  
Labeling of "Environmentally Responsible" Products.....5-22  
Marketable Permit or Surcharge System for Lead .....5-26  
Charge on TRI Releases .....5-30  
Reduction of Federal Subsidies Encouraging  
Virgin Material Use .....5-33  
Federal Procurement Policy Initiatives.....5-38

## Administrator's Preface

Since its creation two decades ago, EPA has made great strides in protecting the environment. For the most part, these environmental improvements were made through the use of "command-and-control" regulation; that is, promulgation of uniform, source-specific emission or effluent limits backed up by the threat of enforcement actions.

Yet it is becoming increasingly clear that reliance on the command-and-control approach to environmental regulation will not, by itself, allow EPA to achieve its mission or many long-established environmental goals. A number of persistent, seemingly intractable problems remain. Whereas in the past we focused mainly on controlling pollution from large, industrial sources, we are now confronted by environmental concerns that stem from a diverse range of products and activities. Some of these new problems are global in scope, such as stratospheric ozone depletion and global climate change. These kinds of problems typically are less amenable to traditional command-and-control approaches than are large, industrial sources.

To maintain progress toward our environmental goals, we must move beyond a prescriptive approach by adding innovative policy instruments such as economic incentives. Properly employed, economic incentives can be a powerful force for environmental improvement.

Because economic incentives influence rather than dictate action, consumers and businesses can make their own choices. Economic incentives can stimulate private firms and individuals to take actions that serve their economic interests while spurring progress on environmental goals. When designed properly, economic incentives harness the marketplace to work for the environment.

Consideration of economic incentives could not be more timely. Another EPA report ("Environmental Investments: The Cost Of A Clean Environment", 1990) makes clear that the proportion of U.S. GNP devoted to environmental protection is projected to grow significantly (from about 1.7 percent in 1990 to nearly 3 percent) by the year 2000. Most of these costs will be borne by the private sector. Only a handful of other countries -- The Netherlands, and perhaps Canada and Germany -- spend a similar proportion of their Gross National Product on environmental protection.

This level of expenditures thus raises important issues for maintaining U.S. competitiveness in the global economy. Nevertheless, I don't for a moment believe that we should pull back from our environmental commitments. After all, the benefits of environmental protection are substantial. Yet I have concluded that, as we pursue our environmental goals, we must do so in the most cost-effective manner. Today, economic incentives offer an historic opportunity to help reconcile the nation's economic and environmental agendas.

EPA has used economic incentives for a number of years. Our emissions trading policy and our program to phase down the use of lead in gasoline are two prime examples. The wisdom of using economic incentives has also been recognized by both the Bush Administration and Congress. The Clean Air Act Amendments

proposed by the President and adopted by Congress, for instance, contain a market-based acid rain program that would allow utilities to buy or sell emission "allowances" to achieve compliance at reduced cost.

Mindful of the advantages of economic incentives, when I arrived at EPA, early in 1989, I asked the staff to identify ways economic incentives could be used to improve environmental protection. The Economic Incentives Task Force drew upon the experience and expertise of every program in EPA to develop and evaluate a broad array of incentive proposals. Drafts of the report also benefitted substantially from review by our colleagues in other agencies. Needless to say, however, the final text is a product of the Environmental Protection Agency.

I want to stress that this report does not endorse any particular proposal. Nor is EPA prepared now to render judgement on the effectiveness of any specific incentive. Rather, I hope the report will stimulate a continuing dialogue among policymakers on the role and efficiency of economic incentives in environmental policy. The Task Force has tried to advance the dialogue by examining some of the key design and implementation issues surrounding the use of each incentive. I welcome your comments.

William K. Reilly  
Administrator  
March, 1991

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## EXECUTIVE SUMMARY

### Types of Incentive Policies

Incentive-based policies influence rather than dictate the actions of the targeted parties. Incentive-based policies leave the ultimate choice of action to the affected parties, based on their own evaluation of the costs and benefits of the action. By correcting the incentives faced by private parties to reflect important social costs as well as private costs, incentives policies encourage private decisions that more closely approximate socially optimal outcomes.

A variety of market-based measures may be used to promote environmental goals. These include:

- o Creation of Markets - creation of tradable government-issued privileges to discharge pollutants or use scarce environmental resources;
- o Monetary Incentives - methods to change market incentives, including direct subsidies, reduction of subsidies that produce adverse environmental effects, fees, and taxes;
- o Deposit/Refund Systems - schemes to discourage disposal and encourage central collection of specific products;
- o Information Disclosure - actions to improve existing market operations by providing information to consumers; and
- o Procurement Policies - means by which the federal government uses its own buying power to stimulate development of markets -- e.g., for recycled products.

The Task Force and its subcommittees compiled a list of potential applications of a wide range of incentive approaches to address municipal waste management problems, global climate change, water resources, and multi-media concerns (see Exhibit 1). These approaches include fees, information policies (labeling), marketable rights, deposit/refund systems, reduction of federal subsidies with perverse effects, and procurement programs.

A key issue in the design and analysis of incentive policies, as in the case of traditional regulatory approaches, is whether the perceived environmental problem is serious enough to warrant government intervention in the first place. The Task

## EXHIBIT 1

### OVERVIEW OF INCENTIVE APPROACHES

#### Municipal Solid Waste Incentives

1. Volume-Based Pricing of Municipal Waste Services
2. Incentives to Recycle Scrap Tires
3. Deposit/Refund System for Lead-Acid Batteries
4. Credit System or Deposit/Refund System for Used Oil
5. Other MSW Incentive Applications

#### Global Climate Change Incentives

1. Fee on Carbon Content in Fossil Fuels
2. International Trading of Greenhouse Gas Emission Rights
3. Incentives to Encourage Electricity Conservation
4. "Sipper/Guzzler" Rebate/Fee to Encourage Purchases of More Fuel-Efficient Vehicles

#### Water Resource Incentives

1. Changes in the Pricing of Water
2. Deposit/Refund or Tax/Rebate System for Pesticide Containers
3. Reduction of Federal Subsidies Encouraging Development in Coastal Areas

#### Multi-Media Incentives

1. Local Fees on VOC Emissions from Major Sources
2. Market Incentives to Reduce Consumer and Commercial Use of Solvents
3. Deposit/Refund System for Chlorinated Solvents
4. Labeling of "Environmentally Responsible" Products
5. Marketable Permit or Surcharge System for Lead
6. Charge on TRI Releases
7. Reduction of Federal Subsidies Encouraging Use of Virgin Materials
8. Federal Procurement Policy Initiatives

Force was concerned to avoid any possible implication that the elegance and flexibility of economic approaches allows them to be applied more indiscriminately than other types of intervention. Ideally, intervention of all types should be designed to maximize net social benefits -- i.e., the difference between total benefits and total costs.

### Evaluation Criteria

The Task Force defined an initial set of criteria for evaluating the merits of specific incentive-based policies. These criteria address both the need for government intervention of any sort, based on the existence of some market failure that causes socially undesirable use of environmental resources, and the relative merits of incentive-based and other policy approaches where intervention is justified.

Six general criteria were suggested by the Task Force:

- o Is the environmental problem the result of some externality?
- o How significant is the resulting environmental problem?
- o Which jurisdiction (local, state, or federal government) can most effectively address the problem?
- o Will an incentive-based approach help maximize net social benefits?
- o Is an incentive-based approach feasible?
- o Will a particular incentive-based policy be effective?

In many cases, the information required to apply these criteria to evaluate specific policies is not currently available. Therefore, the evaluation of suggested policies relied heavily on the expert judgment of the Task Force members. More analysis is needed to assess the merits of each generic policy, and careful assessment of costs and benefits is a necessary prerequisite to the identification of specific policy options. Absent these analyses, none of the specific policies is currently recommended for adoption.

Although every possible incentive approach for each environmental problem was not considered, the list of policies was sufficiently diverse to include the major incentive approaches in some form.

**WHY PURSUE ECONOMIC INCENTIVES?**

Environmental improvements have been significant over the last twenty years, but these improvements have come at significant cost. Substantial resources have been spent by all levels of government to develop, administer, and enforce regulatory programs. Vastly greater amounts are being spent by private parties to comply with these regulations. The high potential cost of future environmental improvements makes concern about balancing policy costs and benefits a high priority.

The need for government policies to achieve environmental goals derives from the existence of market failures that make private market solutions less than optimal. In particular, environmental policies are needed to address externalities caused by a divergence between the private and social costs of activities that cause environmental damages. In most cases, private markets do not exist for environmental resources (breathable air, water suitable for drinking or recreation, etc.). Private decisions about uses of environmental resources are, therefore, often not based on the full social cost of those uses. Without government intervention, too much activity that imposes environmental costs and too little investment in environmental protection will occur. Generally, elimination of all externalities is not practical or desirable. Government intervention should be designed to encourage the socially optimal amount of environmental protection.

**TRADITIONAL "COMMAND-AND-CONTROL" REGULATIONS**

For the past two decades, EPA has relied heavily on traditional regulations to address all forms of pollution. While these regulations have in many cases dramatically improved environmental quality, in other cases they have not fully achieved environmental goals, or have done so at costs that are higher than necessary. Well-designed, command-and-control regulations can increase social welfare, if they impose requirements only where the benefits of regulatory action outweigh the costs borne to reduce the contamination. Given the wide diversity both in compliance costs and in resulting environmental benefits, it has often proved difficult to design simple and enforceable regulations that meet this standard.

**USE OF ECONOMIC INCENTIVES IN THE U.S.**

Economic incentives seek to correct market failures directly, by changing the costs faced by private decision-makers to reflect the full social costs of their actions. Incentive-based policies seek to influence but not to dictate the actions of the targeted parties. If incentives are properly designed, private actions can more closely approximate the socially optimal use of environmental resources.

Some forms of incentives, such as tradable permits, have been studied and applied by EPA for a number of years. In the new Clean Air Act and elsewhere, we are expanding the use of market-based incentives, such as fees and marketable permits. Market-based initiatives are now a major part of our approach to the problem of acid rain. The Clean Air Act includes the use of tradable emission allowances to reduce in a more cost-effective way sulfur dioxide emissions from utility plants that contribute to acid rain. Economic incentives offer the promise of achieving environmental improvements more cost-effectively in other areas as well. At the state and local levels, pricing of municipal solid waste collection based on the volume disposed is an example of such a practice.

## **INTERNATIONAL EXPERIENCE WITH ECONOMIC INCENTIVES**

Experience with market-based incentives for environmental protection is not limited to the United States. A recent review by the Organization of Economic Cooperation and Development (OECD) identified 150 different applications of economic instruments in 14 countries.<sup>1</sup> While the vast majority of these are not primarily aimed at internalizing environmental costs or modifying environmental behavior, a number do have a significant incentive component.

### **Deposit-Refund Programs**

Numerous deposit-refund systems exist in OECD countries for beer and soft-drink bottles. Most were introduced by the private sector for economic reasons. They have tended to be effective, efficient, and easily administered. Under these systems, the polluter who does not return the container bears more than the direct costs of disposal. Norway and Finland have enacted taxes on non-returnable containers, to prevent excessive use of new materials such as plastics, which have generally not been covered by deposit/refund programs. Norway and Sweden have also instituted deposit-refund systems for junk cars.

### **Market Creation**

While U.S. emissions trading programs are the premier examples of market creation in the environmental area, several other examples exist. Germany has followed the U.S. lead with an air emissions trading program. However, the current German program is highly constrained and has been little used.

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<sup>1</sup>See "Economic Instruments for Environmental Protection," OECD, Paris, 1989, for details on the mechanisms discussed in this section.

Recognizing this weakness, the government plans to expand the program and place it on a more secure footing.

### **Subsidies**

Two examples exist where governments have used price intervention (subsidies) to create or sustain a market important to environmental protection. Finland provides freight rail discounts on vehicle wrecks, other metal scrap, paper, glass, and textile wastes being transported for recycling. Similarly, in the Netherlands, 10 to 15 percent of the municipalities guarantee newspaper collectors (usually schools and charities) a minimum fixed price for collected paper to stabilize the collection process in the face of highly variable prices that would otherwise be offered by recycling firms.

### **Differential Taxes**

A number of European countries have employed differential taxes for leaded versus unleaded gasoline, and for the characteristics of cars related to air pollution. These programs have generally been designed to be revenue neutral, with a combination of surcharge and discount added to an existing tax. They have usually been viewed as only transitional instruments, since direct regulations also exist.

### **Fees**

While the vast majority of fee (tax) systems currently in use in OECD countries have revenue raising as their principal motivation, several are noteworthy because of their incentive aspects. Austria's nominal fee on pesticides and fertilizers reduced consumption of these materials by 30 percent over a two-year period, even though the fee was not designed as an incentive. Finland is considering expanding its fee on phosphate in fertilizers to include nitrogen content. Finland also taxes the carbon content of fossil fuels, and Sweden will impose a CO<sub>2</sub> tax beginning next January. Sweden also plans to impose a sulfur emissions tax of \$4.90 per kilogram on the sulfur content of fuel, with the possibility of a refund if emissions are controlled.

Denmark has a tax on raw materials used by the construction industry to encourage recycling. It has also established a 20 percent tax on pesticides in small containers.

The Netherlands has adopted, but has not succeeded in implementing, a manure charge. It is combined with direct regulations but is expected to have a significant incentive effect. For manure levels greater than 125 kgs per hectare, a relatively steep fee will be imposed. Funds raised will be used for research and pilot projects. The charge is also expected to counteract agricultural overproduction by reducing the quantity of chickens and pigs raised. Implementation has been delayed by the government because of resistance by farmers to the lack of adequate lead time and the complexity of the associated new accounting system.

As a final example, Sweden will initiate a NO<sub>x</sub> emission fee next year. Because of difficulties measuring NO<sub>x</sub> emissions, the charge will cover only 150 to 200 large furnaces. To avoid discriminating against these large furnaces, the charge has been set up to be revenue neutral. All funds raised will be returned to the affected facilities based on the amount of energy they produce. This will reward low-emitting operations and penalize facilities with high NO<sub>x</sub> emissions per unit of production.

## **CRITERIA FOR EVALUATING INCENTIVES**

As we continue to evaluate incentive approaches to environmental protection, we must agree on a set of criteria for determining when incentive policies should be adopted. The merits of an incentive program relative to the merits of no government action or of some other policy approach will differ in each application. We suggest the following list of criteria as a basis for future discussion. While the incentives discussed in this report were suggested with these criteria in mind, they have not yet been rigorously tested against them. Future debate on these and other incentives will benefit by more explicit testing against these fundamental standards.

### **Is the Environmental Problem the Result of an Externality?**

Any government intervention to achieve environmental goals should be based on the existence of a market failure (an "externality"). An "externality" is a cost that is borne by a person other than the person who caused the cost to arise. For example, a smokestack emitting thick black smoke may impose a cost on an open-air restaurant immediately downwind. Because the owner of the smokestack does not bear the cost of the smoke emission, he will not take that cost into account when he determines the appropriate level of emission reduction (i.e., the cost is "external" to his decision process). An appropriate government policy would induce the owner to take those costs into account, i.e., "internalize" the external cost.

Absent market failure, environmental degradation is not by itself sufficient to justify government action. After all externalities have been internalized to decision makers, some pollution may continue to exist. Cost-beneficial policies must reflect the trade-offs between environmental protection and other societal goals. Therefore, the first step in evaluating any policy proposal is to determine whether and why existing private markets fail, and what adjustments are required to redress environmental market failures.

### **Is the Environmental Problem Significant?**

Generally, policy action is justified only where the benefits derived from the action are greater than the action's cost (in general, interventions should be designed to maximize the difference between total benefits and total costs). One component of the cost of a policy action is the expenditure of government resources to develop and enforce the policy. If an environmental problem is not significant, a policy action to address that problem is unlikely to generate significant

benefits. Consequently, even if the cost of compliance for the private sector is relatively modest, the policy is unlikely to promise positive net benefits because of the policy development costs. Therefore, the greatest effort to develop ideas for incentives ought to be focused on the most significant cases of environmental contamination, where one is most likely to find the greatest net benefits.

### **Which Jurisdiction Can Most Effectively Address the Problem?**

Some externalities affecting environmental resources are localized in their effects, and may not justify federal action. A case in which both the costs and the benefits of reduced contamination would accrue within a state's boundaries, for example, may more appropriately be addressed by the state than by the federal government. Federal action may be justified when the effects of contamination cross state boundaries. Federal involvement may also be warranted where an otherwise desirable policy can be implemented more effectively or less expensively at the federal than at the state level -- for example, where national markets make uncoordinated state action ineffective -- or where other policy goals, such as constraints on commerce imposed by individual state or local regulation, are significant enough to warrant federal intervention.

The federal government may play a variety of roles with respect to new incentive-based programs, even in cases where a federal policy is not justified. The federal government can encourage policy innovation by state and local governments by providing information on effective policies or by offering grants for state program development, without imposing any requirements for states to adopt specific programs. To encourage discussion of potential applications of incentives at all levels of government, this report discusses some incentives that might be best implemented at a state or local level, but where the federal government could play a useful role in supporting such action.

### **Will an Incentive Approach Maximize Net Social Benefits?**

Once the need for government intervention has been determined, and the most appropriate jurisdictional level has been identified, different policy approaches can be considered. The goal is to select the policy approach and policy objectives that maximize net social benefits. Policy approaches should be evaluated on the degree to which they address the target market failure. To the extent allowed by statute, policies should limit required or induced changes in action to cases where environmental benefits outweigh costs.

Economists have long argued that incentive programs are more likely than command-and-control regulations to minimize the cost of achieving any given policy objective. This is because incentives can be specifically targeted to correct the market failure. Command-and-control regulations can be a clumsy tool for achieving the same goals. Practical problems of administration, monitoring, and enforcement may make regulation a more effective policy approach in some applications. However, incentive-based approaches offer many potential advantages that should be considered before a policy approach is selected.

The most important advantage of incentive approaches is the shift from government decisions to private sector decisions to achieve policy goals. Government regulation can in theory achieve the same results as incentives. In practice, however, optimal regulations are difficult to design because they require detailed understanding of the costs and benefits of numerous activities. The more diverse the sources and activities addressed by a policy are, the more difficult it is for the government to achieve the optimal outcome through command-and-control regulation. Incentive approaches can automatically encourage action where the benefits are greatest relative to their costs.

In addition, command-and-control requirements are often insufficiently flexible to adjust easily to dynamic changes in production and pollution control technologies and in market conditions. For example, economic incentives are more likely than are some forms of command-and-control regulations to induce improvements in pollution control technologies.

Finally, it is important to distinguish between the concept of cost-effectiveness and that of efficiency. A cost effective policy reaches a target at the least cost. To maximize net social benefits (efficiency), it is important to choose the right targets as well as the right instruments.

### **Is the Approach Feasible?**

Some incentives have strong theoretical appeal but are likely to prove difficult to apply in practice. A number of factors may influence the feasibility of a program, including:

- o difficulties defining or measuring desired changes in behavior, making it difficult to design and/or enforce incentives;
- o difficulties identifying important actors whose behavior is targeted by the incentives policy;
- o difficulty in detecting cheating or other undesirable responses (e.g., illegal dumping);
- o lack of information needed to design or analyze the incentive;
- o limited capability on the part of important actors targeted by the program to perform the required roles; and
- o conflicts with other important government policy goals (e.g., foreign trade, energy, or development goals or constraints).

A program that is difficult to develop, implement, or enforce may not be effective, or its administrative costs may simply outweigh its benefits. Finally, in some cases statutes may limit the applicability of incentive approaches.

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## INTRODUCTION

### DESCRIPTION OF THE PROBLEM

Americans generate more municipal solid waste (MSW) per capita than any other nation. Approximately 160 million tons of MSW were generated in the U.S. in 1986, increasing to 180 million tons in 1988.<sup>2</sup> Of this total, EPA estimates that 10 percent was recycled and that 10 to 15 percent was incinerated, primarily for energy recovery.<sup>3</sup> The remaining 75 - 80 percent was managed primarily in landfills. With current purchasing and disposal practices, the amount of waste generated is expected to increase to 216 million tons by the year 2000.<sup>4</sup> The volume and composition of the municipal solid waste stream can lead to environmental risk associated with disposal practices (for example, from toxic substances leaching to groundwater), and problems associated with illegal disposal of waste. In some cases, the combination of local incentives and improper pricing has led to landfill capacity problems.

Figure 1 illustrates the composition by weight of materials in the municipal solid waste stream in 1986, after the recycling of secondary materials.<sup>5</sup> Figure 2 characterizes the contribution of individual products to the total quantities of waste disposed of, following the recycling of secondary materials.

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<sup>2</sup>Office of Technology Assessment, U.S. Congress, Facing America's Trash: What Next for Municipal Solid Waste? October 1989. Estimates cited are from final reports for U.S. EPA by Franklin Associates, Ltd., Characterization of Municipal Solid Waste in the United States, 1960 to 2000 (update 1988), and Characterization of Municipal Solid Waste in the United States: Update 1990.

<sup>3</sup>Franklin Associates, Ltd., Characterization of Municipal Solid Waste in the United States, 1960 to 2000 (Update, 1988), final report, prepared for the U.S. Environmental Protection Agency, March 1988.

<sup>4</sup>Franklin Associates, Ltd., 1990.

<sup>5</sup>Office of Technology Assessment, 1989, derived from Franklin Associates, Ltd., 1988.

Other types of waste not in these figures include: demolition and construction wastes, wastewater treatment residues, trees and brush, street refuse, car bodies, non-hazardous industrial residues, household hazardous waste, hazardous waste from small-quantity generators, and used oil. Comprehensive data are not available on the quantities of these materials disposed of in the municipal waste stream.

In some areas of the country (in the Northeast, for example) capacity to manage MSW is rapidly becoming scarce. One-third of the nation's existing landfill facilities are expected to close by 1991, and EPA estimates that 80 percent of the existing landfills will close over the next 20 years.<sup>6</sup> Increasingly stringent state regulation of landfill and incinerator facilities, forthcoming federal Subtitle D regulations affecting municipal landfills and incinerators, and public opposition are making landfills and incinerators increasingly difficult to site and more expensive to construct and operate. Typical costs for landfill units complying with more stringent environmental standards could range as high as \$45 to \$150 per ton of refuse disposed of, as compared with current costs of \$10 to \$20 per ton for many existing landfills.<sup>7</sup>

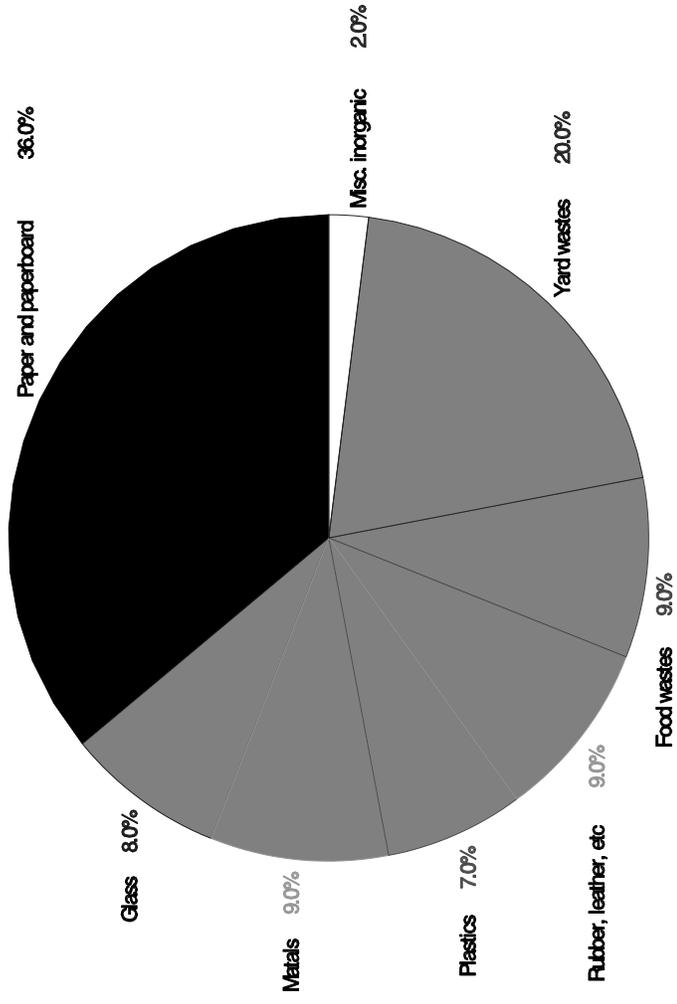
Concern about the environmental risks posed by substandard landfills and incinerators is a major factor limiting growth in capacity. Improperly designed or operated landfills may generate toxic leachate, may present risks of explosion and fire due to methane gas, and may emit organics such as vinyl chloride, benzene, trichloroethylene, and methylene chloride to groundwater or surface water. Of the 1,217 sites listed or proposed for listing on the Superfund National Priorities List, 233 were identified as municipal landfills. However, none of the landfills on the list was designed to meet current standards. In formulating MSW policy, it is important to recognize the

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<sup>6</sup>U.S. EPA, Report to Congress, Solid Waste Disposal in the United States, Volume II, Office of Solid Waste and Emergency Response, EPA/530-SW-88-011B, October 1988.

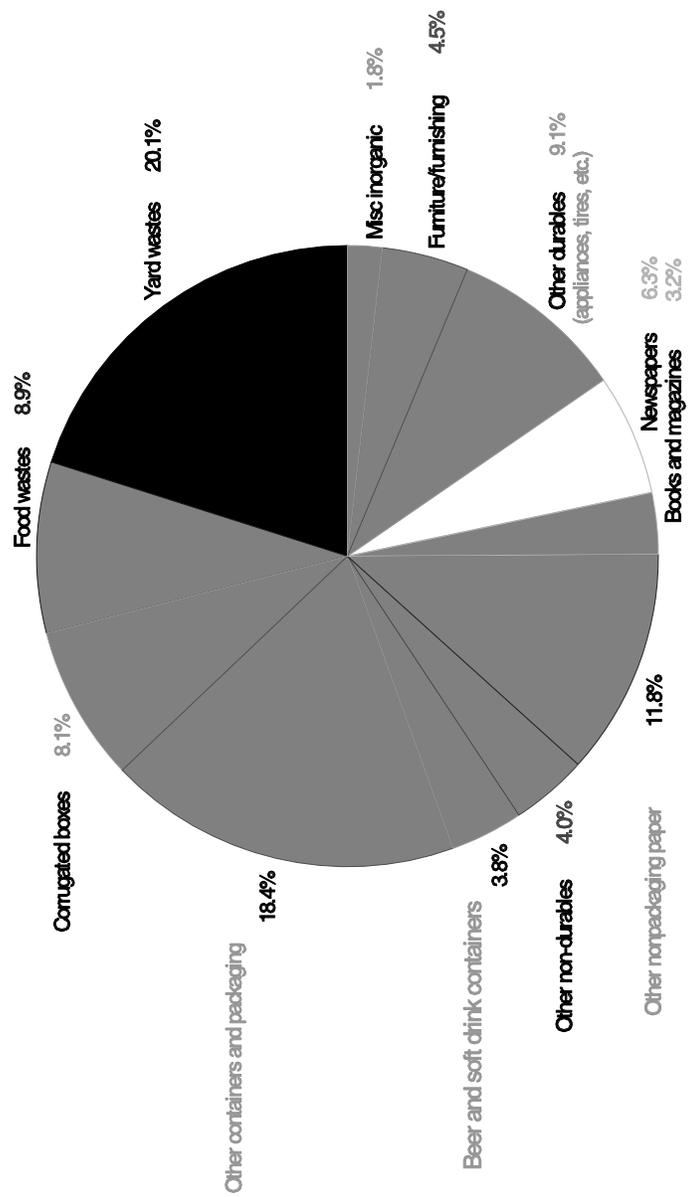
<sup>7</sup>U.S. EPA, Municipal Waste Combustion Study, Report to Congress, June 1987.

**Figure 1**  
**Materials Discarded into the MSW Stream, 1986**



Source: Franklin Assoc., "Characterization of Municipal Solid Waste in the United States, 1960-2000 (Update 1988)", March 1988

**Figure 2**  
**Products Discarded into the MSW Stream, 1986**



Source: Franklin Assoc., "Characterization of Municipal Solid Waste in the United States, 1960-2000 (Update 1988)", March 1988

differing environmental risks posed by the substandard disposal practices of the past and those meeting today's standards.

Some critics argue that MSW disposal may pose environmental risks. Available sampling data indicate that the types of chemical contaminants found in municipal landfill leachate vary widely. However, the related concentrations are generally low. Perhaps the explanation is that past problems at municipal landfills are due in large part to past disposal of large quantities of industrial hazardous wastes which no longer enter municipal landfills.

Municipal incinerators emit toxic compounds to the air, and may generate toxic ash, which is typically landfilled. EPA recently proposed air emission standards for municipal waste incinerators that would, among other things, limit toxic emissions and establish optimum combustion operating standards. Tests of leachate from fly ash and bottom ash have shown levels of lead or cadmium exceeding EP toxicity levels for hazardous wastes. It is uncertain, however, whether these results provide an accurate measure of risks from incineration.

The link between the types of materials discarded and the potential risks from MSW facilities is also not well documented, in part because data on sources of different contaminants in the waste stream are highly uncertain, and in part because products differ in the degree to which they are likely to release toxic compounds. One study prepared for EPA estimated the contribution of different products in MSW to the total amounts of lead and cadmium in the waste stream.<sup>8</sup> As shown in Figure 3, lead-acid (automotive) batteries are estimated to be the major source of lead in MSW, and nickel-cadmium rechargeable household batteries are the major source of cadmium.

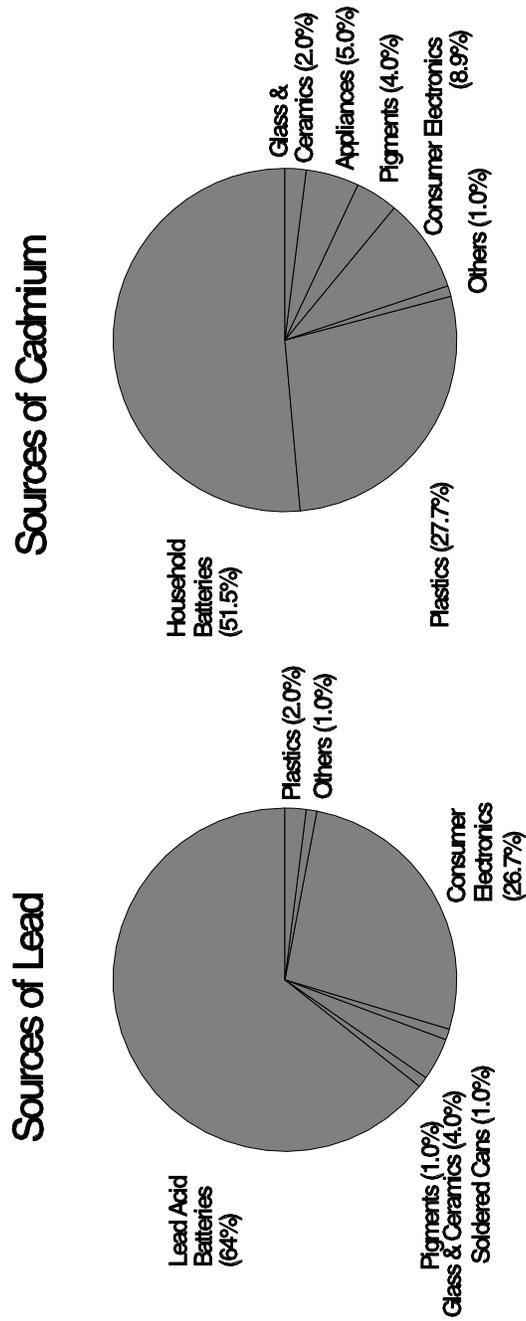
In addition to capacity problems and potential risks to human health and the environment from substandard MSW management facilities, problems result from the illegal disposal of MSW. Illegal disposal creates aesthetic problems (e.g., litter) and may present environmental risks (e.g., disposal of used oil to storm drains).

The generators of municipal waste -- households, commercial establishments, and institutions -- often do not bear the full social costs of their actions that create waste and environmental

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<sup>8</sup>U.S. EPA, Office of Solid Waste, Characterization of Products Containing Lead and Cadmium in Municipal Solid Waste in the United States, 1970 to 2000, Final Report, Executive Summary and Chapter 1, prepared by Franklin Associates, January 1989, EPA/530-SW-89-015B.

**FIGURE 3**  
Sources of Lead and Cadmium in MSW, 1988



Source: U.S. EPA, Characterization of Products Containing Lead and Cadmium in Municipal Solid Waste in the United States: 1970 to 2000, 1989

contamination from waste management. Product prices do not reflect the relative contribution of different products to environmental contamination from disposal. Households are typically charged for waste disposal service either through their local property taxes or by a fixed fee paid to a private collector. The price the household pays for each additional unit of waste it generates is zero no matter what the cost to the community of providing that additional unit of waste disposal service. Littering and illegal disposal provide a zero-cost waste disposal option that is difficult to detect and discourage.

Several types of behavior may result from these externalities. For example, households and businesses may generate more waste than is optimal, by

- o purchasing products requiring more frequent replacement and disposal, rather than more durable tires, appliances, batteries, and the like;
- o purchasing more single-use disposable items (e.g., disposable diapers and razors); and
- o purchasing products contained in extensive packaging.

In addition, households and businesses may use more toxic products and materials than is optimal, and may engage in littering and illegal disposal.

#### **ROLE OF INCENTIVES**

Incentive policies could encourage increased source reduction (producing less waste in the first place) and recycling (collection, transport, and recovery of used material). Only 11 percent of MSW is currently recovered for recycling. This figure includes the following percentages of individual materials:

Aluminum	25%
Paper and Paperboard	23%
Glass	9%
Ferrous Metals	4%
Rubber & Leather	3%
Plastics	1%

Pricing waste management to reflect its full social cost is the most direct and comprehensive way to address the market failures discussed above. Most users of waste disposal services pay less than the full social cost of disposal. Most localities, even if they cover operating costs, do not charge for land, for retirement of the existing facility, for construction of the replacement facility, or for future liabilities associated with disposal. Rarely do households or businesses pay fees based on volume, or fees that include some measure of the present value of the costs of replacing facilities.

A current example of how raising the cost of disposal may work is the Municipal Landfill Criteria rule. When promulgated, the rule is likely to raise the costs of landfilling, particularly in small communities where recycling and source reduction programs are less prevalent. Rather than create a

federally mandated level of recycling, this approach will merely adjust the cost of landfilling to levels better approximating the real social cost of landfilling, and let the market find the appropriate level of increased recycling.

In general, economic incentives should target the specific market failure that requires addressing. For example, if one is concerned primarily with inadequate municipal solid waste landfill capacity, then the appropriate incentive would encourage reduction of waste volume in general (by, for example, increasing the cost of all land disposal). If one is concerned about a different problem, such as toxics or lead disposal, then a variety of product- and material-specific incentives might be considered to encourage source reduction or reduced contributions of specific materials to the waste stream.

## OVERVIEW OF INCENTIVE PROPOSALS

The Task Force considered a variety of incentives and hybrid policies that might be used to encourage reduction of MSW volumes, of MSW toxicity, and of littering. The following specific policies are discussed in this chapter:

1. volume-based pricing of municipal waste management services;
2. incentives to recycle scrap tires;
3. a deposit/refund system to encourage the collection and recycling of lead-acid batteries;
4. a credit system to encourage used oil recycling; and
5. brief discussions of other MSW incentives, including:
  - a. a beverage container deposit/refund system ("bottle bill"),
  - b. incentives to increase composting of yard wastes, and
  - c. a newsprint recycled-content requirement that incorporates trading (a hybrid of command-and-control with incentives).

In addition, the Task Force evaluated proposals that might encourage the reduction of MSW and other sources of environmental releases, including marketable permits or surcharges on lead and removal of federal subsidies that encourage the use of virgin materials. These additional incentives are discussed in Chapter 5.

Most of the proposals address specific products or types of waste that represent a large portion of the waste stream or that are believed to contribute disproportionately to risks from MSW management. However, the contribution of these materials to environmental problems has not been well documented. In addition, there is wide geographic variation in capacity problems, and the risks from waste management facilities are likely to be localized for the most part. To the extent that the environmental impacts are primarily local, the incentives described here might best be applied at the state and local levels, if further analysis indicates that their use is justified. On the other hand, if there are benefits of recycling that are not realized primarily at the state and local level, a federal role would be justified.

## VOLUME-BASED PRICING OF MUNICIPAL WASTE SERVICES

### BACKGROUND AND GOAL OF INCENTIVE

Currently, most municipal trash collection and disposal services are supported through general tax revenues or flat fees. Residents and businesses do not pay different prices depending on the volume and characteristics of the wastes they generate. These pricing practices generate externalities, in that a portion of the costs attributable to an individual's action is imposed on the entire community, rather than borne entirely by the individual.

Volume-based pricing, which bases rates on the amount of waste generated, is a first step toward marginal cost pricing for waste management services. Volume-based rates are designed to provide residents with better information on the cost of managing the waste they generate.<sup>9</sup> In theory, households could be charged rates that reflect both the direct costs of waste collection and disposal (including the value of scarce landfill capacity used) and the social costs of any environmental degradation that results.

Some municipalities are experimenting with volume-based rates. However, most programs are only a few years old and have been subjected only to limited study.

### DESCRIPTION OF INCENTIVE

Volume-based rate programs can take several forms. In one approach, the municipality sells individual trash containers. For example, the borough of Perkasio, Pennsylvania, requires that all wastes be disposed of in bags sold by the city.<sup>10</sup> A bag that holds up to 40 pounds costs \$1.50; 20-pound bags are \$0.80.

High Bridge, New Jersey, uses a related alternative by selling stickers that must be placed on individual bags or trash items.<sup>11</sup> In 1989, High Bridge charged each household \$200.00

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<sup>9</sup>In this discussion, we focus on residential trash collection and disposal. Variable rates are currently more common for commercial enterprises, in part because they often use private waste management services more than do households. Business and industry also often need special services -- e.g., for hazardous waste disposal.

<sup>10</sup>Information sources for the Perkasio program include: Linda C. Good, Annual Report on the Borough of Perkasio for the Year 1988; Neil Fosbenner and Linda Becker, Annual Report on the Borough of Perkasio for the Year 1989; Institute for Local Self-Reliance, Beyond 25 Percent: Materials Recovery Comes of Age, April 1989, pp. 47-55; David Riggle, Biocycle, "Only Pay for What You Throw Away", February 1989, pp. 39-41.

<sup>11</sup>Sources of information on the High Bridge program include: David Riggle, Biocycle, "Only Pay for What You Throw Away", February 1989, pp. 39-41; The New York Times, "Pay-by-Bag Trash Disposal Really Pays, Town Learns," November 24, 1988, p. B-1; and

annually, which covered basic pick-up service and 52 stickers for an average of one container per week. Stickers may be traded among residents, and additional stickers may be purchased for \$1.65 each. Maximum weight and volume restrictions are established on a per-sticker basis.

Seattle, Washington, requires residents to subscribe to a level of service that reflects the number and size of trash cans they expect to fill per week.<sup>12</sup> The charge for using one mini-can (19 gallons) per week is \$10.70 per month, and the charge for using one 32-gallon can per week is \$13.75 per month. There is a minimum monthly charge of \$5.95, applied even to owners of vacant lots. Residents may purchase stickers when they have waste in excess of their standard level of service. Charges are also higher for customers who request backyard instead of curbside pick-up. Recyclables must be separated, and they are collected free of charge.

Municipalities tend to focus on the direct costs of services in setting volume-based rates. For example, High Bridge's yearly fee is designed to cover the administrative costs of the local

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memorandum and ordinance provided by Claire Knapp, Borough Clerk, on August 18, 1988.

<sup>12</sup>Information sources for Seattle include: Lisa Skumatz and Cabell Breckinridge, Variable Rates in Solid Waste: Handbook for Solid Waste Officials, U.S. Environmental Protection Agency and City of Seattle, 1990; Lisa Skumatz, "Variable Rates: Using Your Rate Structure to Encourage Waste Reduction and Recycling," City of Seattle, 1989; Seattle Engineering Department, "Variable Can Rate Study," City of Seattle, June 1985.

solid waste utility, as well as disposal costs for one container per week. The additional per-sticker fee is derived primarily from average tipping charges. Perkasio also based its per bag charges on the direct cost of waste management services.

Seattle initially based its rates on direct service costs. The city recently increased its prices above the marginal costs of collection and disposal to provide additional incentives for waste minimization and recycling. The cost of closing old landfills is also included in setting these fees.

## **EVALUATION**

### **Effect on Waste Generation, Disposal, and Purchasing Practices**

**Amount of Waste.** Significant decreases in waste tonnages have been reported after volume-based rate programs have been implemented. High Bridge reported a 24 percent decrease in the first 10 months of its program, and Perkasio reported a 40 percent decrease in the first year. In Seattle, landfill tonnage decreased by 24 percent from 1988 to 1989, presumably due to the combined effects of Seattle's various cost-reduction and recycling programs.

More research is needed to assess the effects of volume-based pricing on waste volumes. Municipalities generally implement several changes in different programs at the same time, which may complicate evaluation of the effects of individual programs.

**Disposal Alternatives.** If volume-based rates are not based on waste weight as well as volume, they may encourage trash compacting. The ability to use compactors may weaken residents' incentives to minimize waste. In theory, volume-based rates can also provide incentives for increased illegal dumping or littering. However, people operating volume-based rate programs claim that there is little evidence that illegal dumping has increased significantly.<sup>13</sup>

**Purchasing Behavior.** The effect of volume-based programs on consumer purchases has not yet been carefully studied. Ideally, when choosing purchases, such programs would encourage consumers

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<sup>13</sup>Dan Goldberg, Waste Age, "The Magic of Volume Reduction," February 1990, pp. 98-104. Over a two-year period, Perkasio (population: 5,200) prosecuted six or seven cases of disposal in commercial dumpsters.

to think about the amount and type of packaging, and whether the packaging is recyclable. Rising demand for products that minimize waste would stimulate production and innovation, increasing the availability of such items. Volume-based programs could also encourage consumers to retain and repair items, rather than replace them.

Volume-based rates could also encourage consumers to buy products that are packaged in lighter or less bulky materials that are actually more dangerous to the environment, if they take longer to degrade or contain toxic chemicals. Again, policies to discourage these types of purchases may need to be implemented concurrently with volume-based rate programs to avoid undesirable responses.

### **Design of Prices**

While volume-based rates can be set at levels that cover the total social costs of waste disposal, in practice they often reflect only the direct costs of services. In these cases, the programs will not lead to as much waste reduction as may be desirable, because the rates are not high enough to fully internalize the costs of waste management.

Volume-based rates may be most effective if:

- they encourage the provision of alternative options for trash disposal such as improved recycling programs;
- they include provisions to monitor and penalize undesirable disposal practices; and
- they adopt rates that reflect the full costs of disposal (e.g., that landfill replacement costs should be taken into account).

**Environmental Impact.** To fully internalize the social costs of waste management, prices would need to reflect collection and disposal costs, the current and expected future costs of disposal capacity, and the costs of any resulting environmental harm. Ideally, costs should include the net present value of closure, post-closure monitoring, and replacement, and not just expenditures on current operations.

Because trash volume is likely to decrease (and recycling is likely to increase) in response to volume-based pricing, current costs may not be an ideal basis for setting rates. It may be desirable to estimate the impact of the program on waste volumes and set rates based on estimated volumes. Periodic review of the relationship between rates and volume may also be needed.

For several reasons, the appropriate charge for volume-based rate programs will differ from area to area. First, collection and disposal costs vary geographically, reflecting regional differences in the costs of labor, equipment, and land.<sup>14</sup>

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<sup>14</sup>C.L. Petit, Waste Age, "The 1987 Tip Fee Survey," March 1988, pp. 74-80.

Second, the cost of replacing landfill capacity -- and therefore the economic value of capacity used currently -- varies greatly by region. In many areas, costs of new landfills are rising sharply, reflecting lack of suitable sites, expensive siting processes, and the cost of installing required pollution controls.<sup>15</sup> In the future, many closing landfills may be replaced by other waste management technologies, such as disposal -- e.g., waste-to-energy -- systems. These new technologies generally are more expensive than landfills.<sup>16</sup>

It can be difficult to determine the marginal value of scarce landfill capacity, particularly when landfills are owned and operated by the local government and prices are not set competitively. Existing programs often use tipping fees as a measure of marginal costs. However, some argue that commercial tipping fees are currently set too low, because they do not appropriately account for landfill closure and replacement.

If volume-based rates are set too low to reflect projected replacement costs, the program will not fully address concerns about limited landfill capacity, and households will continue to generate more trash than would be desirable.

### **Federal Role**

The most appropriate federal role may be to encourage -- but not require -- volume-based rates. Federal mandates are appropriate only if there are significant externalities that localities cannot address, such as when environmental damages cross jurisdictional lines. This is not likely to be a problem when disposal facilities meet EPA standards.

The limited use of volume-based rate programs may be due to the lack of information on program benefits and effective design and implementation. Localities may also lack funds for start-up costs. It may also be appropriate for the federal government to address these barriers to the development of better pricing programs. For example, the federal government could conduct program research and disseminate results, fund model or demonstration programs, or provide seed money to communities starting such programs.

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<sup>15</sup>For estimates of changes in landfill costs, see Robert Glebs, Waste Age, "Landfill Costs Continue to Rise," March 1988, pp. 84-93.

<sup>16</sup>Frederick Dunbar and Mark Berkman, Waste Age, "Sanitary Landfills Are Too Cheap!" May 1987; Michael Crew and Paul Kleindorfer, Waste Age, "Landfill Tipping Fees Should Be Much Higher," February 1988.

## INCENTIVES TO RECYCLE SCRAP TIRES

### BACKGROUND AND GOAL OF INCENTIVES

Over 82 percent of the 234 million tires that are scrapped each year are landfilled, stockpiled, exported, or illegally dumped. More than 13 percent of the remaining tires are incinerated for energy recovery or recycled into new products.<sup>17</sup> Most landfills do not accept tires because they take up substantial amounts of space and tend to rise to the surface as surrounding waste settles, which creates voids and causes uneven settling. As a result, approximately two to three billion tires are currently stockpiled in the United States.<sup>18</sup>

The stockpiling of tires threatens public health and the environment. Water that collects in stockpiled tires provides a favorable breeding ground for mosquitoes that carry diseases, such as encephalitis and yellow fever. Stockpiles of tires are also a potential fire hazard. The black noxious smoke from tire fires degrades air quality and produces oils, soot, and other materials that may contaminate surface and ground water.<sup>19</sup>

The number of tires requiring disposal could be reduced by increasing the service life of tires (e.g., using steel-belted tires that last longer than other tires), by retreading and reusing tires (e.g., as wheels for farm implements), by burning scrap tires for energy recovery, or by recycling scrap tires into other uses. Since tires have a Btu value comparable to the best coal (i.e., 12,000 - 16,000 Btu per pound), they are an economical fuel option in some situations. Increasing volumes of tires are being incinerated in power plants, pulp and paper plants, and cement kilns. However, pulp and paper and cement kilns generally view tires as auxiliary fuels, and are hesitant to make the capital expenditures required to allow use of tires as primary fuel, except when coal and other fuel prices are high. Whole tires can be used as artificial reefs and breakwaters, as playground equipment, for erosion control, and as highway crash barriers. Used tires may also be processed and used to produce rubber mats and other rubber products, asphalt rubber for roads, playground gravel substitutes, and bulking material for sludge composting.

As evidenced by the large stockpiles of tires, the supply of tires available for recycling substantially exceeds the demand for scrap tires. For example, demand for retread tires has declined considerably over the past decade, and is expected to decline further in the future. Thirty-one million tires were retread in 1978, 15 million were retread in 1986, and only 6

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<sup>17</sup>U.S. EPA, "Market Development Study for Tires," draft, August 1990.

<sup>18</sup>Robert L. Hershey et al., "Waste Tire Utilization," Science Management Corporation, for the U.S. Department of Energy, April 30, 1987.

<sup>19</sup>EPA has been notified of 87 tire pile fires in 1989, 65 in 1988, and 46 in 1987.

million tires are expected to be retread by 2005.<sup>20</sup> Given this decline in demand, incentives that create or induce greater demand for recycled tires would be the most effective method to reduce stockpiles and increase scrap tire recycling.

The initial findings of EPA's draft report, Market Development Study for Tires, suggest that asphalt rubber and combustion facilities have the greatest potential to consume large numbers of tires that would otherwise require disposal. New technologies are also being developed for the use of scrap tires for fuel. Currently, economical processes involve using the whole tire, rather than shredded parts. To meet air emission and fuel standards, however, whole-tire processors need to use extreme heat to separate hazardous materials from fuel and rubber by-products. Permitting costs, concerns over potential air emission control requirements, and large initial capital investment requirements have limited the growth of tire-derived and whole-tire combustion processes to date. Combustion will be a promising end use for scrap tires only if the economic costs are reduced.

Crumb rubber from scrap tires can be used in asphalt as a sealant or in the thick overlay applied to road surfaces. The rubber may be used at one to six percent concentrations in the asphalt. Current formulas for asphalt rubber indicate that 1,200 tires are consumed per mile for an average two-lane project.

There are several barriers, however, to more extensive use of asphalt rubber. State highway departments have been reluctant to incur the capital investments and added operating costs associated with adopting new techniques. Asphalt rubber roads are approximately twice as expensive to install as conventional asphalt roads, but it is believed that the rubber-modified pavement lasts at least twice as long; however, the Federal Highway Department does not consider "life-cycle costs" in its requirements for federally funded paving projects. Many states have tested sections of road containing asphalt rubber, but test results are not yet complete. Finally, local highway departments are not responsible for tire disposal problems, and therefore may not consider reduced tire disposal as a benefit when evaluating the use of asphalt rubber.

#### **DESCRIPTION OF INCENTIVES**

The Task Force considered a range of policies to encourage recycling of tires and to discourage inappropriate disposal of used tires. First, it considered fees on the sale or disposal of tires to generate revenues to subsidize recycling, clean up old tire stockpiles, or conduct research into recycling methods. Second, it considered incentives that might specifically encourage greater use of tires in asphalt rubber.

Currently, thirteen states have passed scrap tire management legislation, and at least a dozen other states are considering proposed regulations. State programs related to tire disposal have included the following kinds of provisions:

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<sup>20</sup>Office of Technology Assessment, Facing America's Trash: What's Next for Municipal Solid Waste? October 1989.

- o Fees to fund scrap-tire programs. Types of fees include a 50-cent fee on all new tires or motor vehicle registrations; a temporary one-dollar fee on all new tires sold; a four-dollar fee on motor vehicle transfers; and a 12-cent fee on every dollar in tire sales.
- o Use of the fee revenues for one or more of the following purposes: funding of state tire disposal regulation programs; clean up of existing tire piles; enforcement, market development, research and development; or reimbursement to tire dealers (if they are involved in collecting fees) and waste tire firms.
- o Grants or loans to encourage recycling, processing, or incinerating used tires.
- o Modification of requirements to encourage proper tire disposal. If tires are monofilled, for example, less stringent liners than those required for MSW landfills can be used. (Monofilled tires are also easier to "mine" at a later date.)
- o Permitting of tire stockpiles.

Fees could be imposed on tire storage and disposal to reflect the social costs of these management practices. Such fees might encourage return of tires for recycling. However, since it appears that lack of demand is the primary barrier to increased recycling, such fees might simply impose costs on tire owners without resulting in much reduction in storage and disposal.

Recent legislation, offered by U.S. Representative Torres and U.S. Senators Heinz and Wirth, would require tire producers and importers to recycle a specified percentage of the tires they produce or import. The companies would have the choice of recycling tires themselves or purchasing recycling credits from state licensed tire recyclers. Tire recyclers would generate credits for each tire recycled (depending on the method of recycling used) and the credits would sell at market prices.

A national charge on the disposal of tires would not induce migration of scrap tires across state lines, as has occurred with some existing state programs. On the other hand, a tire disposal fee might involve collecting fees at a huge number of sites, and might simply encourage increased illegal disposal of tires. A fee imposed on new tire sales does not directly discourage disposal, but might encourage purchase of long-lived tires, and would provide funds for other programs.

Governments could promote the development and use of asphalt rubber by removing existing procurement barriers and by supporting such research projects as:

- o Changing the Federal Highway Administration (FHA) requirements to include consideration of "life-cycle costs."

- o Revising the EPA procurement guidelines for asphalt rubber in highways, and perhaps requiring other federal agencies (e.g., the Departments of Defense, Energy, and Interior and the National Park Service) to use or at least consider asphalt rubber in a certain proportion of the road mileage they build.
- o Working with the FHA's program that funds state highway research projects, to encourage states to study and test asphalt rubber use.
- o Developing a research program with the FHA to develop and test non-proprietary asphalt rubber formulations that can be applied with standard asphalt paving equipment. Much of the research and field-testing of asphalt-rubber has been performed using proprietary products and/or paving equipment.
- o Requiring that federal projects or projects using federal money include specifications that allow the use of asphalt rubber, and consider using asphalt rubber pavement if it meets certain cost and performance criteria.
- o Encouraging state legislatures and environmental agencies to work with their respective highway departments to evaluate the use of asphalt rubber in paving projects.

## **EVALUATION**

Before a determination can be made about the merits of policies addressing scrap tires, more analysis is needed to assess the costs and potential environmental risks of different tire management options, including landfill disposal, storage, incineration, rubber processing facilities, and various recycling applications. In particular, research on the costs and performance of asphalt rubber in paving projects appears worthwhile. More information is also needed on the effectiveness of existing state programs that deal with scrap tires.

Federal involvement in any fee program would prevent problems of interstate migration of scrap tires, which may occur when individual states take action to regulate tire disposal. For example, Florida recently passed tire legislation, and Alabama is currently concerned about an influx of tires from Florida. The landfill tipping fee for tires in Florida (where tires must now be split into at least 8 pieces before they are landfilled) is about twice the tipping fee in Alabama. Although a national tire disposal fee would not induce migration of tires across state lines, it might involve collecting fees at a huge number of sites, and might simply encourage increased illegal disposal of tires. A fee imposed on new tire sales does not directly discourage disposal, but might encourage the purchase of long-lived tires, and would provide funds for other programs.

To the extent that tire incentives are motivated by landfill capacity concerns, any federal program should allow for regional variations in the severity of capacity problems. For example, the federal government could develop model legislation for the

generation and use of tire disposal fees, evaluate and publicize existing state and local programs, and/or require states to develop tire management programs. However, these problems, and the fact that fires at tire disposal sites have created Superfund sites, may argue for a more consistent and aggressive federal program.

## **DEPOSIT/REFUND SYSTEM FOR LEAD-ACID BATTERIES**

### **BACKGROUND AND GOAL OF INCENTIVE**

Lead-acid batteries account for an estimated 65 percent of the lead in municipal solid waste. Lead is highly toxic, so landfill disposal or incineration of products containing lead could pose risks to public health. As indicated by EPA's proposed ban on the incineration of lead acid batteries, it is expected that removal of these batteries will substantially reduce lead contamination in both air emissions and ash residues. Similar benefits would be expected for landfilled waste.

To further ensure that banning lead batteries from disposal will lead to recycling rather than to illegal dumping, economic incentives may be an effective complement to such bans. During the past few years, lead-acid battery recycling rates have averaged roughly 70 to 80 percent, although the level of recycling varies widely with the price of lead.

The choice of the most effective approach to encourage recycling of the remaining 20 to 30 percent of batteries depends on the nature and extent of the barriers to increased recycling. The Task Force believes that a significant barrier is the cost or inconvenience to consumers of returning batteries to collection points. An incentive to induce consumers to return old batteries when they purchase new ones, therefore, may be effective in increasing recycling. If lack of demand for secondary lead is also a problem, then incentives to increase the demand for reclaimed lead would be required. These might include increasing the price of primary lead to users, lowering the cost of reclaiming lead, or subsidizing recycling.

Currently, recycling demand appears to exceed the supply of used batteries. A deposit/refund incentive would bring more batteries into the recycling system, reducing landfill and illegal disposal.

### **DESCRIPTION OF INCENTIVE**

A state or national deposit/refund system would add a refundable deposit to the purchase price of a new lead-acid battery. A consumer who does not return a used battery while purchasing a new battery would, in effect, see the deposit as a fee that would not be paid if a used battery were returned. Consequently, a deposit/refund system would provide an incentive for consumers to return lead-acid batteries.

The detailed arrangements of a deposit/refund system could take many forms. For example, a system similar to that operating in Rhode Island might include the following characteristics:

- o Consumers who do not return old batteries receive a receipt. They would have seven days after purchase of the new battery to turn in their used battery and collect the refund or forfeit the deposit.

- o Consumers must purchase a new lead-acid battery before they can receive a refund. This requirement discourages theft of batteries from automobiles by parties seeking to claim deposits.
- o Battery manufacturers are required to accept used batteries, pay retailers a handling fee, contract with a secondary smelter for recycling, and document sales and recycling of batteries.
- o Enforcement provisions and procedures would be necessary, such as:
  - retailers documenting inventories, sales, and deposits collected and disbursed;
  - manufacturers documenting receipts of batteries from retailers, shipments to recyclers, and payment of handling fees;
  - recyclers (independent battery crackers or secondary smelters) documenting receipt of batteries from manufacturers; and
  - EPA inspections or spot-checks of records from battery retailers, manufacturers, and recyclers.
- o If there are unclaimed deposits, some percentage could be shared by the state or federal government (to fund recycling programs) and the battery retailer (in Rhode Island, 80 percent of the funds go to the state, the rest to the retailer); all unclaimed deposit funds could be kept by the retailer or the state or the federal government.

## **EVALUATION**

Maine and Rhode Island currently operate lead-acid battery deposit/refund systems. Maine's program requires a ten-dollar deposit, and Rhode Island's system, five dollars. Neither system has been operating long enough to provide evidence on the effectiveness of the system in general, or on the level of deposit fees required to encourage recycling in particular.

At least half a dozen other states operate mandatory take-back programs for lead/acid batteries. The mandatory take-back system ensures that motivated consumers will have an outlet other than disposal for their used battery by requiring retailers to accept used batteries from them. However, the system must still rely on existing consumer motivation to return used batteries.

Experience with existing beverage container deposit/refund systems provides some insight into the potential effectiveness and problems of a lead-acid battery deposit/refund program. A battery deposit/refund system is likely to be at least as effective in encouraging returns as are bottle bills, because the burden placed on consumers is lower than with bottle bills. Batteries are replaced infrequently, and replacement is often performed by the battery retailer, requiring no extra trip by the customer. More inconvenience would be imposed on do-it-

yourselves, who might have to make an extra trip to claim the deposit. Because the system would link refunds directly to the purchase of a new battery, retailers will not experience net cash outflows due to an imbalance of deposits and refunds, as may occur with bottle bills.

A deposit/refund system should be largely self-policing. The retailer would have an incentive to collect the deposit, to provide funds to pay refunds for returned batteries. The retailer also should have an incentive to return batteries for eventual recycling, in order to collect the handling fee and avoid costs of disposal. As long as the price for secondary lead exceeds the cost of production plus the handling fee, recycling should occur.

In some cases, retailers might simply dispose of batteries if the handling fee would not cover the cost of returning them. The greater the distance between retailer and recycler, the higher the transportation costs, the greater the incentive is to dispose of rather than reclaim batteries. Disposal would be more common in rural areas where there may not be a scrap dealers' network in place.

Before considering steps toward implementation of this type of incentive, further analysis of the benefits of battery recycling must be conducted. The deposit/refund system involves administrative, storage, handling, and transportation costs that may or may not be justified by the benefits of increased recycling. The fact that the majority of batteries are already recycled suggests, however, that the costs of collection and return to recyclers are not substantial in most cases.

It would also be useful to know whether batteries collected from consumers are all recycled for lead, or whether some batteries are collected but not recycled because secondary lead prices are insufficient to cover the costs of recycling.<sup>21</sup> The impact of hazardous waste (Subtitle C) requirements on the economics of battery recycling should also be evaluated. In addition, information on the effectiveness of existing lead-acid battery deposit/refund systems should be evaluated as it becomes available.

There would appear to be no strong preference for adopting any such program at one particular jurisdictional level. A single national program might be less costly for manufacturers and recyclers to participate in than a variety of diverse state programs. Given the likelihood that most purchasers would have a used battery to trade in at the time of purchase and therefore would not have to pay the deposit, however, the potential for interstate purchases does not seem substantial.

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<sup>21</sup>Congress is currently considering a proposal -- HR 5359, introduced by Esteban Torres (D-CA) -- that would require battery manufacturers to use at least a minimum percentage of recycled lead, with the percentage increased gradually over time. This proposal would increase demand for secondary lead by effectively creating a more certain market for recycled lead.

Similarly, the potential disadvantages of uniform national programs do not seem significant in this case. The primary motivation for a battery recycling incentive is to reduce the toxicity of municipal solid waste, rather than to reduce total waste volume.

## CREDIT SYSTEM OR DEPOSIT-REFUND SYSTEM FOR USED OIL

### BACKGROUND AND GOAL OF INCENTIVE

In 1988, industry, automotive centers, and households used about 2.6 billion gallons of lube oil (Figure 4). They in turn generated about 1.35 billion gallons of used oil (a significant amount of lube oil is lost during use as a result of loss during combustion, spills, leaks, etc.).<sup>22</sup> Used oil may contain a variety of heavy metals and toxic organic compounds, which may present environmental risks if improperly disposed of or burned.

The two most common destinations of used oil are burning as fuel (58 percent) and disposal (including landfill, incineration, and dumping -- 33 percent) (Figure 4). The burning of used oil for energy recovery is currently regulated to a limited degree under the Resource Conservation and Recovery Act (RCRA). But substantial quantities are burned outside of the formal used oil management systems, potentially without adequate controls. Of the 1.35 billion gallons generated in 1988, for example, only 770 million gallons were recycled commercially or burned subject to RCRA provisions. An additional 48 million gallons were recycled in-house by industrial generators.

Of all end-uses for used oil, disposal and improper burning are most harmful to the environment. Do-it-yourselfers (DIYs), though responsible for only 14 percent of the waste oil generated, are responsible for close to 50 percent of illegal dumping. Combined, DIYs and other automotive generators are responsible for over 70 percent (324 million gallons) of used oil dumping and land disposal.

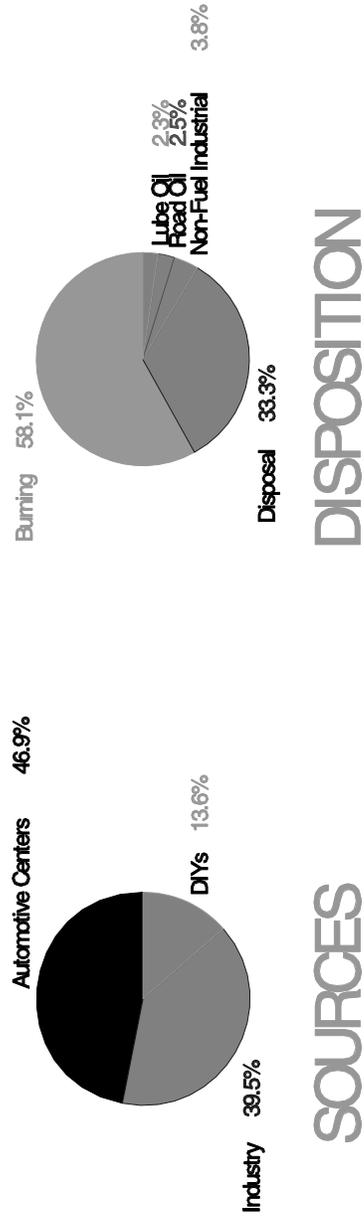
The amount of used oil recycled is strongly and inversely linked to the price of crude oil. In 1980, for example, recyclers were paying up to \$0.50 per gallon for used oil. By the fall of 1989, however, service stations had to pay recyclers as much as \$0.50 per gallon to take the used oil away.<sup>23</sup> Currently, the price of used oil is between zero and ten cents per gallon, depending on location.

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<sup>22</sup>Temple, Barker and Sloane, Inc., "1988 Used Oil Flows in the U.S." Draft. All 1988 used oil statistics used here are derived from this source.

<sup>23</sup>Hazmat World, "Recycling Automotive Oil," November 1989.

**FIGURE 4**  
**SOURCES AND DISPOSITION OF USED OIL, 1988**  
 (Total generated: 1,351 million gallons)



Source: Temple, Barker, and Sloane, Inc.  
 "1988 Used Oil Flows in the U.S." DRAFT

Used oil may be recycled by being reprocessed and burned as fuel, used in other non-fuel industrial applications, or (if rerefined) used again as lube oil. Rerefining includes removing all contaminants and recycling the product as new lubricant. Both reprocessing and rerefining generate small amounts of used oil sludge, which has negative economic value and must be disposed of as hazardous waste.

This incentive would encourage increased return and recycling of used oil, and reduce the amount of used oil burned outside regulatory controls or disposed of illegally.

## **DESCRIPTION OF INCENTIVE**

The Task Force has identified two alternative approaches for using market incentives to encourage proper management of used oil. The first is a recycling credit system. The second is a deposit-refund system.

### **Recycling Credit System**

This hybrid policy would link production of new lube oil to recycling of used oil, implementing the requirement with an incentive-based mechanism. RCRA-permitted recyclers of used oil would create credits when reclaiming used oil. Lube oil producers would purchase credits from recyclers (reprocessors and rerefiners), and would be allowed to produce a certain amount of lube oil per credit. The credit system would create a source of revenue for recyclers, tied to the quantities recycled, which would encourage more recycling.<sup>24</sup>

To generate credits, recyclers would have to demonstrate that they received used oil from a registered transporter and that they recycled and sold the used oil as lube stock or as fuel for energy, subject to existing regulations on burning.

The system would stimulate demand for used oil by recyclers, who would then be more willing to pay generators and gas stations for used oil, because their recycling would be more profitable. Gas stations would in turn be more willing to accept used oil from others.

A fixed percent ratio between recycled used oil and total lube oil production might be established at the outset. The ratio could be raised over time, if it were determined that further promotion of recycling was cost-beneficial. A gradual increase (e.g., 2% per year) in the recycling percent would allow time for expansion in used oil recycling capacity.

Both domestic production and imports of lube oil would be subject to the credit requirement. Producers and importers would have to demonstrate that they had recycled sufficient quantities of used oil themselves, or purchased sufficient credits, given their sales.

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<sup>24</sup>Note that recycling includes the burning of waste oil as well as re-use.

A bill sponsored by U.S. Congressman Torres (HR 872) would require EPA to design a credit system of the type outlined above. The bill would require producers and importers of lubricating oil to recycle a certain percentage each year. A bill containing similar provisions (S 399) has been sponsored by Senators Heinz and Wirth.

The credit system could be supplemented with a labeling requirement for lube oil. Small containers of lube oil might bear a notice of the environmental hazards caused by illegal disposal, describe how used oil should be managed, and perhaps provide a toll-free number to call for information on the location of recyclers or collection points. This labeling requirement would improve household and small business awareness of recycling opportunities.

### **Deposit-Refund System**

A system of deposits and refunds would also aim at encouraging increased return of used oil and discouraging improper behavior. Rather than setting the quantity or percentage of used oil to be managed properly, a deposit-refund system would set prices (the amounts of the deposit and refund) to achieve a particular quantity or percentage target which, in turn, would reflect some measure of the externality. Deposits might be paid by lube oil manufacturers, and refunds might be paid to recyclers on demonstration of oil sold as lube stock or burned for energy recovery. It is conceptually possible to have the deposit-refund system implemented at the retail store level, but the transactions cost of such a scheme would likely be large. In most respects, the implementation of a deposit-refund system for used oil is analogous to the credit system.

### **EVALUATION**

Use of incentives to encourage collection and recycling of used oil is likely to be more effective than a command-and-control approach because of the difficulty of detecting illegal disposal of used oil.

To determine how much additional recycling of various kinds would result from a credit system, it is necessary to evaluate the factors currently discouraging greater recycling. At one extreme, the credit system could encourage the recycling of virtually all used oil, if:

- o only small inducements are needed to encourage generators to send used oil to recyclers, and
- o the demand for credits creates sufficient revenues for recyclers, in addition to the basic value of the recycled oil, to cover the costs of recycling.

At the other extreme, the credit system could provide little inducement to recycle more used oil without a very high recycling-to-lube oil production ratio if:

- o large payments for used oil are needed to encourage generators to provide used oil, and

- o the costs of recycling in compliance with permit standards are high.

Because the regulatory framework for used oil is still evolving, the overall effect of a used oil credit system on recycling rates is difficult to determine. A major focus in past debates has been the potential stigma or other adverse circumstances associated with listing used oil as hazardous under RCRA. Critics of regulating used oil as hazardous argue that recyclers and consumers who perceive used oil as hazardous may be reluctant to participate in recycling.

A deposit-refund system or a credit system could be implemented at either the federal or the state level. However, since lube oil produced and sold in a deposit state is indistinguishable from that sold in non-deposit states, a mechanism would have to be developed to avoid an influx of "foreign" used oil seeking a refund. Further, a credit system imposed on producers by a state would require some way to measure how much of each producer's lube oils was sold in each state having a credit mechanism.

If the regulating agency had complete knowledge of the behavior of used oil suppliers and demanders, credit systems and deposit/refund systems could be structured to produce equivalent results. Because of the potential adverse effects of "misses" from the optimal price-quantity combination, the regulating agency may have a reason to prefer deposit/refund systems when the price effects of a credit system are likely to be large. In this situation, very high credit prices might be required to achieve a given quantity goal. On the other hand, a deposit/refund system may "miss" the desired change in environmental effect. Further research is needed to evaluate the net benefits of recycling credit vs. deposit/refund systems in light of the uncertainties concerning price and quantity effects.

Under a credit system, lube oil supply and demand and the markets for credits would have to be monitored to ensure that the system does not result in shortages of lube oil. In an expanding economy, demand for lube oil could grow faster than the generation of used oil for recycling, causing the price of credits to increase significantly without inducing much new recycling. In this event, "artificial" credits could be created to allow increased production of lube oil.

Tracking the exchange of credits should not present a major administrative problem. EPA estimates that there would be 160 sellers of credits/generators of refunds and 35 to 40 buyers of credits/payers of deposits. Records of sales from recyclers and lube oil producers could be cross-checked, to detect creation of phony credits. However, it would be difficult to detect collusion between buyers and sellers to create phony credits.

Without testing and recordkeeping, it might be more difficult to verify the validity of the number of credits created by recyclers. Recyclers might increase the number of credits they generate by adding hazardous wastes, water, or other substances to the recycled oil, or might simply create credits in excess of their recycled output. Some check on the creation of credits could be provided by requiring recyclers to keep records of both the quantities of oil received for recycling, and the

quantities of recycled oil produced. EPA could also require testing of recycled oil to detect dilution with other substances. However, it would be difficult to verify quantities of used oil received and shipments of recycled oil without imposing record-keeping and reporting requirements on a very large number of gas stations, transporters, and fuel distributors.

Finally, either system could encourage greater import of lube oil, which might contain more hazardous waste or other impurities than domestically produced used oil.

## OTHER MSW INCENTIVES

Economic incentives are designed not to compel a specific course of behavior, but to encourage efficient behavior by changing price signals perceived by individuals. Those price signals should be changed only where the original prices do not reflect external costs that are present. The previous sections have discussed application of a range of incentive approaches to encourage reduced municipal waste generation and increased recycling. Additional incentive applications have been raised in a wide variety of publications and elsewhere. Although, in many cases, questions remain about the seriousness of associated environmental market failures and the appropriateness of a federal role in administration of the incentives, these ideas all merit further consideration.

The following section briefly summarizes the Task Force's discussions of beverage container deposit/refund systems, incentives to increase yard waste composting (including both demand and supply-side incentives), the potential role of trading in a regulatory program that could be established requiring use of recycled newsprint, and the use of fees to reduce purchases of packaging. A number of these incentives might more accurately be referred to as hybrid command-and-control/incentive approaches, as they combine significant elements of each system.

### BEVERAGE CONTAINER DEPOSIT/REFUND SYSTEMS

#### Goal of Incentive

The goal of a beverage container deposit/refund system (or "bottle bill")<sup>25</sup> would be to encourage collection of beverage and perhaps other containers for recycling, thereby reducing litter and potentially reducing the quantities of MSW disposed of and reducing energy use and pollution associated with the extraction and use of virgin materials.

#### Description of Incentive

Nine states currently have bottle laws. Although the details of their programs differ, deposit programs typically involve the following steps:

1. Retailers pay a deposit (e.g., \$.05) to bottlers (soft drink) or wholesalers (beer) for each beverage container product they receive.
2. Consumers then pay the same deposit to the retailer when they purchase the beverage.
3. Consumers receive the deposit back from a retailer when they return the empty container.

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<sup>25</sup>Beverage container deposit/refund systems are commonly referred to as "bottle bills," although they typically cover beverage cans as well as glass and plastic bottles.

4. Retailers claim the deposit from the bottler or wholesaler when they return the empty container to them. In addition, bottlers or wholesalers usually pay a handling fee (typically \$.02 per container) to retailers for each container returned.

### Evaluation

Bottle bill design issues include the types of containers covered, the level of the deposit, the size of the handling fee, and the fate of unclaimed deposits.

Evidence of the effects of existing fees on the behavior of different groups and in different regions is limited. As reported in a study by Richard Porter that examined Michigan's mandatory deposit program, the return rate one year after the mandatory deposit system took effect was 95 percent, and the return rate for containers with a five-cent deposit was as high as the rate for ten-cent deposit containers. Porter's research concludes that high return rates were attributable to the "number, knowledge, and convenience of container return centers" and did not depend on the level of the deposit.<sup>26</sup> Further, evidence from Oregon's system (where deposits are two and five cents) shows that the return rate for two-cent containers was actually higher than for those with five-cent deposits.

Bottle bills are largely self-implementing. Once the deposit is collected, there is an incentive on the parts of consumers and retailers to return containers to reclaim the deposit. The normal recordkeeping involved in transactions between retailer and wholesaler or bottler should be sufficient to ensure that deposits are being collected and repaid as intended.

Although estimated return rates typically range from 70 to over 90 percent, there is controversy about the effects of bottle bills on reductions in overall litter. There is also controversy about how much reduction in MSW disposal results from bottle bills. Bottle bills have the potential to reduce disposal by four percent on average (the portion of the national MSW stream by weight composed of beverage containers). However, bottle bills do not guarantee that all containers collected will be recycled. States report that virtually all aluminum is recycled, but that perhaps 80 percent of plastic containers collected end up in landfills.

In addition, there is some concern that bottle bills may encourage a shift toward purchase of beverages in plastic containers. The Can Manufacturers Institute conducted a study that found a significant increase in plastic containers' share of the soft drink market in New York State -- from 39 to 52 percent -- after implementation of a bottle bill in New York. An increase in the use of plastics is considered undesirable if plastic containers are less recyclable than glass or aluminum containers.

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<sup>26</sup>See Richard C. Porter, "Michigan's Experience with Mandatory Deposits on Beverage Containers," Land Economics, Vol. 59, No. 2, May 1983.

Concern has also been expressed about possible economic conflicts between bottle bills and more general recycling programs, such as multi-material drop-off or buy-back centers and curbside recycling. Because bottle bills take the most profitable components (aluminum cans and some glass) out of the waste stream, they may discourage recycling efforts that target a larger portion of the waste stream.

While evidence on the benefits and costs of bottle bills is limited, it is likely that they vary by region. These variations, in such areas as capacity shortages and the cost of storing and backhauling empties, suggest that the benefits of a bottle bill may not exceed the associated costs in all regions. Consequently, even if bottle bills are justified for certain states or regions, a uniform national bottle bill may not be justified.

To evaluate the merits of a bottle bill, additional information is needed on: (1) the extent to which bottle bills have resulted in increased recycling of different types of containers; (2) the extent to which bottle bills have caused undesirable shifts in container market shares and consumer purchasing decisions; (3) the extent to which bottle bills compete with other recycling programs; and (4) the costs and benefits of bottle bills, including regional variations in both costs and benefits, and the size of economies (if any) in labeling and administrative costs with a uniform national program, compared with the cost of state programs.

## **INCENTIVES TO ENCOURAGE YARD WASTE COMPOSTING**

### Background and Goal of Incentives

According to EPA estimates, yard wastes comprise from 10 to 30 percent of the nation's MSW, varying seasonally and by region, with an national average of 20 percent. Ten states have already passed landfill disposal bans on some or all components of their yard wastes.

Composting is environmentally preferred to either landfilling or incineration as a method for managing yard wastes. Not only do yard wastes take up a significant amount of space in a landfill, but methane gas and acidic leachate are generated during their anaerobic decomposition. Given their low Btu value and potential for contributing to nitrogen oxide and other air emissions, yard wastes are not a good source of potential energy for waste-to-energy (WTE) plants. Combustion of yard wastes, whether at WTE plants or in back yards, also contributes to air pollution.

### Description of Incentives

In general, composting involves creating an aerobic (oxygenated), temperature-controlled environment for compostable material to decompose and form a stabilized humus- or soil-like

product.<sup>27</sup> The speed of decomposition and the quality of the compost product depend largely on proper control of ventilation (oxygen flow) and temperature. Decomposition may take several months or several years, depending on the nature of the yard wastes and the composting practices.

Composted yard wastes can be used as a soil amendment or mulch by residents, nurseries, farms, park services, government and private landscapers, and other groups. Households might use grass clippings directly as mulch, or might use compost in home gardens and on lawns. Centralized programs may give away or sell finished compost to residents, sell it to nurseries, or provide compost for use in public parks, etc.

There are two general forms of yard waste composting: in household back yards and at centralized facilities serving multiple households. Currently, there are over 986 yard waste composting facilities in the U.S., and the number is expected to grow.<sup>28</sup>

Incentives can be used to encourage greater levels of backyard composting and mulching, centralized composting, and use of compost. Incentives to encourage these activities include the following:

Purchase rebates or tax credits for materials used in backyard composting and mulching. This approach would subsidize the purchase of composting equipment, through rebates or tax credits. Rebates would be paid by the federal, state, or local government to consumers submitting proof of purchase.

Investment tax credits and other subsidies for centralized composting facilities. Publicly, privately, or jointly operated centralized yard waste composting facilities could receive any or all yard wastes from one or more communities. Incentives to encourage construction of new private composting facilities could include investment tax credits to reduce capital costs. Another option is for the municipality to simply pay the owner of a composting facility a fee to take municipal yard wastes, in an amount sufficient to make composting profitable but not to exceed the avoided cost of landfill disposal. Finally, private composting investments will be more attractive if the municipality pays for the collection and delivery of yard wastes, and ensures a predictable supply of yard wastes to the facility. Collection and transportation costs for operators of eight municipal yard waste facilities are between one and ten times greater than processing costs.<sup>29</sup>

Subsidies or other incentives for use of compost. The federal government might also help by subsidizing the cost of

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<sup>27</sup>Office of Technology Assessment, U.S. Congress, Facing America's Trash: What Next for Municipal Solid Waste? October 1989, pp. 184-190.

<sup>28</sup>BioCycle, March 1990.

<sup>29</sup>A.C. Taylor and R.M. Kashmanian, Study and Assessment of Eight Yard Waste Composting Programs Across the United States, December 30, 1988. Published as EPA/530-SW-89-066.

purchasing or using compost. For example, the application and/or transport cost of compost could be subsidized when used on farmland to protect soil productivity, reduce erosion, and protect water quality. This approach could be modeled after the USDA's cost-sharing programs to control nonpoint source pollution from agriculture. Alternatively, development on federal land and projects funded by the federal government could be tied to the use of compost.

Technical support and education programs. Any yard waste composting program would need to involve education efforts to be successful, either to provide technical information on backyard composting or to publicize the collection of yard wastes, and uses for compost, with a centralized program.

The need for a federal role in encouraging more composting of yard wastes is not clear. If the merits of increased composting are due largely to reduced demand for landfill capacity, the benefits of federal involvement may not be compelling, since capacity problems vary substantially by region. However, it is possible that federal procurement and tax subsidy incentives might be more effective than those instituted by state or local governments. Also, a federal role may be effective in expanding the market for compost products, particularly if suppliers and users of compost products are located in different areas.

## **NEWSPRINT RECYCLED CONTENT STANDARD WITH TRADING**

### Background and Goal of Incentive

An increased interest in promoting the separation, collection, and reprocessing of old newsprint (ONP) is due in part to the fact that newspapers constitute approximately 5.5 percent of MSW by volume, and also because, compared to many materials, newspapers are easy to recognize and separate out of residential waste.

Of the 13.7 million tons of ONP generated annually in the United States, approximately 4.5 million tons (33%) are currently recycled, with 1.5 million tons recycled to produce newsprint (i.e., 33% of the amount recycled), 2.0 million tons (44%) used to produce other paper and paperboard products, and 1.0 million tons (22%) exported. The remaining 9.2 million tons are landfilled or incinerated. Due to the increasing number of municipalities with ONP recovery programs, it is likely that the supply of ONP available for recycling will increase considerably in the early 1990s.

The demand for ONP for use in newsprint production is limited by cost and environmental concerns. Use of ONP in newsprint production involves installation of expensive equipment that removes the ink from the paper. The secondary fiber is then combined with virgin fiber to produce newsprint. Although research indicates that there may be cost savings from using secondary feed in place of virgin pulp at some plants, the newsprint industry has exhibited only a moderate shift toward the use of ONP. The lack of assured supply of ONP is a major barrier to investment in deinking capacity, particularly since many states and localities are legally barred from entering the long-

term supply contracts paper mills need to justify such capital investment.

In addition, the deinking process itself raises environmental concerns. The environmental and health risks associated with recycling have not been thoroughly studied. This issue must be carefully explored as the possibility of commitments to increased newsprint recycling are evaluated. Newsprint manufacturers may be wary about investing in plants that solve one environmental problem while possibly creating another.

Connecticut and California have enacted legislation to mandate demand for ONP; similar proposals are pending in New York, Illinois, and Wisconsin. The Connecticut statute requires newspaper publishers to increase the recycled content of the newsprint they consume by 10 percent per year, until the recycled content reaches 90 percent in 1998. The recycled content standard first takes effect in 1993 (when a 20 percent content will be required).

A minimum recycled content standard for newsprint imposed on newsprint producers and importers would create additional demand for ONP by mandating specified usage levels. By increasing the demand for ONP, this policy would cause an increase in the price of ONP, and thereby encourage additional collection and reprocessing of ONP. Such a standard could be imposed on publishers instead of on newsprint producers, with similar effect.

#### Description of Incentive

Rather than acting as a strict command-and-control approach, which would require each individual producer or importer (or publisher) to meet the standard, this approach would incorporate a trading scheme, to ensure that the industry-wide standard was met in a least-cost way. For example, if the standard required the use of feedstock containing at least 20 percent of recycled newsprint, producers and importers could create credits for sale by producing newsprint using more than 20 percent recycled feedstock. Thus, a producer of 100 tons of newsprint a year who produced 30 tons of recycled newsprint would have 10 tons worth of credits to sell to another producer or importer.

#### Evaluation

The content standard with trading addresses the problem of insufficient demand for ONP. A standard system that increased the recycled content from the current industry average of 10 percent to 20 percent would increase the use of ONP in newsprint production from about 1.5 million tons to 3 million tons, assuming no loss of volume due to the imposition of the standard.

The benefits of reduction in landfill disposal of ONP resulting from the increased use of ONP in newsprint would depend:

- o on whether the recycled ONP was produced using domestic or foreign ONP as an input (or, for state-level

programs, whether the newsprint with recycled content used ONP from within or outside the state);

- o on whether the increased use of ONP in newsprint reduced landfill disposal or simply displaced other domestic uses of ONP and exports; and
- o on the social value of the landfill space saved.

Given reports of stockpiles and reduced collection of ONP due to lack of demand, it seems likely that the increased use of ONP in newsprint production would result in increased recycling overall, rather than simply a shift in the types of products recycled.

The social cost of a recycled content standard would depend on a variety of factors, including:

- o the cost of expanding deinking capacity, including the cost of complying with applicable regulatory requirements;
- o the cost to society of a reduction in value of products made with newsprint, due to the possibility of a reduction in product quality as a result of use of increased recycled content; and
- o the opportunity cost of deterring other forms of ONP recycling.

In general, the cost of complying would vary across firms, depending on the distance between publishers (users of newsprint), consumers (sources of ONP), and newsprint producers.

More information is needed on the economics of using ONP in producing newsprint, especially on the costs of collecting and shipping ONP to newsprint plants and how these costs affect economic incentives to use ONP, and on the environmental impacts of ONP recycling, which may involve the location of noxious papermaking and deinking processes in heavily populated areas. A newsprint recycled content standard may hurt other users of ONP, such as manufacturers of other paper products made with ONP, exporters, and insulation suppliers. This could significantly reduce the benefits of the minimum recycled content standard. Analysis is also needed to determine the distributional effects of this policy, especially differences in regional impacts. Information on the foreign trade implications of this policy is needed -- e.g., how severely U.S. demand for Canadian newsprint would be affected (the U.S. imports approximately 60% of its newsprint from Canada) by the need to purchase import credits, whether it is feasible for Canadian plants to employ ONP in newsprint production, and whether this policy would violate existing trade agreements. Finally, a minimum recycled content standard does not address the problem of lack of assured supply. It may be that an easing of state and local restrictions on long-term contracts would be sufficient to allow the market for recycled newsprint to function smoothly without a minimum recycled content standard.

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**INTRODUCTION****DESCRIPTION OF THE PROBLEM**

"Greenhouse" gases released by human activities, such as carbon dioxide, methane, and chlorofluorocarbons, absorb heat that has been radiated from the earth's surface and trap it in the atmosphere. Scientific theory suggests that a steady increase in the concentration of greenhouse gases in the atmosphere could alter global climate, increasing temperatures and changing rainfall and other weather patterns.

Carbon dioxide (CO<sub>2</sub>) emissions are the largest contributor to global warming, followed by methane (CH<sub>4</sub>), chlorofluorocarbons (CFCs), and nitrous oxide (N<sub>2</sub>O).<sup>30</sup> Detailed measurements of carbon dioxide levels in the atmosphere since 1958 show an increase in CO<sub>2</sub> concentrations from 315 to 350 parts per million by volume. A recent EPA study reports that an estimated 5.5 billion tons of CO<sub>2</sub> emissions result from fossil-fuel combustion, and 0.4-2.6 billion tons from deforestation.<sup>31</sup> Table 1 lists the major stratospheric air pollutants and their sources and effects.

There is much scientific uncertainty about the magnitude and timing of temperature changes that may be caused by a build-up of greenhouse gases. One recent review of the research suggests that, by the second half of the 21st century, past emissions of greenhouse gases will raise the global temperature by one to two

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<sup>30</sup>D.A. Lashof and D.A. Tirpak, eds., Policy Options for Stabilizing Global Climate: Draft Report to Congress: Executive Summary, U.S. EPA, February 1989, pp. 11-12.

<sup>31</sup>Ibid., p. 15.

degrees Celsius.<sup>32</sup> By causing temperatures to increase, greenhouse gas emissions may alter precipitation patterns and increase evaporation. These climate changes could have profound environmental and socioeconomic impacts by inducing changes in forests, biodiversity, coastal wetlands, water resources, and agriculture. By the same token, efforts to reduce emissions could impose high costs, and themselves could cause significant economic dislocation.

Global warming raises a unique set of policy issues because the effects of global greenhouse gas emissions transcend national boundaries. The United States is currently engaged in a major international research effort to assess the potential for climate change as a result of increased emissions of CO<sub>2</sub>, CH<sub>4</sub>, and other greenhouse gases. Support for this effort is needed to ensure that our policies are based on sound scientific analysis. Economic factors as well as scientific ones must also be taken into account. Estimates of the costs and benefits of alternative response strategies can be used to identify cost-effective policy designs and efficient policy targets.

It is important to recognize, when comparing the benefits and costs of control actions, that policies to reduce greenhouse gas emissions would reduce, but not eliminate, any future warming. Benefits are measured by the difference in impacts with and without the policy in place. In addition, analyses of policies to reduce emissions must consider their full global impact. Policies that raise the cost of production in the United States may simply shift emissions to other countries, since lost U.S. production could result in greater production (and thus greater emissions) in other countries. In addition, the effect of restrictions on the consumption of fossil fuels in countries adopting greenhouse gas policies may be to lower world market prices for those fuels, thus increasing consumption in countries not adopting such policies.

If economic and scientific research indicates that policies to reduce emissions are warranted, a variety of incentive-based programs might be used to encourage reduced emissions in the most cost-effective manner. Final judgment on the merits of these incentives will depend on the results of the ongoing research and analysis. For these reasons, policies with global leverage, such as efforts to accelerate the development of new reduced-emissions technologies that will be voluntarily adopted on a worldwide basis, may be attractive alternatives to the emission reduction strategies considered in this chapter.

## **THE ROLE OF INCENTIVES**

Economic incentives could play a valuable role in efforts to implement any reductions in net greenhouse gas emissions. First, no individual country can, through its own actions, have an adequate impact on the level of global net greenhouse emissions. Any actions to reduce net emissions would have to be agreed upon by countries with very different institutional arrangements for

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<sup>32</sup>J.B. Smith and D.A. Tirpak, eds., The Potential Effects of Global Climate Change on the United States: Draft Report to Congress: Executive Summary, U.S. EPA, October 1988, p. 5.

addressing environmental problems. Moreover, both the costs of reducing net emissions and the economic resources available to invest in mitigation vary greatly among countries and sources. The most cost-effective approach to reducing net emissions would take into account these differences in control opportunities and resources. Incentive approaches could achieve desired reductions in net emissions at a lower cost than an approach that did not provide flexibility to reallocate the effort demanded of different sources and countries.

#### **OVERVIEW OF INCENTIVES**

The Task Force considered four incentive strategies to reduce emissions of greenhouse gases. Two of the incentives -- a fee on the carbon content of fuels and a vehicle "sipper/guzzler" fee/rebate system -- could be used to internalize the cost of environmental damage caused by emissions from use of fossil fuels. A third incentive would encourage use of electric utility rate-setting practices that take more accurate account of the costs and benefits of conservation. The fourth policy would incorporate trading as part of negotiated international restrictions on net emissions.

## **FEE ON CARBON CONTENT IN FOSSIL FUELS**

### **BACKGROUND AND GOAL OF INCENTIVE**

Carbon dioxide (CO<sub>2</sub>) is the most abundant greenhouse gas after water vapor. The combustion of fossil fuels is the major human source of carbon dioxide emissions, accounting for 65 to 85 percent of global carbon dioxide emissions. Since preindustrial times, the atmospheric concentrations of CO<sub>2</sub> have increased 23 percent. Although higher concentrations of carbon dioxide induce smaller and smaller temperature changes, CO<sub>2</sub> is expected to be a dominant gas in future increases of the greenhouse effect.

This incentive would impose a fee on fossil fuel production or on the carbon content of different imported fuels. The fee would be higher for fuels containing more carbon and therefore contributing more to CO<sub>2</sub> emissions. The fee would raise prices to fuel consumers, and might promote energy efficiency and fuel substitution, which would in turn reduce greenhouse gas emissions.<sup>33</sup> The fee could also be accompanied by a decrease in other business taxes (e.g., social security payroll taxes) to offset its effects on inflation and national income.

### **DESCRIPTION OF INCENTIVE**

One of two approaches might be taken to set fee levels. Fees could be set to internalize the social costs imposed by CO<sub>2</sub> emissions, with total emission levels to be determined by the responses of fuel users. Alternatively, specific emission targets for greenhouse gases could be established based on economic and scientific assessments. Then, fees could be used as a tool to reach these targets.

The fees would be imposed on fuels from foreign as well as domestic sources, to avoid fuel switching by U.S. customers. The U.S. Treasury would collect fees at the point of entry for imported fuels and at the point of primary production for domestic fuels. Thus, for domestic fuels, the fee would be applied to coal shipments from coal mines, crude oil received at refineries, and natural gas received by pipelines. The U.S. Treasury would also be responsible for enforcing the fee.

Although the fee would be imposed directly on fossil fuel production or import, consumers of goods and services produced with fossil fuels would bear this fee in the form of higher prices. Initially, consumers might not alter their energy consumption behavior appreciably. With time, however, they would have more opportunities to reduce their consumption and turn to alternative sources of energy.

### **EVALUATION**

A recent EPA report on global warming concluded that a fee on fuel carbon content could encourage fuel substitution, reduced

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<sup>33</sup>Reductions in fossil fuel use would generate other environmental improvements, such as acid rain reduction and improvements in urban air quality.

fuel use, and associated reductions in CO<sub>2</sub> emissions.<sup>34</sup> Substantial costs would have to be imposed on fuel users to achieve significant change in fuel use, however. For example, rough estimates indicate that by the year 2000 a fee of \$5 per ton of carbon would reduce annual U.S. carbon emissions between 0.6 and 4.0 percent from baseline levels and raise \$7 to \$10 billion in revenues per year once fully implemented; a fee of \$15 per ton would raise \$20 to \$30 billion and reduce annual carbon emissions by 3 to 12 percent from baseline levels; and a fee of \$25 per ton would raise \$38 to \$50 billion in annual revenues and reduce annual emissions by 8 to 17 percent from baseline levels.

The competitiveness of certain U.S. industries could be affected by large fees on fuel carbon content. Industries for which energy costs are a large portion of production costs, such as primary metals and chemicals, would be most severely affected. In addition, certain regions that are heavily dependent on fossil fuels, such as the Northeast, would incur larger costs under such a program.

Because the effects of CO<sub>2</sub> emissions cross state and national boundaries, federal government involvement might be justified to ensure that the cross-boundary effects of emissions are considered. However, state-level greenhouse policies have been proposed. For example, California's Proposition 128 (Big Green) included a provision to limit emissions of greenhouse gases.

The ultimate effect of U.S. efforts on emissions, international trade, and competitiveness would depend on the extent to which other countries restricted their greenhouse gas emissions. Implementation of a carbon fee in the United States might therefore be made contingent on efforts by other major emitting countries. It also might be accompanied by reductions in other business taxes.

Substantial additional scientific research is needed on the costs and environmental benefits of reduced fossil fuel use. In particular, more understanding is needed of the relationship between CO<sub>2</sub> emissions and global warming, and of the impacts of possible future global warming, to determine the costs and benefits of major reductions in fuel use. Depending on how fee levels would be established, detailed analysis of the economics of fuel use may be required. Finally, in-depth analyses of the macroeconomic effects and distributional impacts (by industry, region, and income group) of different fee levels are needed.

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<sup>34</sup>D. A. Lashof and D. A. Tirpak, eds., op. cit., pp. 37-38.

## **INTERNATIONAL TRADING OF GREENHOUSE GAS EMISSION RIGHTS**

### **BACKGROUND AND GOAL OF INCENTIVE**

Each greenhouse gas has a different impact on the atmosphere. These gases come from diverse sources, both natural and anthropogenic (human-induced), that involve virtually all economic sectors. Humans can also remove greenhouse gases from the atmosphere by planting trees.

Substantial reductions in greenhouse gas emissions would require the cooperation of many nations and changes in a wide range of economic activities. The costs of reducing net emissions would most likely be high, and would vary greatly from country to country and from one type of source (or sink) to another. Policies to limit the economic burden would be desirable, if further scientific and economic research indicates that reductions in net greenhouse gas emissions are justified.

This incentive would introduce trading provisions to an international limit on net emissions of greenhouse gases. A trading component could promote international participation in the agreement by encouraging the greatest reductions in those countries with the lowest-cost opportunities to reduce emissions. In addition, international trading may provide a source of funds for countries with relatively low-cost options for reducing net emissions, but with limited funds to invest in those options.

### **DESCRIPTION OF INCENTIVE**

This incentive assumes that a number of nations reach agreement to impose limits on net emissions of greenhouse gases from each nation. The agreement might address one or more of the greenhouse gases believed to have the greatest direct impact: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), chlorofluorocarbons (CFCs), and nitrous oxide (N<sub>2</sub>O); or, it could also include gases believed to have an indirect impact: volatile organic compounds (VOCs), nitrogen oxides (NO<sub>x</sub>), and carbon monoxide (CO) -- each of which also contributes to tropospheric ozone.

It is difficult to compare policy options that target different gases. Any agreement covering more than CO<sub>2</sub> alone would require some method for establishing net emission limits for individual gases on an equivalent basis, since the different gases vary in their contribution to global warming. A single metric that can integrate and estimate the contribution of a mix of gases would allow policymakers to assess more accurately the total impact of a policy option on global climate. Several proposals have been made for a CO<sub>2</sub> equivalent index, which could be used to include additional gases in an agreement.

EPA has recently developed and implemented a comprehensive method for determining each greenhouse gas's specific contribution to temperature change. EPA's approach measures the emissions of individual greenhouse gases using a common metric: "carbon equivalents." The Intergovernmental Panel on Climate Change recently published a list of these equivalents, the "Global Warming Potentials" of various greenhouse gases. Emission equivalents are then summed to yield total current

greenhouse gas emissions.

The trading component is straightforward in concept. Each country would have a target for net greenhouse gas emissions, and would have two options for achieving the target: (1) investing in programs to reduce actual emissions, or (2) purchasing from another country a right to emit greenhouse gases at levels above their own target. Countries could create rights for sale to other countries by reducing their net emissions below their agreed-on target.

The private financial system could provide for the transfer of funds among countries to finance trades. Each country would have to determine how to distribute or collect funds involved in international trades among its businesses and populations. One method for countries with market economies would be to replicate the trading system on a national scale, and simply allow trading among private and public sources within each country as well as among countries.

## **EVALUATION**

Incorporating trading in any international agreement to limit net greenhouse gas emissions could have a number of potentially important benefits.

First, trading could reduce the aggregate worldwide cost of achieving net emission reductions, by encouraging the greatest reductions and/or sink enhancement by the countries and emission sources with the lowest emission reduction costs.

Second, by allowing flexibility in response, trading may encourage greater participation among nations in an international agreement. Finding ways to encourage participation would be crucial, because many countries would most likely face difficult conflicts with economic and other goals if they agreed to significant net emissions reductions. By focusing on the diverse assortment of greenhouse gases, and not solely on CO<sub>2</sub>, systems like EPA's comprehensive approach may avoid placing an excess burden on energy-intensive (particularly those using fossil fuel) industries that emit CO<sub>2</sub>.

Third, the trading of emission rights may help to finance emission reductions in developing countries, by providing a means of financing investments in control technologies. In effect, trading would create a new export "commodity" -- rights to emit greenhouse gases. Some developing countries might have a comparative economic advantage in producing such rights. Reforestation may be a very promising activity in many of these countries. These countries could sell rights to countries that would incur higher costs to achieve equivalent reductions, at a price sufficient to cover the cost of the required investments. Depending on the market price that emerged for emission rights, countries with a strong comparative advantage in net emission reductions may even find trading to be a positive source of economic growth.

However, several areas pose difficult challenges for the design and implementation of an emission trading system.

The first and perhaps most difficult issue is how to determine initial allocations of emission rights among countries. There is some precedent for such an agreement in the Montreal Protocol on Substances that Deplete the Ozone Layer. One option would be to cap emissions at current levels; however, emissions per capita today vary considerably across the world. Developing countries might view a cap at current levels as unfair, due to concerns that it could impede economic development. However, since growth in emissions from developing countries is a major source of predicted baseline growth in greenhouse gas emissions, targets that allow developing countries to emit as much per capita as industrialized countries would most likely defeat the purpose of the agreement. More energy-efficient industrialized countries might view reductions tied to current emission levels as inequitable, since it might not compensate for past emission reductions. In general, any method for allocating emission rights among nations would need to consider current emission levels, and to incorporate reasonable assumptions about population growth and likely impacts on economic growth.

Second, any agreement to limit emissions must specify how emissions would be monitored. There are trade-offs between ease of monitoring and accurate measurement of contribution to global climate changes. For example, reduced fuel use might be relatively easy to monitor, but it is an imperfect measure of contribution to greenhouse gas emissions. Emissions also depend on the use of control devices, agricultural practices, and reforestation. Methods would have to be developed to express the contribution of each activity to emissions on an equivalent basis. In addition, systems would be needed to monitor fuel use, use of control technologies, reforestation, changes in agricultural practices, and other activities that influence greenhouse gas emissions.

All of these issues would arise under any type of international compact to reduce net greenhouse gas emissions. Adding a trading component to the system should impose only limited additional administrative or enforcement complexity, and could substantially reduce the economic burden imposed by agreed-upon net emission limits.

## INCENTIVES TO ENCOURAGE ELECTRICITY CONSERVATION

### BACKGROUND AND GOAL OF INCENTIVES

Energy use in electricity generation is an important source of carbon dioxide (CO<sub>2</sub>) and other greenhouse gas emissions. Sharp increases in oil prices in the early 1970s and increases in electric rates due to rising costs of construction prompted widespread efforts among U.S. households, commercial establishments, government agencies, and industries to conserve electricity. Substantial improvements in energy efficiency were achieved in response to these strong economic incentives. Further reductions in electricity use through increased investment in conservation measures may be justified, if further scientific and economic research indicates that policies to reduce greenhouse gas emissions are needed.

Some economists argue that customers already have sufficient incentives to employ energy-saving technologies, because they thereby achieve savings in their electric bills, and that many proposals to promote further conservation are not cost-beneficial.<sup>35</sup> Other economists argue that there has been underinvestment in conservation programs.<sup>36</sup> The latter view has led to various proposals to encourage greater utility investment in conservation programs.

Discussions concerning conservation often suggest that conservation programs should only be undertaken if the benefits in reduced generation costs (including fuel use) exceed the cost of the conservation program. The relative cost of conservation vs. generation therefore determines the optimal policy. However, considering the environmental consequences of different options might change the optimal policy choice. The contribution of that electricity generation using fossil fuel to global warming, acid precipitation, and other environmental problems would suggest that conservation has social benefits beyond those reflected in private costs.

Incentive programs could be designed simply to remove existing biases against investment in conservation, or could go further to account for the contribution of electricity generation to environmental externalities.

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<sup>35</sup>See Kenneth W. Costello, "Ten Myths of Energy Conservation," Public Utilities Fortnightly, March 19, 1987.

<sup>36</sup> Underinvestment in conservation is attributed to a variety of causes--for example, the fact that the marginal cost of electricity often exceeds rates charged to customers (which are based on average costs); that some customers (e.g., renters without individual meters) do not incur the costs of their electricity use directly; that there are information barriers hindering customers' evaluation of conservation alternatives; that capital constraints discourage investments in conservation technologies; and that methods used to set rates do not reflect the full social costs, including environmental costs, of electricity generation.

## **DESCRIPTION OF INCENTIVES**

Regulation of electric utilities is the responsibility of state regulatory commissions. Therefore, the primary opportunity to apply economic incentives arises at the state level. The types of programs that can be used include:

- o demand-side bidding and
- o utility rate reform.

The federal government could encourage states to adopt policies that promote conservation and to factor the environmental impacts of power generation into regulatory decisions. For example:

- o The Federal Energy Regulatory Commission (FERC) has already proposed regulations on supply-side bidding to promote deregulation. This proposal could be expanded to incorporate demand-side provisions as well.
- o The Department of Energy could provide assistance to state public utility commissions, to support any of a number of conservation incentive programs.
- o EPA could assist states and utility commissions in their evaluation of the environmental costs of different energy options.

### Least-Cost Planning

Least-cost planning is a comprehensive method for evaluating options for meeting energy-service needs. The least-cost planning process differs from traditional utility planning by (1) explicitly including conservation and load management programs as options, (2) considering environmental and social as well as direct economic costs, and (3) analyzing the uncertainties and risks as well as expected costs associated with different energy supply options.<sup>37</sup> The use of least-cost planning approaches in a number of states has led to increased interest in demand-side management programs generally. These demand-side programs influence the characteristics of customers' demand for electricity, including both total demand for energy and the timing of demand. Utility demand-side management programs have included education programs, audit services, promotion of appliance efficiency, and funding of conservation investments.

### Demand-Side Bidding Programs

Programs designed to promote deregulation in power supply have become common in recent years. The passage of the Public Utility Regulatory Policies Act of 1978 created a new market for third-party electricity generation. For some utilities, third-

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<sup>37</sup>See C. Goldman, E. Hirst, and F. Krause, Least-Cost Planning in the Utility Sector: Progress and Challenges, Oak Ridge National Laboratory, May 1989.

party sources have become a major source of new additions to power supply. A number of jurisdictions have used auction-type bidding programs to acquire specified amounts of electric power. These programs ensure that the most cost-effective method is used to acquire power.

Recently, there have been a number of proposals to include "demand-side options," including conservation, in such bidding programs.<sup>38</sup> In these proposals, conservation services would be considered as an alternative to new power sources in the bidding process. Bids might be submitted by utility customers themselves, or by energy service companies, who would share savings with the customers.

The specific design of such programs is the subject of much debate. Various economists have offered different approaches to structuring the bidding process, with the goal of ensuring that only efficient conservation measures (those for which the true savings, based on the marginal cost of additional generation, exceed their costs) are undertaken. Different mechanisms are proposed for sharing the savings among the utility, the suppliers of conservation technologies and services, and utility customers.

More extensive use of bidding requirements that include demand-side options might encourage greater investment in conservation measures, reduce the need for new generating capacity, and reduce utility fuel use. Bidding programs could be designed to provide an advantage to demand-side options, based on the negative environmental externalities associated with generation.

### **Changes in Utility Rate-Setting**

The methods commonly used to set utility rates discourage utilities from investing in or promoting conservation.<sup>39</sup> Two factors contribute to this problem.

First, utilities are generally allowed to earn returns on investments in generating capacity, which are included in the utility's rate base. However, most commissions require that conservation investments be expensed, providing no addition to the rate base.

Second, once rates per kwh have been set in a rate case, utilities have an incentive to sell as many kwhs as possible. Encouraging conservation decreases a utility's earnings.

Some states have revised their procedures to address these disincentives to invest in conservation. In some jurisdictions,

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<sup>38</sup>See Amory Lovins, "Saving Gigabucks with Megawatts," Public Utilities Fortnightly, March 21, 1985, for a description of a bidding system requiring utilities to purchase "saved" kwh of electricity as an alternative to new generation.

<sup>39</sup>See Alliance Technologies Corp., Electric Utility Conservation Incentives: Potential Federal Roles, Draft Final Report for U.S. EPA, August 1989, for a discussion of the effects of utility ratemaking on conservation incentives.

utilities are allowed to include conservation investments in their rate base. Some states, such as Wisconsin and Washington, even allow utilities to earn a higher return on conservation than on other investments. A variety of methods have been proposed to address utilities' incentives to maintain sales. For example, California's "Electric Revenue Adjustment Mechanism" adjusts rates upward if sales fall below forecasted levels. Utilities are therefore not penalized if they invest in conservation programs.

## EVALUATION

Some studies indicate that significant reductions in future generation of electricity are possible with increased conservation efforts. For example, a study by Applied Energy Services estimated that conservation programs could reduce electricity demand from projected levels by 101,000 Megawatts (or 14 percent of total projected U.S. demand) in the year 2006.<sup>40</sup> The effect of increased conservation incentives on greenhouse gas emissions depends on what type of utility generation is displaced by conservation. The greatest emission reductions would occur if conservation induced substantial reductions in coal-fired generation.

Any programs to promote further conservation of electricity must address certain basic issues. These include:

- o how to define and measure the benefits of conservation, including direct savings in electric generation costs and reduced environmental impacts, and
- o how to design programs that ensure that beneficial and economically justified conservation programs are undertaken and that conservation measures with costs that exceed their full benefits are not encouraged.

There is substantial controversy, for example, about whether utilities should be required to pay for demand-side conservation at all and, if so, how much should be paid.<sup>41</sup> Among the proposals are requirements that utilities pay:

- o the average cost of electricity to the generator
- o the utility's full avoided cost of generation or
- o the difference between the average cost of electricity to the consumer and the avoided costs to the utility resulting from conservation.

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<sup>40</sup> Roger F. Naill, "Least-Cost Alternatives for Electricity Generation," Energy Economics and Energy Politics, op. cit., pp. 15-19.

<sup>41</sup> Charles J. Cicchetti and William Hogan, "Including Unbundled Demand-Side Options in Electric Utility Bidding Programs," Public Utilities Fortnightly, June 8, 1989.

The differences among these proposals basically involve the sharing of savings from conservation between the utility and the customer. Some economists argue that paying the customer the utility's full avoided cost would result in excessive investment in inefficient conservation measures, because the customer is essentially paid twice--once in reduced electric bills and again in payments from the utility. The third approach is designed to correct incorrect price signals to the customer when rates (based on average costs) are below marginal costs, and is less likely to encourage overinvestment in conservation.

There are also concerns about the effects of conservation programs on the rates paid by customers who are not able to reduce their electricity demand. Some proposals to promote conservation impose a "no losers" test, requiring that conservation programs be adopted or funded only if they represent savings to the utilities and if no customers face higher rates as a result. There is controversy about how much such provisions discourage the adoption of cost-effective conservation programs.<sup>42</sup>

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<sup>42</sup> Larry E. Ruff, "Least-Cost Planning and Demand-Side Management: Six Common Fallacies and One Simple Truth," Public Utilities Fortnightly, April 28, 1988, pp. 22-25.

## "SIPPER/GUZZLER" REBATE/FEE

### BACKGROUND AND GOAL OF INCENTIVE

Automobiles contribute to increasing greenhouse gas concentrations by emitting carbon dioxide and nitrous oxide as they burn gasoline. The most obvious, direct, and efficient way to limit greenhouse gas emissions from this source would be to impose emission taxes. The amount of the tax would be equal to the economic value of the damages caused by the emissions. The advantage of this approach is that it internalizes the social cost of pollution, while minimizing interference in the market.

An alternative, less economically efficient, approach would be to focus on new-car fuel efficiency. Technologies are already available that can increase automobile fuel economy from current levels. A recent study estimated that fleet average levels of 34 mpg could be achieved by the year 2000, as compared with a 1987 level of 27 mpg, without reducing vehicle sizes or performance.<sup>43</sup> Substantially greater fuel efficiencies are technologically feasible, although they may require sacrifices in vehicle size and performance. Existing purchase patterns, such as a revealed preference for expensive optional engines that add to the purchase price and fueling costs, suggest that consumers place a high value on performance. Performance and safety considerations would merit close attention in any cost-benefit analysis of this incentive.

Existing programs designed to encourage fuel economy rely on a traditional "command-and-control" approach. The primary mechanism for increasing fuel economy has been the corporate average fuel economy (CAFE) standard established by the U.S. Department of Transportation. Under this program, each auto manufacturer's fleet of cars produced over a year must meet the fuel economy standard on average (currently 27.5 miles per gallon) or pay a penalty. Auto manufacturers have struggled to meet these standards, partly because consumers have continued to demand high performance and, therefore, less fuel-efficient cars, despite higher prices for such cars and the gas guzzler excise tax.

This incentive would impose a new gas guzzler fee, with rebates offered for sales of highly fuel-efficient cars. The incentive would encourage vehicle owners to reduce fuel use by: (1) purchasing more fuel-efficient cars (gas sippers) and (2) retiring the stock of old, fuel-inefficient cars (gas guzzlers) more quickly.

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<sup>43</sup>Carmen Difiglio, K.G. Duleep, and David L. Green, "Cost-Effectiveness of Future Fuel Economy Improvements," August 1989. Prepared for publication in The Energy Journal. However, most manufacturers have exploited new technologies to increase performance rather than fuel economy in recent years.

## DESCRIPTION OF INCENTIVE

Currently, automobile manufacturers pay an excise tax based on the mileage rating per gallon of an automobile. As currently structured, the gas-guzzler fee paid by manufacturers applies to a small percentage of sales (less than 5 percent). To date, the gas-guzzler tax has been applied mainly to high-priced foreign luxury car imports; no domestic manufacturer has ever had to pay the fee. The current fee is levied on vehicles whose combined EPA-rated highway and city fuel efficiency is less than 22.5 mpg. The tax imposed on 1987 cars ranged from \$500 for ratings of 22.5 miles per gallon or more to \$3,850 for cars with ratings under 12.5 miles per gallon.<sup>44</sup>

Designing the incentive system would involve specifying the amount of fee or rebate to be applied for each fuel-efficiency level. The fee and rebates could be indexed over time. In deciding where to draw the line between sippers and guzzlers, decision-makers would have to consider both the average fuel economy of the existing vehicle stock and the level of the fee to impose on guzzlers.

The fees could be set to reflect the social costs imposed by vehicle gasoline use, without regard to a specific target for emission reductions. In this case, the fee/rebate system might substitute for rather than reinforce the CAFE program. Alternatively, the program could be designed to achieve a specific target improvement in overall fuel efficiency, in which case careful analysis of baseline trends in vehicle purchases and of the price sensitivity of different customer groups would be needed.

The federal government could collect fees and provide rebates to manufacturers based on their sales over a designated period. Systems for measuring and reporting vehicle design fuel economy are already in place under the CAFE program.

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<sup>44</sup>EPA's Office of Policy Analysis analyzed an alternative scenario wherein the purchasers of all but the most fuel-efficient vehicles were taxed at the time of purchase. The preliminary analysis estimates the fee level necessary to hold CO<sub>2</sub> to 1989 levels through the year 2000, and to maintain this level through the year 2010. Using simplified assumptions, the results suggest that the average vehicle would need to be taxed \$1,300 (in 1989 dollars) by the year 2000, and taxed \$1,500 by the year 2005. The year 2000 goal corresponds with a tax schedule that assesses, on average, a \$75.00 penalty for every mpg below 50 (the current standard for the most fuel-efficient vehicles predicted for the year 2000).

## EVALUATION

The effect of specific fee and rebate levels on emissions would depend in part on the price sensitivity of different vehicle purchasers. Many low mile-per-gallon cars are luxury cars. Purchasers of these cars appear to be relatively insensitive to small price increases. Purchasers of gas sippers are likely to be more sensitive to vehicle price than purchasers of gas guzzlers. Although further analysis is a prerequisite to implementation, this proposal holds some promise to improve upon the current programs by adding an incentive for price-sensitive customers to increase the average fuel efficiency of their purchases.

However, the effects on emissions of encouraging purchases of more fuel-efficient vehicles, however, are uncertain for two reasons.

First, the effects of improved fuel efficiency might be reduced by increases in the numbers of miles driven (because of the reduced marginal costs of driving brought about by the program) and by failure to maintain cars properly. Moreover, the owner of an existing gas guzzler might avoid replacing the vehicle and instead continue to operate the older, less fuel-efficient vehicle.

Second, increases in miles driven can result in higher levels of other, indirect greenhouse gases, such as NO<sub>x</sub> and VOCs. The relationship between gasoline consumption and emissions can vary, depending on the nature of design changes used to improve fuel efficiency. Some engine design changes that improve fuel efficiency may increase the rate of emissions per gallon of fuel for certain pollutants.<sup>45</sup>

This incentive does not address vehicle owners' driving practices. If total vehicle emissions continued to be significant despite new incentives to increase fuel efficiencies, more complex incentives could be considered to target the behavior of vehicle owners more directly. Examples of incentives include:

- o A federal income tax credit or debit based on the fuel economy of new automobiles or the automobile(s) that a taxpayer currently owns. The tax credit/debit could be based on a schedule of automobiles classified according to fuel economy, fuel use, age, and/or location of registration.
- o Increasing the cost of operating fuel-inefficient cars through a "smog" tax on gasoline purchases, to encourage consumers to buy fuel-efficient cars and drive less.<sup>46</sup> One study has proposed that cars be

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<sup>45</sup>Lester Lave, "Conflicting Objectives in Regulating the Automobile," in Public Expenditure and Policy Analysis (Third Edition), Houghton Mifflin Co., Boston, MA, 1983.

<sup>46</sup>For certain emissions, such as CO<sub>2</sub>, which is emitted at a constant rate per gallon of fuel, the "smog tax" would be in effect a simple "gas tax."

given a smog rating that would affect the cost of gasoline for that car.<sup>47</sup> A similar approach might be taken using a broader-based index that reflected the costs of greenhouse gas emissions.

These alternatives could be considered as supplements to or substitutes for a fee/rebate program.

Some new record-keeping systems would be needed to implement these alternative incentives. For example, the tax credit/debit would require vehicle owners to use (and the IRS to audit) an annual credit/debit schedule incorporated into the computation of their income taxes. (Vehicle owners could keep records on gasoline purchases and mileages in lieu of using the schedule.) Proof of vehicle characteristics and vehicle maintenance records are normally kept by consumers, so this would not involve an additional record-keeping burden. A "smog tax" would require record-keeping by gasoline retailers similar to that now done for collection of gasoline taxes.

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<sup>47</sup> See A. Myrick Freeman III, Robert H. Haveman, and Allen V. Kneese, The Economics of Environmental Policy (John Wiley and Sons: 1973), pp. 132-134.

## INTRODUCTION

## DESCRIPTION OF THE PROBLEM

The U.S. has basically relied on command-and-control approaches to manage water resources. EPA has focused on regulating water quality, while state and local agencies have focused on water supply.

Effective management of water resources may require control of water quality problems, reduced water consumption, and wetlands protection. The environmental impacts of these aspects of water resource management are interrelated. If water quality is degraded, less water is available for consumption. Conversely, excessive withdrawals from surface and ground water and destruction of wetlands degrade water quality.

**Water Supply**

Water is becoming an increasingly scarce resource. According to the 1983 National Fisheries Survey, low water levels are harming fish in 68 percent of U.S. inland waters.<sup>48</sup> In 1975, two-thirds of the nation's ground water was not fully recharged.<sup>49</sup> Public opposition to new reservoirs and economic concerns increase the benefits of relying on improved management and conservation measures to meet water needs.

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<sup>48</sup>Conservation Foundation, State of the Environment: A View Toward the Nineties, p. 226.

<sup>49</sup>Ibid., p. 231.

## Water Quality Degradation

### Surface Water

The United States has made considerable progress during the past twenty years in cleaning up many of the nation's waterways. However, degraded water quality persists as a problem in certain areas. Recent data from the states, as reported to EPA, indicate that approximately 10 percent of the nation's river, stream, and coastal water mileage and lake and estuary areas continue to be too polluted to support recreational fishing and swimming.<sup>50</sup> These data reveal that 17,365 different segments of these water bodies in 49 states and 6 territories are contaminated by toxic contaminants, conventional pollutants, or both.

In a recent study, EPA found that approximately 595 stream segments are contaminated by one or more of 126 toxic contaminants.<sup>51</sup> The major sources of these contaminants are industrial facilities, sewage treatment plants, and "nonpoint sources" (nonpoint-source pollutants originate from nonspecific sources, such as urban and agricultural runoff). EPA identified 627 industrial point sources that discharge toxics directly to surface waters, including metal finishing and manufacturing plants, pulp and paper mills, petroleum-refining plants, and organic chemical and plastics plants. EPA estimated that, in 1987, 554.7 million pounds of toxic chemicals were discharged directly to surface waters, and 883.5 million pounds were discharged indirectly through publicly owned treatment works (POTWs).<sup>52</sup>

Toxic pollutants in surface waters may pose ecological and health risks in some areas. EPA studies have shown that certain toxic organics and metals can threaten aquatic life and build up in the food chain. When these chemicals concentrate in fish, they can pose a significant human health risk if consumed.

In addition to health and ecological effects, there may be significant economic damages associated with toxic discharges to surface water. EPA's Unfinished Business report estimated that industrial discharges to surface water cause losses of approximately \$800 million per year in recreational fishing, swimming, and boating opportunities. Similar discharges from POTWs cause welfare losses of approximately \$2.4 billion.

In many water bodies, nonpoint sources are greater contributors of conventional and toxic pollution than industrial or municipal sources. The primary nonpoint-source pollutants

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<sup>50</sup> U.S. Environmental Protection Agency, Report to Congress: National Water Quality Inventory--1988.

<sup>51</sup> Stream segments are generally six to ten miles long.

<sup>52</sup> Section 313 of the Emergency Planning and Community Right-to-Know Act requires manufacturing firms to report releases of toxic chemicals for the Toxic Release Inventory (TRI). These reported releases are a subset of all point-source toxic releases; non-manufacturing and transportation sources and certain industrial sources are not included. The quantities of chemicals discharged to surface water that are reported here do not include sodium sulfate.

degrading freshwater are agricultural fertilizers, insecticides, and herbicides. EPA knows much less about the quantities and sources of nonpoint-source pollutants than about point-source pollutants. However, EPA estimated in Unfinished Business that nonpoint-source pollution causes \$3.6 billion in damage to recreational fishing, swimming, and boating.

### **Groundwater**

In recent years, EPA and other environmental agencies have begun to focus on protecting groundwater resources. EPA has found that past mismanagement of wastes and products has seriously contaminated aquifers in certain areas. This contamination can pose significant risks of cancer and other health effects to the people who use the groundwater for drinking water.

Improper waste storage and disposal practices may have contributed to groundwater contamination in some areas. Underground fuel storage tanks, improper disposal of used containers of pesticides and other chemical products, municipal solid waste landfills, and active and inactive hazardous waste disposal facilities have been responsible for contaminating ground water at various locations. Facilities meeting current state or federal standards are not likely to pose these types of problems.

Because of all the public attention to groundwater protection, the issue has become a major focus of agency activities. Both efforts to prevent contamination and to treat or clean up a contaminated aquifer are expensive and can take many years. EPA's estimates of the health risks associated with groundwater contamination are somewhat speculative. Improvement of these estimates is needed to assess the level of intervention that serves to maximize net social benefits.

### **Wetlands**

During recent decades, the United States has been filling wetlands at a rate of between 300,000 and 450,000 acres per year.<sup>53</sup> Wetlands destruction can result in the loss of a number of important natural resources, including:

- o habitat for a large number of aquatic and terrestrial animals;
- o natural filtration for removing pollutants from water;
- o storage area for flood waters; and
- o primary production of plants that provide the nutritional basis for the food chain that supports finfish and shellfish.

These damages often cannot be easily reversed.

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<sup>53</sup> U.S. Fish and Wildlife Service, Status and Trends Report: National Wetlands Inventory (1983).

EPA and other federal agencies require permits for the development of wetlands under Section 404 of the Clean Water Act. However, there are important exceptions to Section 404 requirements, most notably for agricultural users, that have led to the net loss of freshwater wetlands in many areas. In addition, many areas of the United States are seeking new or expanding existing drinking water supplies. The development of these supplies may contribute to a number of environmental problems, including the destruction of wetlands.

#### **OVERVIEW OF INCENTIVES**

Incentives can play an important role in protecting water supplies and water quality where market failures exist, especially where contamination is caused by numerous small sources. The Task Force considered three incentives that would affect water quality and supplies. The first incentive addresses the pricing of water for consumption by households and businesses. This incentive would alter both the level and the structure of water rates to encourage more efficient use.

The second incentive would involve a deposit/refund system for pesticide containers. Users would return these containers to central locations for proper reuse or disposal in order to recover their deposits.

The third incentive would reduce federal subsidies that encourage environmentally damaging development in coastal and wetland areas. The discussion addresses the National Flood Insurance Program and various federal infrastructure programs that subsidize bridges, marine construction, and highways.

## CHANGES IN THE PRICING OF WATER

### BACKGROUND AND GOAL OF INCENTIVE

Inefficient use of water resources can lead to a number of environmental problems, including:

- o wetlands destruction resulting from construction of new water supply projects;
- o reductions in assimilative capacity, temperature increases, and changes in natural flow patterns from water withdrawals and damming of streams and rivers;
- o reductions in ground-water flow to surface water due to increased withdrawals from aquifers;
- o increased contamination of ground water from excessive irrigation of agricultural areas; and
- o excessive demands on and reductions in the efficiency of wastewater treatment facilities.

Inefficient use of water by households, firms, and farms may be encouraged by current water pricing policies. Water has historically been considered in many regions as a plentiful and "free" good. However, water is increasingly being viewed as a scarce resource that has been improperly priced.

Most municipally supplied water is consumed by households, although practices vary among communities.<sup>54</sup> Only about five percent of water consumed indoors by households is used for drinking and cooking; the remainder of indoor household use is for sanitary purposes. Water is also used outdoors for watering lawns, washing cars, and filling swimming pools. Household water demand is influenced by location, population density, household income, season, and the price of water. Studies have found that household water demand in the winter is relatively insensitive to price, while summer water demand shows significant price elasticity.<sup>55</sup> Other studies show that industrial and agricultural water demand are also responsive to price.

The goal of this incentive would be to promote changes in the level and structure of municipal water prices, to encourage more efficient use of water resources, and to reduce the environmental degradation that accompanies ever-expanding water demand.

### DESCRIPTION OF INCENTIVE

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<sup>54</sup>Diana C. Gibbons, The Economic Value of Water, Washington, D.C: 1986, pp. 7-8.

<sup>55</sup> Ibid., p. 10.

As is the case with electricity generation and telephone service, the variable costs of water supply are relatively small, while the fixed costs of the distribution of water can be very substantial. Frequently, water pricing does not reflect the full fixed operating and long-term capital costs of providing water services. For example, roughly 85 percent of smaller water utilities use a flat-rate or declining-block-rate pricing structure. Few areas have instituted peak load water prices that reflect the high marginal cost of serving seasonal demands or increasing-block-rate pricing that would discourage excessive water use. In addition, water metering is not universal, so households may not be billed at all.

Water pricing has historically been the responsibility of local governments. There may be a justification for federal involvement in water pricing where increased water withdrawals impose costs that cross municipal and state boundaries, or when the federal government subsidizes the cost of water supply projects. The federal government could encourage municipalities to improve pricing practices, for example, by:

- o funding public education activities and research on the benefits of changing water-pricing structures; or
- o providing technical assistance to communities for studies on alternative water-pricing structures.

EPA currently issues a number of permits, grants, waivers, and approvals to municipalities for water supply and wastewater treatment projects. These include: (1) approval of environmental impact statements under NEPA; (2) Clean Water Act section 404 wetlands permits for water supply projects; (3) waivers from compliance with certain provisions in the Safe Drinking Water Act (SDWA); (4) construction grants and state revolving funds for sewage treatment facilities; and (5) exemptions to antidegradation and antidegradation requirements for publicly owned treatment works (POTWs). A larger number of communities will need to implement new EPA stormwater and safe drinking water regulations. For those communities that do require some form of EPA approval, EPA could require that they improve their water-pricing structures as a condition for securing EPA's approval on these items.

## **EVALUATION**

The effect of pricing changes on water demand by various sectors will depend on the price levels and the price sensitivity of each use. As noted above, water demand may be responsive to changes in water-pricing structures. Residential demand for lawn and garden watering, car washing, and other outdoor water-based activities can be very responsive to increases in water prices. These uses tend to cause peak demand, which often dictates the size of water supplies. As a result, future needs for water supply capacity can be influenced by water pricing structures that account for the increased costs associated with meeting these peak load demands.

Improvements in water pricing would be designed to internalize the true marginal costs of water use. The appropriate level and structure for water rates would depend on a

number of local factors, including the cost of new supplies, seasonal variations in demand, and the relative importance of different water supply cost components (fixed vs. variable costs, distribution vs. water purchase or source development costs, etc.).

The benefits of improved water pricing are likely to vary by region. In areas where water supplies are plentiful, rates that accurately reflect supply costs would be relatively low, while in areas with limited water supplies, water users would pay substantially higher prices. The greatest benefit to improved pricing would result in those areas with high water supply costs and current pricing practices that seriously understate the cost of water use to consumers.

In addition, the costs of implementing improved pricing would vary in different communities. Many large water utilities already bill consumers for water use based on meter readings. Changing the pricing structure in these communities should involve few administrative hurdles. Other communities would have to pay the cost of installing metering equipment. In addition, city owned or municipally owned utilities may be able to change their rate structures more easily than privately owned water utilities, which typically need to seek approval from state Public Utility Commissions for their rates.

The costs of implementing improved rate structures must be weighed against the benefits of improved pricing in each locality. If the federal government required municipalities to adopt new pricing practices, there is a danger that the costs of implementing these programs would exceed the resulting benefits. Water use would be unnecessarily reduced if these costs were passed through in prices, or utilities would receive lower earnings, imposing costs that exceeded benefits. Any federal program to encourage or mandate changes in water pricing would have to take account of geographic variations in the costs and benefits of such programs.

Water utilities may be reluctant to adopt new pricing policies due to public opposition to water rate increases. Changes in water pricing may be more palatable politically if they are tied to providing safer drinking water and a better understanding of the scarcity of water supplies. EPA may have to combine the incentive program implemented through EPA approvals with tailored technical assistance and education programs. In any event, further detailed analysis is needed before the design and implementation of incentives of this type.

## **DEPOSIT/REFUND OR TAX/REBATE SYSTEM FOR PESTICIDE CONTAINERS**

### **BACKGROUND AND GOAL OF INCENTIVES**

EPA estimates that more than 100 million pesticide containers are discarded annually by commercial and agricultural applicators in the United States. Also, approximately 1.1 million pounds of pesticide residues (active ingredients) are discarded along with these containers. This figure does not account for the amount of inert ingredients (e.g., solvents and diluents) that are also discarded as a significant portion of pesticide formulations. Although a portion of these containers are disposed of legally in regulated hazardous waste facilities, EPA believes that a significant number are disposed of without effective hazardous waste controls. Discarded pesticide containers vary greatly in size and material type, from large metal canisters to plastic buckets to paper bags.

Uncontrolled disposal of pesticide residues and containers might contribute to groundwater contamination as well as other environmental problems. Implementation of a deposit/refund or tax/rebate system for pesticide containers might encourage proper management of empty pesticide containers by encouraging the return of containers to pesticide formulators.

### **DESCRIPTION OF INCENTIVES**

#### Deposit/Refund System

A deposit/refund program could affect three groups involved in the sale and distribution of pesticides:

- o registrants/formulators;
- o dealers; and
- o consumers (agricultural and homeowner).

When dealers purchase pesticides, they would pay a deposit to the formulator. Dealers would then charge the deposit to consumers when they purchase the pesticides. When consumers return the containers, pesticide dealers would refund the deposit, or credit the value toward their next purchase. Dealers would collect the containers and transport them to pesticide formulators to obtain their refund. Formulators would be responsible for recycling or properly disposing of the waste materials. The difference between deposits paid and refunds generated is, in effect, a tax on losses of containers from the system.

Deposits could be set at a single rate (e.g., \$5.00 per container), as is generally done for beverage containers. The variability in sizes and types of pesticide containers, however, makes the use of a single deposit a poor measure of potential environmental damage from improper disposal. Instead, the deposit could be based on the volume of pesticide held in the container -- e.g., \$0.50 for each pound of pesticide. This approach would provide additional incentives to return larger

containers, which contain the largest quantities of residual pesticide.

Deposits might also be higher for containers that hold exceptionally toxic pesticides. For example, two or more toxicity "tiers" could be developed, and deposit amounts would increase as a function of the toxicity rating. Use of variable deposit schedules might make the system more difficult to administer than a single deposit system, but would internalize the costs of improper container disposal more accurately.

### Tax/Rebate System

This incentive would be similar to a deposit-refund program, but would instead place a tax or "fee" on the active ingredients used in pesticide formulations supplied by pesticide "registrants." The fee from registrants would be held in trust by the federal government and distributed to the states via FIFRA grants to administer the collection programs. The states would have to revise their federally approved pesticide plans to include pesticide container recycling/disposal plans in accordance with federal guidelines. Such guidelines would presumptively include provisions for rebates paid to farmers/ranches/other applicators of agricultural pesticides to return spent pesticide containers. The state would inspect incoming containers to ensure they had been properly rinsed (to qualify for exemption from RCRA) and would then shred the plastic container for subsequent recycling or disposal.

## **EVALUATION**

### Deposit/Refund System

More information is needed on the contribution of pesticide container disposal to environmental contamination, to determine whether any policies addressing this source are warranted. In particular, better information is needed on the danger posed by management of pesticide residues and containers in landfills and waste piles, relative to the hazards associated with general pesticide use. The estimated 1.1 million pounds of pesticide residues disposed of annually is a relatively small amount, compared to the roughly 2.2 billion pounds of pesticides applied each year in the United States. Direct use of pesticides may be a more important source of nonpoint source pollution, worker exposure, and consumer exposure through pesticide residues on food, than improper disposal of residues and containers. Resources might be better used to reduce exposures to pesticides by targeting nonpoint-source pollution, training in proper pesticide application techniques, and worker safety.

In addition, more information is needed on the extent to which management of used containers by formulators would be better than management by end-users or other intermediaries. A deposit/refund system would not, by itself, ensure that residues and containers would be properly managed once returned. The goal of the incentive would be to encourage return to locations (1) where recycling may be a viable option, and (2) where disposal practices may be more protective and easier to monitor. Further research is needed on supply and demand elasticities to determine

the correct level of deposits and refunds. Evaluation of any differences between the number of units on which deposits are paid and the number on which refunds are paid would support analysis of the "tax" effects of such a system, or it might allow analysis of whether a higher refund than deposit amount might be advisable. For example, if only 80% of pesticide containers were being returned, then a refund of 125% of the deposit amount might be feasible.

To be effective, a deposit/refund system might need to be accompanied by other programs to improve recycling opportunities. Many pesticide containers may not be refillable or recyclable as general-purpose packaging. More information is needed on the potential for reuse of pesticide residues and containers, especially in the manufacture of new formulations and new pesticide containers.

Finally, more information is needed on the effects of existing regulations on the environmental benefits of container return and on formulators' incentives to participate in a deposit/refund system. The system would most likely result in reduced contamination if formulators receiving the used containers were regulated as RCRA Subtitle C hazardous waste facilities. However, deposits would have to be high enough to cover the added costs of RCRA compliance, if many formulators are not already regulated under Subtitle C.

#### Tax/Rebate System

Research would be necessary to determine both the level of funding required to run pesticide collection programs in each state, and the level of refund necessary to attract clean pesticide containers. Research would also be necessary to determine the overall and "distributional" effects of imposing a fee on pesticide registrants, as opposed to placing a fee on containers shipped by formulators in order to address the problem of container disposal. If imposed on registrants, a formula would be required to allocate program costs based on a number of containers in which such active ingredients might be found. That is, based on how a formulator of pesticides marketed or packaged active ingredients in a product, a gallon of a particular active ingredient could be found in, e.g., 3, 6, or 12 containers. Further, research would be necessary to determine the extent to which taxing active ingredients would encourage substitution of "inert" ingredients.

## REDUCTION OF FEDERAL SUBSIDIES ENCOURAGING DEVELOPMENT IN COASTAL AREAS

### BACKGROUND AND GOAL OF INCENTIVES

Three out of four Americans live within 50 miles of a water shore.<sup>56</sup> Coastlines, however, are not stable. Over time, wind and waves erode and shift the shore, and in the process destroy and damage buildings, roads, and other structures. During the last one hundred years, the Atlantic Coast has eroded, on average, two to three feet per year.

Despite the risk of hurricanes and floods, low-lying areas and the beach are attractive home and vacation spots for many Americans. Many people have substantial investments in property and businesses located in these areas. This development has been encouraged and supported by a variety of federal programs.

This development, unfortunately, has deleterious effects on the sensitive ecosystems of coastal and flood zones. Development destroys wetlands and increases vulnerability to flooding and storms by removing areas that buffer wave action and storm surges. Loss of wetlands affects the productivity of fisheries and the wildlife dependent on these areas. Development also stresses the ecosystems by increasing nonpoint- and point-source pollution.

Some federal subsidy programs have been designed either to reduce the risk of developing in certain areas, or to defray expenses for large public projects. These programs have indirectly encouraged environmental degradation by promoting development or land-use practices that degrade water quality, and/or sensitive coastal environments.<sup>57</sup>

The goal of this incentive would be to remove or reduce subsidies in federal programs that indirectly encourage environmental degradation. While over 50 federal programs affect coastal and inland shores, this discussion focuses on the National Flood Insurance Program and federal infrastructure programs.

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<sup>56</sup>U.S. EPA, Office of Water, Office of Marine and Estuarine Protection: Briefing Book, January 1989.

<sup>57</sup>EPA's Office of Marine and Estuarine Protection (OMEP) is developing a compendium of about 50 federal financial assistance programs that have an impact on coastal waters.

## DESCRIPTION OF INCENTIVES

### The National Flood Insurance Program

As of 1989, the National Flood Insurance Program (NFIP) underwrote 2.1 million policies covering 170 billion dollars worth of property.<sup>58</sup> The average homeowner's premium was \$270 per year, generating total annual funding of about \$600 million per year. When a property loss occurs due to a storm, hurricane, flood, erosion, or sea level change, those insured under the NFIP can rebuild or repair the structures through this program.<sup>59</sup>

Congress instituted the NFIP in 1968 to reduce the federal government's need to support property owners suffering damage from natural disasters such as floods and hurricanes, by requiring property owners to pay some insurance premiums. In addition, the program was to "minimize the development of land which is exposed to flood damage and minimize damage caused by flood losses" by guiding "the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards."<sup>60</sup> Thus, the program is intended to reduce federal outlays by creating a self-financed insurance program and by slowly reducing the number of covered properties in zones likely to suffer flood, erosion, or hurricane damage.

The NFIP has failed to meet these objectives.<sup>61</sup> According to the Federal Emergency Management Agency (FEMA), which administers the NFIP, the number of households located in flood hazard areas has grown by 40 percent since 1966. In addition, the NFIP has not been self-supporting during its existence, and has had to be funded in part by general revenues.

In fact, the NFIP has the mandate and structure in place to reduce the federal subsidy of coastal and flood zone development through insurance, or to minimize the environmental damage resulting from the subsidy. The Coast Alliance and the Wildlife Federation have made ten recommendations to improve the effectiveness of the NFIP, including:

- o requiring that new and substantially improved construction be located behind the erosion-prone zone;

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<sup>58</sup>In terms of domestic liability, the NFIP is the second largest government program. The Social Security System is the largest.

<sup>59</sup>Other federal subsidy programs, such as the Federal Disaster Relief Agency, the Small Business Administration, the Farmer's Home Administration, and the Department of Agriculture programs, also underwrite the development, repair, and restoration of coastal communities.

<sup>60</sup>Chapter 50, Section 4001 (e).

<sup>61</sup>An evaluation of the National Flood Insurance Program is presented in Storm on the Horizon: The National Flood Insurance Program and America's Coasts, by Beth Millemann, Director of the Coast Alliance, with assistance from Elise Jones, National Wildlife Federation, September 1989. Much of this discussion is based on this report.

- o discontinuing issuance of flood insurance policies for new or substantially improved development in the coastal high-hazard zone, and its corollary along the Great Lakes; and
- o increasing premiums for repeated damage claims to encourage relocation instead of reconstruction.<sup>62</sup>

### **Federal Infrastructure Programs**

Federal infrastructure programs managed by the Departments of Transportation and Defense and by EPA fund local and state projects, such as highways, bridges, ports and harbors, water supply, and sewage treatment. This development may be located in ecologically sensitive flood zones or coastal areas. For example, some Corps of Engineers (COE) projects to create or increase water supplies result in upstream dams and diversions, and coastal dredging operations for ports and harbors disturb fragile wetlands and estuaries. Other COE activities, such as beach replenishment programs, may encourage increased use of lands in sensitive areas. The government could amend its decision criteria for these programs to take greater account of environmental effects for projects located in sensitive areas.

### **EVALUATION**

The NFIP and federal infrastructure expenditures cause environmental degradation by promoting development in sensitive coastal ecosystems. Over the long term, removing or reducing subsidies in federal aid programs would limit development in sensitive areas, thereby improving coastal water quality.

These programs involve several federal departments or agencies. Thus, the responsible agencies would have to initiate rulemaking to modify these programs, and in some cases, Congress might need to revise the underlying statute. EPA has effectively supported environmentally positive changes to existing programs of other federal agencies in the past, as evidenced by its recent work with the Department of Agriculture on the Farm Act.

These programs have encouraged economic development and have the support of the communities and businesses that benefit from their provisions. Changes in these programs should focus on environmental problems, while mitigating economic impacts. Strategies might include grandfathering existing buildings, increasing incentives to relocate structures to less sensitive areas, and developing more appropriate environmental criteria for use in evaluating infrastructure projects.

In addition, more information and public education is needed about the costs and environmental impacts of these federal programs. For example, FEMA estimates that federal agencies spent \$6.5 billion for flood-related disasters between 1979 and 1988.

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<sup>62</sup>In South Carolina, there is legislation to discourage owners from rebuilding properties in the flood zone. This law is being challenged in the courts.

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## INTRODUCTION

### DESCRIPTION OF THE PROBLEM

Many of EPA's existing regulations address problems specific to a single medium (e.g., water). The programs implementing the Clean Air Act and the Clean Water Act are prominent examples. Regulations under the Resource Conservation and Recovery Act (RCRA) governing waste disposal are potentially multi-media in scope, but in practice have tended to focus on groundwater protection. EPA is planning to promulgate additional RCRA standards to control air releases from other waste management activities.

This medium-specific focus may have had some advantages in the past. For example, the focus on individual media may have allowed more timely development of regulations in the early days of new programs. Regulators were able to focus on the numerous sources and substances of concern to a specific medium, without having to comprehend and craft rules to address all the possible transfers to and transformations affecting other media. Also, this approach may have allowed regulators to build an expertise in the environmental and technical issues associated with a particular medium. This experience has provided a much clearer understanding of the nature of pollution affecting air, water, and land.

As media-specific expertise has grown, however, so has awareness of potential inter-media effects. The single-medium approach has generated different sets of regulations for controlling air and water pollution and for land disposal. Differences in the costs of controlling releases to each medium, and in the standards governing these releases, have led some firms to shift pollutants to the medium with the least expensive control costs or the least stringent regulations. Unfortunately, the least costly releases may not pose the least risk to human health or the environment. Bans on land disposal under RCRA, for example, increased toxic releases from incineration of the displaced hazardous wastes. Stringent incinerator emission controls designed to capture these releases may create toxic ash and wastewaters, which must then be disposed of. This example leads to the problems inherent in the RCRA land ban, which may lead to environmental problems in other media. Furthermore, the focus on releases to a specific medium, instead of on all releases from a given source, may be a more costly and less

efficient means to achieve a given degree of risk reduction. For this reason, many states have begun to coordinate environmental permit processes, and to consider all environmental impacts when designing and issuing permits. New York's Environmental Quality Act, for example, requires government agencies to minimize all adverse environmental effects in decisions on permits or projects.<sup>63</sup>

For releases to a given medium, choice of control technology may also affect the volume and toxicity of releases to other media. For example, firms that choose to use a wet scrubber instead of a dry scrubber to control air emissions generate much greater volumes of wastewater that must then be disposed of. For a rotary kiln incinerator, use of a dry scrubber instead of a wet scrubber reduces wastewater from 130 tons to 20 tons per day.<sup>64</sup> Air stripping of organics to meet water quality standards may release toxic organics to the air, instead of reducing overall releases of toxic organics. Control technologies for wastewater treatment requirements generate large quantities of potentially toxic sludge that may contaminate groundwater if disposed of in landfills or may cause toxic emissions if incinerated. Overall, in 1983, pollution controls generated approximately 118 million dry metric tons of sludge (80% from air pollution controls).<sup>65</sup>

Releases to one medium may also be transferred to another medium in the environment. Land disposal may result in air emissions or leaching of toxics to groundwater; contaminants in air emissions may be deposited on land or in surface water; and discharges to surface water may volatilize to air. The single-medium approach has often not adequately addressed chemical or physical transformations that may occur once a pollutant is released. For example, ambient air quality standards for sulfur dioxide have been written to protect against the health effects of inhalation. However, sulfur dioxide released to the atmosphere may also combine with water vapor molecules to form sulfuric acid, which leads to corrosion and contaminates soil and water when deposited. Regulations that assume releases will remain unaltered and in the original medium may not capture the full range of risks posed by a given release.

EPA's increasing concern over these issues has led to a strong emphasis on strategies that take account of all the environmental ramifications of its regulatory decisions. Reducing the volume and toxicity of waste at the source of its generation (source reduction) is an approach avoids cross-media transfers. Individual applications should reflect the costs and benefits of programs in particular areas.

## **ROLE OF INCENTIVES**

Multi-media pollution could be reduced through better coordination of media-specific regulatory programs. As the number of sources and media being considered increases, however,

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<sup>63</sup>Conservation Foundation, State of the Environment: An Assessment at Mid-Decade, 1984, p. 351.

<sup>64</sup>Conservation Foundation, op. cit. 1984, p. 324.

<sup>65</sup>Conservation Foundation, op. cit. 1984, p. 326.

incentive approaches often become more attractive than command-and-control programs. While the cost of medium-specific, "end-of-pipe" pollution controls is often relatively uniform across industries, the cost of source reduction through raw materials substitution and process change can vary dramatically in different sectors. Assessing the costs and benefits of regulatory programs becomes more difficult when source reduction and multi-media pollution reductions are the goal. Therefore, the problem of developing regulations that are not cost-beneficial in some sectors increases.

Incentive-based policies that allow different parties to respond differently to appropriately designed financial inducements may reduce the risk of over- or under-regulation in many multi-media applications.

## **OVERVIEW OF INCENTIVES**

Many of the incentives discussed elsewhere in this report have multi-media benefits. For example, incentives designed to encourage the use of recycled products (particularly incentives to recycle used oil, scrap tires, and lead-acid batteries) could lead to potential multi-media benefits. For example, increased recycling of hazardous materials could divert these materials from landfills, sewers, incinerators, or water supplies.

This chapter describes eight incentives that specifically focus on multi-media issues. These incentives illustrate a range of approaches to encourage multi-media environmental improvements, including the use of fees, deposit/refund systems, labeling programs, marketable permits, improved information exchange, and removal of federal subsidies. The incentives described here are only some of the many ways these general incentive strategies could be used to address different products or materials.

## **FEEES ON VOC EMISSIONS FROM MAJOR STATIONARY SOURCES**

### **BACKGROUND AND GOAL OF INCENTIVE**

Large stationary sources are significant emitters of VOCs, and thus contributors to tropospheric ozone formation and air toxics problems. The most recent National Acid Precipitation Assessment Program inventory suggests that these sources emit 1.2 million tons of VOCs annually in areas that are not in attainment with national standards, or about 10 percent of total VOC emissions in these areas. A number of our largest cities, including Los Angeles and New York, continue to experience local air quality problems.

An incremental fee placed on VOC emissions from these large sources might provide an incentive to reduce emissions below the regulatory requirements currently imposed on a source. However, such action would be desirable only if the existing standards achieve less than optimal emission reductions. In areas currently not in attainment with national standards, any additional reductions in emissions from major stationary sources could lead to significant improvements.

Assuming attainment of the ozone standard by most cities by 2005, ozone non-attainment will be restricted to just a few major cities. Therefore, fees should be localized to avoid imposing increased costs on areas where there is little opportunity for environmental benefit.

### **DESCRIPTION OF THE INCENTIVE**

While the details of the fee can be flexibly tailored to the circumstances of a given non-attainment area, certain decisions must be made in each case. These include: (1) the sources to be covered; (2) the amount of the per-ton fee; (3) the appropriate non-monetary parameters of the fee, such as whether fees should increase over time and the proportion of emissions subject to the fee; (4) the relationship between the fee and the renewable permit issued a source under the Clean Air Act; (5) whether to institute a banking and trading program for emission reductions to encourage more rapid adoption of control strategies; and (6) methods of enforcing the program. Under its authority to issue Control Technique Guidance, EPA could assist states and localities in developing policies for each of these key design issues.

### **Sources to Be Covered**

Fees could apply only to major sources, as defined by the Clean Air Act. Currently, a "major source" is a source that emits more than 100 tons of VOCs annually. Expanding coverage to include smaller sources would significantly increase the number of sources, with only a modest increase in emissions subject to the incentive. For example, extending the fee program down to 25-ton sources would triple the number of sources covered (from 3,300 to 10,000 nationwide), while increasing the quantity of emissions affected by only 17 percent. While extending the

program down to 25-ton sources may not be advisable in most areas, a state with a strong need for reductions and adequate staff to administer the program might elect to extend the program to these smaller sources.

### **Fee Levels**

Developing a reasonable fee structure is crucial to designing a cost-beneficial incentive. Ideally, fees would be set to reflect the health and environmental damages caused by incremental VOC emissions. In practice, states and localities might instead set fee levels to achieve a pre-determined quantity reduction in emissions. The latter approach may not result in cost-beneficial emission reductions, unless the target quantity reductions themselves are selected based on cost-benefit criteria. For example, high fees to encourage significant reductions in VOC emissions might encourage pollution control investments whose costs exceed their environmental benefits, or might simply place unwarranted economic burdens on sources. In addition, substantial information on marginal control costs at different sources would be needed to set fee levels to achieve a specific change in emissions.

If states and localities did elect to set fees on some basis other than the cost of environmental damages, it might be desirable to take a conservative approach initially. For example, the fee might initially be placed below the marginal cost of control for the average stationary source, currently estimated at approximately \$5,000 per ton of emissions reduced, to encourage only firms with relatively low control costs to further reduce emissions.

The incremental fee might be assessed on a proportion of the baseline emissions allowed a major source under existing regulations. For example, a state agency could assess a major source an initial fee of \$1,000 per ton on 20 percent of annual permitted emissions, and increase this by \$1,000 per ton after two and four years until a maximum fee of \$3,000 per ton would be assessed. If the source were able to demonstrate at any time that its annual emissions were 20 percent below the baseline (i.e., below its permitted level), it would be exempt from the fee. After an initial period, fees could be increased to encourage more sources to reduce emissions, if further reduction in local emissions were determined to be cost-justified.

Adjusting the fee over time toward optimal levels would reduce economic impacts at the beginning of the program, as firms evaluate methods to further reduce emissions, and would give firms some time to adjust while still encouraging emission reductions. However, it would be important to make future fee increases predictable, to ensure that firms can anticipate the economics of future emission reductions.

### **Non-monetary Parameters**

Linking fees to current emission requirements could result in discrepancies across different sectors in the costs and benefits of the incentive. If fees are linked to existing permit levels for administrative convenience, some adjustments may be

required to reflect the fact that different sources currently are subject to different effective emission limits. A source that is currently subject to a Lowest Achievable Emissions Rate (LAER) standard might not be required to pay a fee on the same percentage of emissions as a source that faces a Reasonably Available Control Technology (RACT) standard, as the LAER source is already controlling emissions to a greater extent. For example, chemical manufacturers required to meet a LAER standard might pay a fee on 10 percent of emissions, those required to meet a Best Available Control Technology (BACT) standard might pay on 20 percent of emissions, and those required to meet a RACT standard might pay on 30 percent of emissions. To determine the appropriate proportions for a particular industry, EPA could assess the control technologies and the characteristics of emissions for the industry and provide guidance to the states in selecting the appropriate targets.

A related issue concerns sources in different industries that face the same technology standard. These sources should not necessarily pay the fee on the same percentage of emissions, because control technologies achieve different emission levels in different industries. For example, states could require a LAER source in one industry to pay a fee on 10 percent of emissions, and a LAER source in another industry (with a less stringent LAER standard) to pay a fee on 20 percent of emissions.

### **Interface with Permit Program**

The percentage of emissions subject to the fee, and the timing of any fee increases, could be incorporated in the source's permit. The percentage might then be reassessed at the expiration of the permit so that the percentage could increase if a major advance is achieved in control technology. This would provide a continuous incentive for sources to adopt new technology.

### **Banking and Trading**

If the percentage reduction in emissions required to avoid fees remained constant over time, a system that allowed sources to bank emission credits would not be needed.<sup>10</sup> A program that allowed firms to trade emission reductions could be incorporated into the program. Furthermore, trading across geographic regions is inappropriate where the desired pollution reduction is aimed at ameliorating a localized problem.

### **Enforcement and Fee Collection**

The enforcement problems associated with this program would be the same as those associated with the existing permit system. Administering and collecting fees would not be complicated.

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<sup>10</sup> If adjustments were made frequently in the proportion of emissions subject to the fee, then it might be appropriate to allow firms to bank reductions made below the current standard for future use.

Penalties for misreporting emissions to avoid fee payment would need to be severe enough to provide a sufficient deterrent.

## **EVALUATION**

A well-designed fee system has the potential to encourage cost-beneficial VOC emission reductions beyond existing technology-based requirements if the existing standards achieve less than the optimal levels of emission reductions. Some sources may have opportunities to reduce VOC emissions through changes in chemical usage or better work practices. These opportunities are variable across sources and are difficult to include in a command-and-control program, even if the reductions would be cost-beneficial. A fee system would encourage sources with such opportunities to reduce emissions beyond levels that can reasonably be imposed on all sources.

In addition, unlike technology-based standards, fees would encourage firms to continue research and development on control technologies.

## MARKET INCENTIVES TO REDUCE CONSUMER AND COMMERCIAL USE OF SOLVENTS

### BACKGROUND AND GOAL OF INCENTIVES

Use of solvents in consumer and household products and in industrial processes is a significant contributor to ozone non-attainment problems. According to the National Acid Precipitation Assessment Program (NAPAP) data base, 4.2 million tons of volatile organic compound (VOC) emissions are from solvents. This is approximately 18 percent of total VOC emissions. A wide variety of products and processes generate these emissions, including the application of architectural coatings, metal parts degreasing operations, and the application of household and personal-care products, such as hair spray, disinfectants, and household pesticides.

### DESCRIPTION OF INCENTIVES

The Task Force considered two market-based approaches to reducing VOC emissions: (1) placing a dollar-per-ton fee on VOCs emitted from these products, to encourage product formulators to make products releasing less VOCs; and (2) allotting or auctioning permits to consumer and commercial product distributors and retailers, allowing them to sell the permits among themselves.

The CAA generally requires that areas prepare plans to attain standards within the next 15 years. VOC-related non-attainment problems are expected to be limited to a handful of cities by 2005. Therefore, implementation of these incentives probably makes most sense at the local level. Although solvents are distributed nationally, and placing a localized fee might require formulators to vary their product slightly for different markets, to impose the fee nationally would require attainment areas to pay increased costs without receiving commensurate benefits.

### Product Fee System

Imposing a fee on VOC-emitting products would involve:

1. publishing the names and Chemical Abstract Service (CAS) numbers of all VOCs of concern;
2. notifying organizations that sell or distribute products containing any listed VOC that they must register each product with the regulatory agency if the ultimate use of the product releases the VOC contents to the atmosphere, either as an inherent part of the product's design (e.g., aerosol products) or because the product is used in equipment that is not totally enclosed (e.g., metal cleaning);
3. providing these organizations with (a) a registration number for each VOC-containing product, which must be published on the label of each unit of the product sold, and (b) simple forms on which they must report

(on a quarterly basis) the total quantity of each registered product sold, and calculate and remit the product fee due on this quantity sold; and

4. providing a simple formula and parameters to allow calculation of the fee owed for any product formulation, based on the specific weight of VOCs included in each unit of the product and the fee per unit of VOC.<sup>11</sup>

Thus, under this system formulators would register all VOC-emitting products and provide quarterly payment of fees owed, along with a simple report of the quantity sold for each registered product. The regulator could issue a registration number for each VOC-emitting product to simplify record-keeping and, through the labeling requirement, assist inspection and enforcement efforts.

Requiring formulators to include the registration number on the label of each unit of registered product could make it relatively easy to check specific registrations and to identify products that had not been registered. Regular inspections of distributors' inventories as well as cross-checking registrations with industry statistics on number of products and units shipped could be used to discover unregistered products sold in areas where the program was in effect.

The issue of confidential business information may become important at the product registration stage, as formulators may claim that information about their products' formulations and sales quantities are trade secrets. Since the regulatory agency need not require a complete list of ingredients for a given product but only needs to know the VOC components, this problem may not be severe.

Once the product fee system was in operation, regulators would receive simple quarterly reports and payments from thousands of organizations distributing or selling tens of thousands of products. This flow of information and payments would have to be managed to allow accounting for all payments as well as storage and periodic analysis and reporting of who is and is not remitting fees, major changes in fee remittance, and so forth.

Enforcement efforts would need to be directed toward at least three types of potential noncompliance: (1) unregistered products, (2) misreported formulations, and (3) misreported quantities shipped and associated product fees owed. Methods to detect unregistered products were mentioned above. Misreported formulations could be discouraged through a program of random product tests. Misreported quantities shipped and associated fees owed could be discouraged through a program of random

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<sup>11</sup>This option assumes that all VOCs would receive the same dollar-per-ton fee. This is based on the opinion that all VOCs should be treated the same, as even slowly reacting compounds will eventually react to form ozone, due to "multiple-event" (more than one violation) days and the existence of long-range transport of these substances. A possible alternative would be to scale the fee based on the photochemical reactivity of the different substances.

inspections of distributor's or retailer's records. Penalties for noncompliance in each case would need to be severe enough to provide a sufficient deterrent, even in view of possible low probabilities of detection (which will depend on the extent of the enforcement efforts).

The product fee system would require an importer of VOC-emitting products to pay the same fee as a distributor or retailer who produces the product in the United States. In addition, U.S.-manufactured products that emit VOCs and are destined for use outside of the United States would be exempt from the product fee system so as not to place U.S. manufacturers at a competitive disadvantage in world markets.

Emissions from these products could be discouraged by placing a fee on the manufacturer of the VOC directly, thus increasing the price of the raw material itself. This approach would be simpler to administer than a fee on products because fewer companies manufacture VOCs than manufacture products using VOCs. However, many of these chemicals are used in ways that do not result in air releases. For example, according to the NAPAP data base, approximately 540,000 tons of ethylene are emitted annually. This is less than two percent of ethylene production, according to International Trade Commission data on chemical production. Thus, a raw material charge would inappropriately apply to 98 percent of ethylene production. Since the program is designed to deal with a local problem, placing a fee on VOC production would inappropriately place the burden of reduction on all solvent users. To avoid a poorly targeted incentive, the fee should be placed at the local level.

#### Impact of VOC Product Fee: Two Examples

Personal-Care and Household Products. According to data compiled by California's Air Resources Board (adjusted to represent the United States as a whole), 615,000 tons of VOCs were emitted from personal-care and household products in 1984. These products account for approximately 6 percent of all non-mobile VOC emissions, and include pesticides and insect sprays, personal-care products, aerosol paints, household cleaners, and automotive products. Between 70 and 90 percent of VOC emissions from this entire group come from products that are packaged in aerosol cans.

A VOC fee would encourage formulators to manufacture aerosol products using formulations that contain less VOCs, such as a water-based formulation, or by switching to a non-aerosol packaging device. Mechanical pump containers release approximately one-half the amount of VOCs per application as aerosol containers. Thus, a fee encouraging a switch to mechanical pump containers could reduce VOC emissions by approximately 25,000 tons per year.

Architectural Coatings. During the application of architectural coatings, solvents contained in the coatings evaporate. According to the NAPAP data, 426,000 tons of VOCs were emitted from architectural coatings in 1985, which is 4 percent of non-mobile VOC emissions. Nearly 70 percent of all VOCs emitted from architectural coatings come from solvent-based

paints. However, these solvent-based products account for only 30 percent of total production; water-based products account for the other 70 percent.

A fee placed on VOC emissions from architectural coatings would increase the price of both solvent-based and water-based paints.<sup>12</sup> However, the effect on the price of solvent-based paints would be far greater than the effect on the price of water-based paints. As a result, one would expect this fee to further encourage the ongoing switch from solvent-based to water-based paints, further lowering VOC emissions. For example, a shift of an additional 5 percent of market share to water-based paints would reduce VOC emissions by 50,000 tons per year.

### **Marketable Permits System**

Marketable permits are entitlements to emit specified amounts of a pollutant in a period of time at a specified location or area. As with traditional regulations, marketable permits "ration" the amount of pollution that the control authority is willing to allow. Those entities with permits (usually companies) could only emit the amounts specified in the permits they own, but would be free to buy and sell permits. Under this system, firms with low reformulation costs would be encouraged to adjust their product formulations to provide reformulated solvents to distributors. Less flexible formulators would be unable to compete in the area where permits were required if the cost of permits exceeded the cost of reformulating solvents.

To establish a marketable permits system, the regulator would need to decide on how the permits are to be allotted initially. One method for allotting the permits is based on past emissions from the products of distributors or retailers. Using this method, a distributor or retailer of a household pesticide that emits 500 tons of VOCs per year would receive twice the initial permit privileges received by a distributor or retailer of a pesticide that emits 250 tons of VOCs per year.<sup>16</sup> However, this method of allocation may impose unequal economic hardships on distributors.

The consumer and commercial products considered would fall into two broad categories: (1) products where VOCs are released directly during product use, such as spray paint, and (2) solvents used in commercial or industrial settings, such as a dry cleaning solvent. For the first category of products, permits could be allotted based on the quantity of VOCs contained in the product, as this figure will equal emissions from the product. Specifically, the regulator could require distributors or retailers to report the total quantity of VOCs contained in each

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<sup>12</sup>"Water-based" paints do contain some volatile organics.

<sup>16</sup>Another, more economically efficient possibility would be to distribute permit privileges using an auction. However, providing for thousands of companies to participate in an auction would involve some logistical problems. In addition, deciding who the recipients of the revenues from the auction would be and how the monies would be spent would need to be determined.

product of concern over the past three years, and could thus allocate the permits based on average VOC content over these three years. Using an average over three years would reduce the possibility that a firm is allocated too many or too few permits based on one exceptionally strong or exceptionally poor year for the company.<sup>17</sup>

For the second category of products, not all VOCs used as solvents are emitted to the environment. A percentage of the solvent is recaptured, and later recycled. Because all of the solvent is not emitted, permits should be assigned in a slightly different fashion. Permits could be allotted to solvent distributors based on the difference between the amount of solvent they sell to commercial and industrial operations and the amount of solvent that they recycle. Thus, the regulator would require these distributors to report each of these figures for the past three years, and assign permits based on the average difference between these figures.

To accomplish an initial reduction in VOCs from both classes of products, the regulator could assign the initial permits at a level below current emissions. For example, allocations could be made for 90 percent of current emissions--i.e., a firm that distributes or sells products that emit 100 tons of VOCs would be allocated permits for 90 tons of emissions. The regulator might also design the system so that the permits decline over time. For example, permits allowing for 90 tons of emissions in the first year could be worth 10 percent less, or 81 tons of emissions in the second year. Decreasing the permitted emissions over time would reduce the economic impacts at the beginning of the program, giving firms time to adjust while still encouraging emission reductions.

The Agency could also retain the right to periodically issue new permits to new firms who wish to enter the market. This would prevent the marketable permits system from restricting competition in a particular product area.

#### Permit Trades

A large number of firms distribute or sell consumer and commercial products that contain VOCs; therefore, a large number of firms may be interested in either buying or selling permits. To facilitate these sales, the regulator could provide information on firms wishing to buy or sell permits to all interested parties, charging a small fee to cover the administrative costs of such a program. This service would help firms--particularly small firms--minimize the transaction costs associated with identifying other buyers or sellers.

Enforcement of a marketable permits system would be a two-stage process. First, the regulator must encourage firms to accurately report the amount of VOCs contained in the product they distribute so that the initial allocation of permits is equitable. To accomplish this, the regulator could randomly

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<sup>17</sup>The regulator may want to assess a small fee for the initial purchase of each permit, to cover the cost of administering the permit program.

inspect distributors' or retailers' records, and cross-check them against the records of the formulator supplying the solvent to the distributor. Penalties for non-compliance would need to be severe enough to provide a sufficient deterrent.

Second, after the permit system had been established, the regulator would need to monitor compliance. This could be accomplished by randomly checking distributors' records, and cross-checking them against other data sources. The regulator could also test products "off the shelf" for their VOC content, multiply this percentage by the quantity of the product sold, and match the total against the distributors' permits for the particular product. Again, penalties for non-compliance would need to be severe to deter distributors or retailers from violating their permits.

## **EVALUATION**

The merits of this incentive first depend on whether reductions in VOC emissions from products are cost-beneficial, given the social costs and benefits of reduced emissions. If reductions are cost-beneficial, incentive approaches might reduce the cost of achieving these reductions, due to the difficulty of regulating the numerous and diverse products and processes emitting VOCs.

A fee system could be designed to directly internalize the externalities associated with VOC emissions. A marketable permit system would achieve a specific quantity reduction in VOC emissions cost-effectively.

These incentive programs would be likely to require no more resources to establish, manage, and enforce than a command-and-control system set up for the same regulatory purpose. Because of the local nature of the non-attainment problem, fees should be imposed on distributors and retailers in non-attainment areas only. However, since solvents are manufactured nationally, and these local areas could comprise large consumer solvent markets, manufacturers could be induced, through demand for low VOC solvents, to reformulate their products. California is considering both incentive and command-and-control programs as options for regulating VOC emissions from consumer products.

Both these incentive schemes would involve thousands of manufacturers. To minimize the administrative burden, the systems proposed here place much of the responsibility on product distributors, rather than on the regulator. The systems are "self-reporting" -- which is important, given the very large number of producers and products involved and limited government resources. However, because the systems would depend on self-reporting by distributors or retailers, effective enforcement would be essential to the success of the program.

## DEPOSIT/REFUND SYSTEM FOR CHLORINATED SOLVENTS

### BACKGROUND AND GOAL OF INCENTIVE

Each year hundreds of millions of pounds of chlorinated solvents are released to the environment, primarily to the air, but also to water and land. Three chlorinated solvents are among the top 35 chemicals in total releases and transfers reported in the 1987 Toxic Release Inventory (TRI): methylene chloride, perchloroethylene, and trichloroethylene. These solvents are also all among the top 20 TRI chemicals for air emissions. EPA considers these chemicals to be probable human carcinogens, and the Clean Air Act of 1990 specifically addresses them.

A large proportion of these chemicals are not consumed or converted into other products, but rather are used to remove dirt, grease, metals, and other contaminants. Thus, in addition to significant air emissions, these processes result in large volumes of spent solvent, which must then be carefully managed to minimize risks to human health and the environment.

These solvents are widely used at a large number of facilities. For example, degreasing units (which account for 100 percent of trichloroethylene use, over 50 percent of trichloroethane use, and at least 15 percent of the uses for the three other solvents) numbered more than 220,000 in 1981.<sup>18</sup> Because of this widespread use, it is difficult to ensure that the spent solvent is disposed of in accordance with EPA regulations.

EPA has announced its intent to list methylene chloride, perchloroethylene, and trichloroethylene as hazardous air pollutants and anticipates regulating them under the Clean Air Act. Currently, emissions of these three solvents are controlled -- if at all -- only by states.

Most collected spent solvent is currently being recycled. In 1987, for example, 400 million pounds of solvents were recycled on site, and another 280 million pounds were recycled off site. Despite this, there remain problems: first, fugitive solvent losses in the work place are released to the atmosphere, and second, highly contaminated spent solvent sludges are not economical to recycle and thus may be illegally dumped to avoid disposal costs.

Should the CAA amendments fail to achieve the optimal level of emission reductions, a deposit/refund policy could have the following three objectives:

- o to encourage solvent users to modify the degreasing process to minimize fugitive and accidental releases of the chemical;

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<sup>18</sup> U.S. EPA, Office of Air, Noise, and Radiation, "Guidelines for Control of Trichloroethylene, Perchloroethylene, 1,1,1-Trichloroethane, Methylene Chloride, and Trichlorotrifluoro-ethane from Existing Organic Solvent Cleaners," Working Group Package, July 1981.

- o to combat illegal dumping of spent solvents by making it economically preferable to send the solvent to a certified disposal/recovery facility; and
- o to promote the search for substitutes.

#### **DESCRIPTION OF INCENTIVE**

A deposit/refund system would be implemented by first placing a deposit on each pound of solvent purchased. These sales could be tracked using recorded receipts from distributors of the solvents. Once the solvent had been used, it would be taken to a designated off-site recycling facility. These facilities would pay the price they normally offer for spent solvent, plus the amount of the deposit.

In many cases, solvents are recycled by parties other than the original solvent distributor (e.g., by independent solvent recyclers or in on-site recycling). Therefore, some mechanism is needed to transfer deposits from the point of deposit to the point of refund. EPA could collect deposits from distributors based on sales records, and then pay refunds to recyclers who document receipt of solvents for recycling. To simplify verification and enforcement, on-site recycling might not be eligible for refunds. On-site recycling could continue nevertheless, in order to avoid paying deposits on new purchases.

Under the deposit/refund system, solvent users would have an incentive to retain as much of the solvent as is feasible to recover the largest refund possible and/or to avoid paying the deposits for new solvent purchases. Theoretically, firms would choose the least-cost combination of lost deposits (due to releases) and expenditures to recover solvents. Possible facility responses include the installation of equipment to control vapor losses (e.g., carbon adsorption units, freeboard chillers), and the substitution of new materials and processes (e.g., the use of alkaline cleaners in place of chlorinated solvents).

The deposit/refund system could be extended to allow refunds of deposits for solvents disposed of in specified ways. This would encourage the use of the best waste management methods for solvent wastes that are not economic to recycle. In addition, refunds could be tied to the quantities of solvent actually recovered, rather than to the quantities of spent materials delivered for recycling (to address the issue of solvent mixtures that include non-solvent materials).

While a large proportion of the solvents under consideration could be returned, significant quantities are incorporated into a variety of products, such that the solvent could not be returned for deposit. In such cases, the deposit/refund system would function as a front-end fee on the use of the solvent. For example, methylene chloride is used in aerosols and is ultimately released to the air. Since the solvent that goes into the aerosol can could not be returned for a refund, the deposit paid would be essentially a charge on the use of methylene chloride. These uses, as well as applications where the chemical is used as an intermediate, could be exempted from paying the deposit. This would make the program more complicated to administer and

enforce, since distributors collecting the deposits would need evidence of how the chemical is being used to determine whether a deposit is required.

Unclaimed deposits could be used to finance waste audits at metal-cleaning facilities and other solvent use locations, or to provide technical assistance for efforts to minimize solvent releases and to substitute less toxic materials for solvents.

## **EVALUATION**

Federal administration of the deposit/refund program is likely to be more effective than having a variety of state deposit/refund systems. State programs may create incentives for solvent users to purchase solvents in neighboring states to avoid the deposit. This would give an unfair market advantage to solvent distributors in states without a deposit/refund system.

A deposit/refund system presents a number of administrative complications. First, a variety of actors would be involved, including solvent distributors, solvent users, and solvent recyclers. Establishing procedures to verify the accuracy of each group's claims may be difficult. Methods would be needed to verify sales (and hence deposit collections) and to verify quantities of solvents delivered for recycling (and hence refunds).

Verification of the solvent content of recovered solvents delivered to recyclers could be difficult. For example, a deposit/refund system could encourage solvent users to dilute spent solvents to obtain a larger refund. Testing of each batch of solvent might be required to eliminate such practices. The laboratory facilities required for such testing may add considerably to the cost of conducting the deposit/refund system. On the other hand, testing of individual solvent shipments is already standard practice at many recycling facilities.

Even without deliberate dilution, there can be substantial variation in the solvent content of spent solvent wastes. Solvents recovered for recycling often consist of a three-layer mix of heavy sludge (e.g., grease deposits, metals), solvent, and water. The mix of these constituents varies across solvent applications, and across facilities engaged in the same solvent application. Variations in waste composition make accurate estimation of solvent content difficult if the reclamation facility simply weighs barrels. Again, testing of each solvent shipment may be needed to calculate the appropriate refund.

The impact of a deposit/refund system on the additional volume of solvent recovered depends on the size of the deposit. Specifically, solvent users will increase the volume recovered only if the deposit charged per unit of solvent is greater than the marginal cost of implementing measures to reduce solvent losses.

A decision on the viability of the incentive needs to come only after clear demonstration of the benefits and resolution of several issues.

More information is needed on the availability, cost, and current degree of implementation of solvent control technology. Many solvent users have already instituted some of the more common types of solvent control technology, such as carbon adsorption. Research is needed to identify what control technologies (or other waste minimization measures) have not been adopted on a large scale. The cost of these modifications will play a key role in determining the appropriate deposit level. If new control measures have a high marginal cost, large deposits will be needed to induce greater solvent collection, and hence increase recycling of solvents.

Finally, as with many other incentive approaches, a domestic deposit/refund system may affect solvent imports and exports. If deposits are placed only on sales of domestic solvents, imports may then have a competitive advantage and exports a disadvantage relative to the domestic solvent market. Research on solvent import and export markets is needed before designing this incentive system.

## **LABELING OF "ENVIRONMENTALLY RESPONSIBLE" PRODUCTS**

### **BACKGROUND AND GOAL OF INCENTIVE**

Consumers concerned with minimizing the adverse environmental impacts of their purchases currently lack sufficient information to reflect those concerns in their purchasing decisions. Product labels seldom contain information on the efficiency or safety of the manufacturing process, the recycled materials content, the product's recyclability, or its toxicity. In addition, there are no standard terminology or symbols for producers to use to promote the environmental benefits of their processes or products, and existing labels may be difficult to interpret or misleading. For instance, few states have regulations governing whether a product with low recycled content may be labeled "recycled".

This incentive would establish a product labeling program to enable consumers to identify products that are manufactured with a safe or efficient process, or that are recycled, recyclable, or less toxic. The objectives of this labeling program would be:

- o to enable and encourage consumers to make environmentally responsible decisions;
- o to promote commercial development of environmentally responsible products and manufacturing processes; and
- o to ease the waste management burden associated with certain products.

### **DESCRIPTION OF INCENTIVE**

The definition of such terms as "recycled" or "recyclable" is distinct from the operation of environmental labelling programs. The government would appear to have a much larger role to play in the definitional arena than in the operational one. The incentive program described here concerns a labelling program only.

Programs for labeling consumer products could be managed by independent boards that set program policy. Panels of technical experts would develop guidelines and criteria to determine what products or product categories would qualify for a seal indicating their acceptance as environmentally preferred. Eligibility for various seals could be based on the external costs generated during production and consumption.

Submitted products would be tested to ensure that they meet the panel's guidelines. The Canadian Standards Association is the independent testing and certification agency for Canada's Environmental Choice Program (ECP). A similar independent group could be formed for the proposed U.S. program, or the program could use existing testing labs, such as those of Underwriters Laboratory.

Anyone would be allowed to submit suggestions of products that should be considered for a seal, but applications would come

primarily from manufacturers interested in obtaining the label. Manufacturers would submit the initial application, and the product would be tested and assessed for compliance with applicable criteria. The manufacturer would pay for the testing.

Once the product was approved, the manufacturer would pay for the right to use an approval label. Charges could be set to finance the program without discouraging manufacturers from applying. Directors of Canada's ECP predict that the program will be self-financing by 1990.

A labelling program could be implemented with national sanction, state sanction, or with no official sanction. A national labelling program would yield a single set of product labels. This could simplify the message to consumers, avoiding confusion that may arise with interpreting multiple labels in different states, and avoiding duplication in efforts to educate consumers about the labels. Preemption of different state labeling requirements may be appropriate if the proliferation of programs is a major concern. However, state labelling requirements in other areas have not been proven to cause problems. Entirely private programs of product certification have also been successful and can be tailored to address particular concerns of individual consumers.

Labelling programs will require considerable promotion, particularly at the outset. First, manufacturers must be informed of the program and told how to apply. Second, consumers must be educated as to the meaning of the labels and the overall goals of the program. Such information dissemination will be essential in fostering a widespread response to the labels.

Experience with similar programs in this country and elsewhere should guide the design and implementation of this incentive. The Canada ECP, which covers several categories of products, began in January 1989.

The Blue Angel program in the Federal Republic of Germany began in 1978. Product categories receiving labels include retread tires, returnable bottles, non-CFC spray cans, recycled paper, and paint low in lead and chromium. In all, the program has approved 3,500 products in 60 categories and has achieved household recognition among 80 percent of consumers. As one indication of the program's success, the German environment ministry has estimated that altered buying patterns have led to a 44,000-ton reduction in the use of carcinogenic or ozone-depleting solvents.

Norway began a program modeled after the Blue Angel program in the fall of 1989. Japan's "Ecomark" program is run by the nonprofit Japan Environment Association and has approved labels for 3000 products.

Industries in the U.S. have also undertaken labeling programs related to the environment. The National Paint and Coatings Association has developed a labeling statement that instructs consumers to contact their local environmental control agency for guidance on disposal of unused paint. The Society of the Plastics Industry has developed symbols to help consumers, collectors, and recycling processors identify the type of resin used in plastic packaging and other products.

## EVALUATION

Product labelling programs would be designed to give consumers better information so that they may make environmentally responsible purchases. By promoting safe and efficient processes, and encouraging the development of recycled, recyclable, and non-toxic products, such programs could ease landfill capacity shortages and prevent toxic products from entering landfills and incinerators.

Labelling programs would be entirely voluntary, relying on improved information to allow consumers to exercise their preferences for environmentally responsible products, and creating market incentives for manufacturers to submit products for review. Manufacturers must perceive a market advantage associated with obtaining certification from the labeling program. In this sense, the program is very dependent on consumer preferences for environmentally responsible products. Canadian polls have shown that 80 percent of the population would be willing to pay 10 percent more for environmentally responsible products. In U.S. surveys, 50 percent of those surveyed said they would change their purchasing habits to buy recycled or recyclable products, and 90 percent said they think that increasing product recycling will help solve the solid waste problem. These figures indicate that American consumers may respond positively to a labeling program, but the evidence is not definitive.

To assess the merits of product labeling programs, closer examination of consumer preferences for "environmentally responsible" products is needed. If manufacturers are confident that there is a demand for environmentally responsible products, they will have the incentive to develop such products and to submit the products for review and approval. More information is also needed on the costs of administering labeling programs, to determine whether programs can be self-financing without discouraging applications or must receive outside funding as well, and whether the costs of the program would outweigh its benefits.

One complicating factor affecting labeling programs is the level of subjectivity that is involved in declaring a product "environmentally responsible." A multiplicity of labelling programs could allow for a narrower focus on individual product attributes, possibly reducing the level of subjectivity.

## MARKETABLE PERMIT OR SURCHARGE SYSTEM FOR LEAD

### BACKGROUND AND GOAL OF INCENTIVES

Over 213,000 tons of lead enter the municipal solid waste stream each year. Lead is a toxic element used in a variety of consumer and industrial products. While its use in gasoline has been phased out, continued use of lead in other products may pose a serious health threat to different segments of the population.

Historically, lead exposure has occurred through a variety of routes that are now subject to regulatory control. For example, inhalation has been sharply reduced by the phase-out of lead additives from gasoline. Similarly, ingestion of lead has been substantially reduced by the removal of lead from interior paint. Ingestion of lead-contaminated drinking water, which was primarily caused by lead pipes and solder, also has diminished due to prohibitions on the use of lead in these products.

Remaining lead exposures thus are limited to the manufacture, recycling, and disposal of consumer products that contain lead, such as lead-acid batteries, plastics, and consumer electronic parts, and to air emissions from lead smelters and certain other industrial facilities. Lead exposures during manufacturing and recycling have been well demonstrated, but exposure due to groundwater contamination subsequent to disposal has not. Exposures to air emissions tend to be limited to the immediate vicinity of industrial facilities that use lead, and waste-to-energy plants and other incinerators in which lead may be an incidental contaminant of the waste feedstock or fuel.

Regulations intended to further reduce lead exposure would be based on pathways that have not yet been subject to regulatory control. Such regulations would be good candidates for incentive-based regulatory systems for two reasons:

- o Lead is ubiquitous, leading to a variety of exposures, potentially requiring a very complex command-and-control regulatory structure that would most likely have high administrative costs.
- o Attempts to control releases of and exposure to lead in one medium may result in shifts to other media (e.g., incineration of lead in products banned from disposal in landfills may increase air emissions).

The Task Force considered two incentives designed to limit the amount of lead produced and used in the United States: (1) a marketable permit system, and (2) a surcharge on lead sales. These incentives are designed to limit future increases of lead into the environment; they do not address lead contamination due to past practices (such as lead in paint). If one wanted to discourage disposal of lead (i.e., encourage substitution of recycled for virgin lead in production), then the incentive would be targeted at virgin lead only.

### DESCRIPTION OF INCENTIVES

#### Marketable Permit System

Under the marketable permit system, EPA would distribute permits that allow the production or importation of a limited amount of lead during some specified time period (perhaps two years). The permits would be distributed at an auction where firms would bid for the right to produce or import lead. The funds raised would go to the U.S. Treasury as general revenues.

Following the initial distribution, firms would be allowed to trade permits among themselves, but EPA would have to be notified of all exchanges. The number of permits could gradually be adjusted downward as market behavior suggests the development of cost-effective substitutes, progressively limiting the amount of lead that is allowed to enter consumer products and industrial applications.

Two enforcement issues would need to be addressed in designing the marketable permit system. First, EPA would have to perform inspections at lead-producing facilities to ensure that permitted production levels are not being exceeded. Second, imports of lead would have to be monitored to ensure that they are accompanied by a permit.

An implementation alternative to this marketable permit policy would be to require battery manufacturers to produce products containing a certain content of recycled lead, and implement this provision with a recycling credit mechanism. A bill sponsored by U.S. Congressman Torres and Senators Heinz and Wirth would require EPA to design a credit system of this type.

### **Surcharge on Lead Sales**

A surcharge program would impose a fee on the sale of lead, including imports. Sellers of domestic or imported lead would be required to collect a fee from purchasers. Sellers would complete formal reports (developed by the IRS) of all lead sales and fees collected in each transaction. The reports and the associated fees would be submitted to the administering federal agency (probably the Treasury Department). The fees would go to general revenues.

### **EVALUATION**

The basic objective of both the marketable permit incentive and the surcharge incentive is to make the production and use of lead more expensive, thereby encouraging the use of substitute materials and products.

Reductions in exposure to lead could result through substitution of other materials for lead in various end-uses and through overall reduction in the demand for lead-containing products. Private markets would continue to allocate lead among end-uses, with reductions most likely to occur in the lowest-value uses of lead.

The effects of either a permit system or a surcharge on lead exposures are uncertain for several reasons. First, different lead uses result in different potentials for exposure. The allocation of more scarce and/or costly lead among end-uses may

or may not reduce use in the applications causing the greatest exposure to lead. Any comprehensive regulatory system, including an incentive system that raises the price of lead, has greater merit if most uses ultimately result in exposure, and less merit if a limited number of lead uses are the greatest contributors to human exposure.

Second, these incentives may encourage recycling of lead. There is evidence that secondary lead smelting may itself generate significant releases of lead, primarily through air emissions and subsequent deposition onto land. Encouraging increased recycling, therefore, may or may not result in a net reduction in exposure to lead.

Research should be conducted on the short- and long-run elasticities of supply and demand for lead, to determine where lead use will decline and who will bear the burden of the charges (lead producers, lead users, or consumers of final products). In addition, lead substitutes should be studied to assess how net risks posed by these substances compare with net risks from lead. The benefits of implementation of this type of incentive must also be demonstrated before any decision is made to proceed.

These incentive instruments also raise foreign trade issues worthy of closer examination. For instance, importers of televisions might have to purchase permits or pay surcharges according to the volume of lead contained in television tubes, insofar as the risks addressed by the regulatory program are derived from disposal or incineration of discarded products.

Extending the requirements to lead in imported products, however, raises two problems. First, involving importers in the program greatly increases the number of actors whose behavior must be monitored to verify compliance with the program. Second, there is the practical problem of validating the amount of lead in imported products. Checking foreign manufacturers' claims about lead content may be extremely difficult.

A second foreign trade issue concerns the potential for creating barriers to the importation of foreign lead. The United States imports large quantities of lead. In 1986, the U.S. imported over 148,000 tons of lead (compared to roughly 348,000 tons of domestic production), exclusive of all lead contained in finished products.<sup>19</sup> Imposing restrictions on imports of virgin lead may violate existing trade agreements (e.g., the recent free-trade agreement with Canada, supplier of over 70 percent of U.S. lead imports). More research is needed to assess potential effects on imports.

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<sup>19</sup>Bureau of Mines, Metal Statistics, 1987.

## CHARGE ON TRI RELEASES

### BACKGROUND AND GOAL OF INCENTIVE

Toxic Release Inventory (TRI) reports for 1987 from manufacturers have documented 4.6 billion pounds (approximately 20 pounds per person) of potentially toxic substances released to air or water, or shipped off-site for recycling, treatment, or disposal. Most of the releases to air and water are consistent with existing environmental regulations and permits. Further regulation required under the Clean Air Act Amendments of 1990 will substantially reduce air emissions over the next decade. Similarly, toxic substances disposed of on land according to regulations promulgated under the Resource Conservation and Recovery Act minimize risks to human health and the environment.

While the TRI data base provides a useful measure of total generation of potentially toxic substances, it does not deal with actual exposure to such substances. Reducing certain TRI releases through traditional command-and-control regulations might be time consuming, administratively expensive, and unduly costly.

Economic incentives could achieve reductions in TRI releases at less cost than would a command-and-control system. A charge on TRI releases could be designed to internalize the social costs resulting from these releases to the extent that external costs are not already internalized due to existing regulations.

### DESCRIPTION OF INCENTIVE

This incentive would levy a charge per ton of reported TRI releases. The charge could be applied to all chemicals or to some subset of TRI chemicals. If the charge was placed on a subset of chemicals, two approaches could be used to define the subset:

- o chemicals with certain toxicity characteristics --such as known or probable human carcinogens; or
- o certain classes or categories of TRI releases -- such as non-metallic inorganics, halo organics, or metals.

Charges could be imposed gradually, to allow firms time to implement waste reduction and emission control efforts without imposing too great a financial burden initially. A phased-in fee should be predictable, to encourage appropriate long-range responses. Frequent and major revisions to the fees would be disruptive to industry and would make planning difficult.

## EVALUATION

Economic incentives to control toxic releases have the advantage of encouraging reductions that go beyond regulatory or statutory (such as in the Clean Air Act) requirements, where these requirements fail to internalize social costs fully. A charge on releases directly addresses the practices of concern -- releases of toxic compounds to the environment -- rather than proxies that may be even more poorly correlated with environmental releases.

A national TRI fee will be inefficient and undesirable if there are significant differences in the problems posed by TRI releases across substances. It will also be inefficient if there are differences across states or regions.

The costs of efforts to reduce releases may vary substantially among industries. Owners of some facilities may find it relatively easy to reduce the quantity of toxics released, and would be encouraged to do so even by a relatively low fee. Owners of other facilities may choose to simply pay the fee, because the cost of reducing releases exceeds the fee. The advantage of an economic incentive approach such as this (contrasted with a traditional command-and-control approach) is that it encourages pollution abatement by those who can do so at the lowest cost.

The design of the fee should consider differences in the social costs of releases to different media. A single fee based on quantities released could encourage undesirable intermedia shifts. For instance, it may be that a given volume released to air poses greater overall risk than the same volume released to land. Furthermore, it may be more costly for a facility to reduce air emissions than to reduce releases to land. Faced with a charge on releases based only on volume, the facility will choose the least-cost reduction and reduce land releases. A shift from land toward air releases may actually increase overall risk levels. Therefore, the fee should be adjusted to reflect differences in risks via different media releases, as well as differences in the toxicity of individual chemicals.

For some types of TRI chemicals, it may make more sense to use a marketable permit approach, which explicitly limits total releases but allows trading of rights to release the chemicals. Such an approach may be preferred where it is reasonable to establish aggregate quantity limits based on the absorptive capacity of the environment, and where it does not matter greatly where the releases occur (e.g., for problems involving global effects and long-range transport, rather than localized effects). Control of ozone depleters, for example, might lend itself to such an approach.

A charge based on TRI reporting may be difficult to enforce. TRI reporting is currently based on estimated mass balances. A charge on the release of certain chemicals may provide an incentive to underreport releases. To discourage underreporting, EPA must pose a credible enforcement threat. For example, facilities reporting large reductions in volume releases might be investigated to confirm that waste minimization actually occurred. Unfortunately, enforcement in this manner may discourage responsible pollution prevention efforts, because

facility owners may perceive the threat of investigation as a cost of release reduction. Alternatively, random monitoring of facilities may help to discourage underreporting.

EPA could also address underreporting by requiring more documentation of TRI release estimates. For example, EPA could require actual monitoring of air and surface water releases, and testing and record-keeping for wastes discharged to land, to POTWs, or to underground injection. Such reporting requirements would likely be very costly. Alternatively, EPA could require record-keeping to document the quantities of toxic chemicals purchased or used and the quantities contained in products, and simply assume that the residual not contained in products is released to the environment and is subject to the fee. Even the latter approach might be difficult to enforce, since there is substantial potential for underreporting initial purchase or production of toxic chemicals. In addition, the latter approach would not allow for differential charges on releases to different media.

Finally, toxic chemicals are released from many sectors not subject to the TRI reporting requirement: non-manufacturing industrial processes, use and disposal of consumer products, agriculture, and transportation. In addition, only manufacturing facilities using more than certain quantities of TRI chemicals are required to report. Imposing charges on releases from only some sources may be difficult to justify.

## REDUCTION OF FEDERAL SUBSIDIES ENCOURAGING VIRGIN MATERIAL USE

### BACKGROUND AND GOAL OF INCENTIVES

Since the early part of this century, the federal government has granted preferences in the federal tax system for the extraction and refining of certain natural resources (minerals, timber, and energy sources). These subsidies were implemented to encourage and sometimes maintain the development of mineral and other natural resources during periods of economic hardship.<sup>20</sup> While some tax preferences were originally intended to be temporary, many have persisted. Subsidies to mineral industries in particular are thought by industry and many others as vital to our national security.

Natural resource extraction and refining industries often generate large volumes of waste, which, if not properly managed, can contaminate land, groundwater, surface water, or air. Extraction and refining processes usually consume large amounts of both water and energy. For example, production of aluminum from virgin materials is estimated to consume 95 percent more energy than production using recycled materials. Subsidizing the production of virgin materials can reduce the relative competitiveness of secondary (recycled) materials, thereby working against resource conservation goals.

### DESCRIPTION OF INCENTIVES

Federal policies that subsidize the use of virgin materials fall into two categories: federal tax code provisions and federal programs.

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<sup>20</sup>Office of Technology Assessment, U.S. Congress, Facing America's Trash: What Next for Municipal Solid Waste?, October 1989, p. 197.

## **Federal Tax Code Provisions**

The following tax code provisions have the greatest potential to result in environmental degradation and to discourage recycling:

### **Mineral Depletion Allowances**

Percentage depletion allowances are tax deductions available to mineral industries. Mineral producers are allowed to deduct a certain percentage of the value of mineral production in computing taxable income.<sup>21</sup> The deductions are computed as a percentage of gross income received from production, and not as a percentage of cost.<sup>22</sup>

The allowances are designed to promote resource exploration and development by defraying some of the cost of replacing lost resources. Depletion allowances range from 5 percent for materials such as sand, to 22 percent for bauxite.

### **Expensing Provisions for the Timber Industry**

Most investments are capitalized and written off once the investment begins generating revenue. However, the tax code currently allows the timber industry to expense some timber management costs in the year they are incurred, rather than in the year the timber is harvested for sale. Expensing is currently allowed for interim management expenses, and construction of spur roads for harvesting.

Special allowances in the tax code also favor reforestation activities. The direct costs incurred for reforesting a site for commercial development can be amortized over a 7-year period, rather than capitalized and recovered when the timber is cut and sold.

## **Federal Programs**

Federal programs that preferentially encourage the production and use of virgin materials include timber production and energy subsidies.

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<sup>21</sup>Office of Technology Assessment, U.S. Congress, Facing America's Trash: What Next for Municipal Solid Waste? October 1989, pp. 199.

<sup>22</sup>Kieso and Weygandt, Intermediate Accounting, Third Edition, p. 542.

### Timber Production Subsidies

The federal government transfers ownership of timber on government land to private enterprises through the use of "timber sales." Sales are often subsidized through one of the following practices:

- o calculating the sale price based on the amount the industry can pay and still make a reasonable profit, rather than on the market value of the timber;
- o charging a price for the timber that covers only the government's cost; or
- o subsidizing private timber harvests by building spur roads with public funds.

### Energy Subsidies

Subsidies for the development and use of energy are widespread, including programs of numerous agencies, and federal loans and loan guarantees. These subsidies often lead to below-market energy prices, which in turn subsidize energy-intensive industries. In addition, since energy production is often waste-intensive, energy subsidies can indirectly increase the volume of waste.

### **EVALUATION**

In general, the federal subsidies described above were intended to encourage economic development and, in some cases, to protect national security. The impacts on the environment, on waste management, and on recycling industries are unintended side effects. Removing or reducing these subsidies, then, might have dramatic impacts on the industries and individuals whom the subsidies were designed to assist. Furthermore, if the problem is the imbalance posed by preferential subsidies to virgin material producers, extending similar subsidies to recycling industries is an alternative to eliminating existing subsidies.

Many of these subsidies are designed to promote multiple, sometimes competing, goals. Predicting their environmental and economic consequences, especially in increasingly global markets for the basic commodities affected, is complicated and requires detailed analysis of each incentive. For example, it is not clear that changes in such subsidies will necessarily have any effect on the price of commodities traded in international markets, though U.S. competitiveness in these markets could be impaired.

Evaluating the effectiveness of any proposed reductions in subsidies will require identifying the changes in behaviors that are likely to result from the reductions, and the positive and negative environmental and economic consequences of those changes. The environmental benefits must be clearly demonstrated and weighed against the economic impacts on affected groups.

Furthermore, the merits of reducing or removing these subsidies should be measured against other policy alternatives. For example, offering positive incentives to meet environmental goals may be more effective than the removal of subsidies.

Reducing or removing subsidies to virgin materials could, in theory, lead to any of the following types of economic effects, each with different environmental implications:

- o No change. Recycling rates may not change, or the industry may reduce costs of other factors to offset the reduction in subsidies.
- o Foreign virgin materials may be substituted for domestic materials, particularly if the U.S. producers are price takers in competitive world commodity markets. U.S. producers would be most affected by this scenario, as costs increase but prices received do not. From the perspective of global environmental goals, it may be undesirable to encourage foreign extraction and refining industries if these industries have less stringent environmental standards.
- o Recycled materials may be substituted for virgin materials. Studies done in the mid- to late 1970s analyzed likely impacts of subsidy changes on recycling rates for several products.<sup>23</sup> In general, they determined that subsidies appear to have little effect on recycling rates for the products examined (aluminum, paper, steel, copper, and lead). In addition, if removal of subsidies might increase the use of recycled materials, the environmental consequences of increased recycling should be considered.
- o Other materials may be substituted for virgin materials. Manufacturers may substitute other materials for virgin materials if subsidy changes alter the price of virgin materials relative to its substitutes. Though general substitution effects are difficult to predict, the likely impacts of these substitutions on the economy and the environment should be considered.
- o The consumption of materials may be reduced overall. Overall consumption of some materials could decrease if prices for these materials were to increase relative to income. More efficient use of virgin material could also occur.

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<sup>23</sup>Office of Technology Assessment, U.S. Congress, op. cit., p. 200.

## FEDERAL PROCUREMENT POLICY INITIATIVES

The federal government can assume a leadership role in encouraging the use of certain goods or services (e.g., recycled goods) by using its procurement authority to increase demand for those goods or services. Although this is not, strictly speaking, an economic incentive to reduce the degree of externality, it would increase demand, and thus the willingness of producers to supply goods considered to be socially desirable.

### FEDERAL PROCUREMENT OF RECYCLED PRODUCTS

Recycled products may cost more than comparable virgin products, especially in the initial development of markets for those recycled products. Because such factors as economies of scale in manufacturing, and tax credits or subsidies provided to virgin product manufacturers, place recycled products at a competitive disadvantage, potentially recyclable materials end up in the nation's landfills. When the avoided costs of materials disposal are considered, purchase of more recycled products would be economically beneficial to society. However, purchasers of recycled products do not directly receive the benefits of avoided disposal costs, and therefore do not have an incentive to purchase as many recycled products as would be desirable based on comparison of total costs and benefits to society.

This same "disincentive" applies to the federal government, a major purchaser, who could take the lead in expanding purchases of recycled products. Guidelines already promulgated by EPA under Section 6002 of the Resource Conservation and Recovery Act (RCRA) for five product categories are intended to promote federal purchase of recycled products. EPA issued guidelines in 1988 for procurement of fly ash in cement and concrete, paper products, retread tires, re-refined oil, and building insulation that uses secondary materials. Implementation of the guidelines by federal procuring agencies has been hampered, however, by the cost of recycled products in comparison with prices of comparable virgin products. Consistent with the provisions of Section 6002, the guidelines currently state that procuring agencies are not required to purchase a recycled product if the price of the product is "unreasonable," which has been interpreted as any price greater than the price of the competing virgin product.

Thirteen states and five local jurisdictions already have price preference authority. The amount of preference ranges from 5 to 10 percent. Three states and one local jurisdiction have set-aside authority. Many of the preferences are for recycled paper only, although some cover all recycled products.

Programs that require federal agencies to purchase recycled products that cost more than comparable virgin products will obviously increase the government's purchasing costs. The impacts on federal budgets will depend (1) on whether purchase of higher-cost recycled products is required or simply allowed under a price preference, (2) on the size of set-asides, and (3) on the criteria federal agencies must use to justify a decision not to buy recycled products under a petitioning process. With each option, budget impacts could be limited by a spending cap.

Three forms of federal procurement incentives were considered by the Task Force:

- o Price preferences for recycled products would either allow or require federal agencies to purchase recycled products with performance characteristics equivalent to comparable virgin products at up to a certain price premium. For example, agencies might be permitted to purchase recycled products that cost up to 10 percent more than the comparable virgin product.
- o Set-asides for recycled products would require that a certain portion of federal purchases in a product category be reserved for purchase of recycled products -- either regardless of price differential or, more likely, subject to the availability of acceptable recycled products at no more than a specified price differential.
- o A petitioning procedure would allow manufacturers of recycled products to petition federal agencies to purchase recycled products. The petitioners would have to demonstrate that their product met certain performance and price requirements. By requiring the procuring agency to perform a more thorough evaluation of recycled products and to justify a decision not to purchase those products, the petitioning process would probably generate more purchases of recycled products.

The effects of these programs on the production of recycled products and on budget outlays will depend on the relative costs of recycled and virgin products, compared with the degree of preference given to recycled products. For product categories where recycled products are closely competitive with virgin products, a relatively small price preference may be sufficient to encourage larger federal purchases. For example, data collected by the Office of Solid Waste indicate that some grades of recycled paper do require a price preference to compete. Although the price differential between recycled paper and virgin paper can be as high as 20 percent, the price of most grades is within 10 percent of the price of virgin products.

All three procurement incentives, used singly or in combination, should improve the competitive position of recycled products in the federal procurement market. At a minimum, the incentives should encourage greater purchases of recycled products, and therefore reduce disposal of recyclable materials. A larger and more certain federal market may also encourage changes that will increase the competitive position of recycled products in other markets. If there are scale economies in the manufacturing of recycled products, for example, an increased federal purchase of recycled products may allow recycled product manufacturers to capture those economies and lower their prices, thus encouraging more purchases of the recycled products by other levels of government and by the private sector. Increased federal purchases may also fund more product innovation to improve recycled product performance, and development of lower-cost recycling technologies. Finally, a relatively certain federal market may also fund demonstrations of recycled product performance, which may then encourage more private-sector purchases of recycled products.

Before EPA can effectively develop and implement an incentive of this type, more information and analysis would be needed on (1) the current price and performance characteristics of recycled vs. virgin products, and (2) the size of federal purchases of each product, to determine how procurement policies might best be designed. The experience of states with existing preference programs should provide useful insight into the costs and benefits of procurement incentives.

## **OTHER PROCUREMENT INITIATIVES**

### **Energy Initiatives**

Federal leadership in improved energy efficiency, through procurement practices, R&D, and informational programs, can also serve as an important model to local and state governments, as well as to private industry.

The federal government engages in and finances a variety of productive activities. To help improve overall energy efficiency and reduce harmful pollutants, the federal government could engage in one or more of the following activities:

- o increase the fuel efficiency of the federal vehicle fleet, through the purchase of higher MPG gasoline-powered vehicles and the purchase of alternative-fueled vehicles;
- o tighten and enforce more strictly federal building code standards, including lighting and HVAC standards; and
- o improve the efficiency of public housing through tightened standards and increased funding for energy-efficiency retrofits.

### **Water Policy Initiatives**

There are several water policy areas where the federal government could assume a leadership role in promoting efficient use of water resources. Some examples (not confined to procurement issues) of non-regulatory initiatives include:

- o amend the Federal Acquisition Regulations to allow federal agencies to purchase water-efficient fixtures and appliances for federal facilities, reducing federal building water use and stimulating demand for such fixtures;
- o include water-efficiency programs that reduce wastewater volume in the list of items that can be funded with state revolving funds (for wastewater treatment facilities), saving local governments money and stretching those funds, as well as reducing water use; and
- o in the absence of market pricing, provide technical assistance to state regulatory commissions and to local water providers on the redesign of rate structures to encourage full cost pricing and efficient water use.