CHAPTER 3

Policy Options

Contents

List of Tables

Figure

CHAPTER 3

Policy Options

Introduction

This chapter presents for congressional examination five policy options for the Federal hazardous waste program. Rather than mere control of potential threats, the primary problem facing the current program has become one of preventing impending crisis situations, which present sudden problems of large proportions. For example, aquifers serving as sources of drinking water have recently been discovered to be contaminated from hazardous waste, Little reliable information concerning the likelihood of future incidents is available—and, as this study indicates, there is a lack of general confidence that current regulations will prevent future incidents. However, there is general agreement that it is far more costly to respond to such adverse effects than to prevent them.

The five policy options, which are evaluated in terms of certain overall goals, are as follows:

- Option I: Continuation of the Current Program.
- Option II: A More Comprehensive and Nationally Consistent RCRA Program.
- Option III: Use of Economic Incentives for Alternatives to Disposal and Dispersal of Hazardous Waste,
- Option IV: Development and Potential Use of a Hazard Classification Framework.
- Option V: Planning for Greater Integration of Environmental Protection Programs.

With the exception of the first, maintaining the current direction of the evolving regulatory program, the other four policy options, taken together, can be viewed as a series of complementary changes to improve and reorient the current program. Four scenarios are presented to indicate how several options may be combined. For example, one scenario (a combination of options I and III) responds both to the belief that the current regulatory program, will prove to be effective and to the need to promote greater use of alternatives to land disposal.

One general constraint on this consideration of policy options is that analysis has been less quantitative than desired because of a lack of complete and reliable data. Detailed analyses of the costs and benefits of particular options require extensive data concerning wastes, facilities and technologies, and potential adverse impacts on health and the environment, This information is generally unavailable or insufficient. A discussion of available data is contained in chapter 4.

Moreover, the objectives and limitations of this study (described in ch. 2) should be kept in mind when considering these policy options. The focus of this assessment has been on technologies and management strategies; the policy options address problems and issues associated primarily with these two areas. Although this study does not focus on strictly administrative and procedural issues, such as enforcement of regulations, permitting of facilities, or authorization of State programs, OTA examined these problems when they were closely connected to the technical components of the regulatory program,

The General Accounting Office, among others, has focused on several administrative aspects, including the critical area of enforcement, in a number of reports to Congress, Most recently, a congressional study has documented critical concerns in the enforcement of both the Resource Conservation and Recovery Act [RCRA) and the Comprehensive Environmental, Response, Compensation, and Liability Act of 1980 (C ERCLA) statutes and regulations.[1] There are indications of an increased adminis-

[1]U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, report on enforcement of hazardous and toxic substances regulations during fiscal year 1982, October 1982.

trative reliance on voluntary compliance and settlements with responsible parties, and of substantial reductions in funding for enforcement activities. OTA'S study of technical issues and problems, such as the effectiveness of pollution control regulations or the exemption of waste from RCRA regulation, cannot substitute for congressional examination of the administration of the Federal program. The policy actions discussed below, regardless of their merits, are not likely to produce favorable results unless enforcement is effective.

Common Goals for Policy Options

The current Federal hazardous waste program presents a dilemma. There is a sense of urgency and impatience, derived from 6 years of difficulties in dealing with an extremely broad and complex set of issues. Suggesting changes in Federal policies, therefore, creates concerns over the possibility of still more delays, Those who support the current Federal program (both RCRA and CERCLA) believe there is a need to allow more time before conclusions concerning effectiveness are drawn and possibly disruptive changes are made. On the other hand, there is also a widespread belief that current programs could be made more technically, economically, and socially effective. Waiting for the determination of the current program's effectiveness, it is argued, may lead to the development of outright crises, such as widespread ground water contamination. There is consensus that we are now acting more effectively than in the past to protect the public from improper hazardous waste management. But there is also considerable evidence (concerning, e.g., the technical limitations and uncertainties of land disposal techniques) that we may be acting in ways which are too temporary in nature, leading to greater public risks in the future, and increased ultimate costs to industry, the government, and the public,

This dilemma must be considered in the context of reduced funds for government programs. Such conditions may prompt industry, State and Federal Governments, and the public to avoid additional costs associated with a cleaner environment in order to cope with economic difficulties. Options that defer costs, that do not jeopardize current industrial activities, that shift risks to the future, may become more attractive than in the past. Such tradeoffs pose formidable choices for policy makers, made more difficult by current uncertainties concerning the effectiveness of laws and programs not yet fully implemented.

It is therefore helpful to define specific goals for policy options for purposes of comparison and evaluation. Eight such goals for any practical congressional option are presented below. These goals will be used later to evaluate each of the policy options.

GOAL 1

Improve protection of health and the environment without undue delays and uncertainties by:

- **reducing the magnitude and hazardous nature of potential releases of waste constituents from all types of waste generation and management facilities,**
- **improving monitoring programs to quickly detect such releases, and**
- **improving corrective actions to mitigate releases.**

Many of the analytical results of chapters 5, 6, and 7 support the need for improving the level of protection of human. health and the environment by concentrating on technical, as well as administrative, matters. It would be desirable to achieve this goal without causing undue delays in the program that could have counterproductive effects leading to unacceptable releases before improved policies and programs became effective, and would seriously erode public confidence. It should be clearly understood that the current Federal hazardous waste program offers unequivocal improvements over the virtual absence of regulations that existed previously.

GOAL 2

Expand the universe of federally regulated hazardous waste, recognizing that different levels of regulation under RCRA may be appropriate and desirable.

During the inception of the RCRA program, it was reasonable to limit the scope of regulated wastes. It has become increasingly clear, however, that the exemption of hazardous waste from Federal regulation has not been well correlated with the degree of hazard of the waste. Nonregulated (under subtitle C of RCRA) hazardous waste may constitute very large volumes (see ch. 4) and may be legally disposed of in ways that threaten health and the environment.

There is no way of knowing with certainty whether the current regulatory program is directed at those wastes representing the greatest or most immediate threats. It is probable that both underregulation and overregulation are occurring. A more inclusive approach could address problems created by disposing of unregulated hazardous waste in sanitary landfills. Furthermore, careful definition of specific levels of increased control could reduce the amount of effort currently expended in attempts to have various wastes delisted.

Policy options should be evaluated with regard to their effect on bringing those wastes that are hazardous to any degree into the regulatory system in appropriate ways, if only for reporting and notification for low-hazard waste. Policy options differ regarding the determination and recognition of varying levels of hazard (assessment, e.g., maybe only qualitative) and in corresponding assignments of appropriate levels of regulatory control.

More complete regulatory coverage of hazardous waste would likely improve public confidence in the Federal program, thus contributing to the achievement of goal 8. Such control could lessen concern that wastes regulated on State initiative may receive low priority. Furthermore, there would be less likelihood of new uncontrolled waste sites requiring large Federal expenditures in the future.

A more inclusive system would encourage the development of new waste management technologies (see ch. 5) for an increased and more stable commercial market (goal 3). It would also facilitate the development of improved data bases [goal 4).

GOAL 3

Encourage development and use of technological alternatives to land disposal (including land and ocean dispersal), such as waste reduction and treatment, to reduce risks resulting from release of hazardous waste constituents into the environment.

This policy goal reflects a primary strategy of minimizing releases of hazardous constituents by initially avoiding the placement of hazardous waste in the environment. There are approaches for the control of risks involved in disposal and dispersal. However, those desiring to use such options should demonstrate that acceptable levels of releases are achieved and maintained for the particular waste so managed.

Chapter 5 discusses various technologies and the different levels of certainty and reliability they provide with regard to control of releases into the environment. Disposal and dispersal of hazardous waste in the environment involve too many uncertainties concerning acceptable levels of releases. Cleanup of uncontrolled sites involves unacceptable levels of technical difficulty, cost, and uncertainty. Discussions and analyses of the current regulatory programs in chapter 7 also indicate that the use of disposal and dispersal approaches should be minimized. Ground water contamination is a primary threat. A U.S. Geological Survey (USGS) report supports these concerns:

> Present technology is not adequate to develop regulations to protect the public from hazardous waste contamination in a cost effective manner. Major technical questions are yet to be answered regarding the behavior of specific wastes under different hydrogeologic conditions and on the safety, suitability, and economics of restoration and disposal methods. z

"'Management Implementation Plan, FY 1984," for Toxic Waste-Ground-Water Contamination [Washington, D. C.: U.S. Geological Survey, Sept. 27, 1982).

There will always be questions concerning the definition and determination of acceptable risks. It is clear, however, that the safest course is to promote the use of waste reduction and treatment alternatives as much as is possible and practicable. In so doing, **costs** must be appropriately taken into account. RCRA does not mandate a balancing of costs and risks as a means of determining what should be done to protect the public good. Instead, a cost-effectiveness approach is indicated, by which the management alternative is chosen that, for the least cost, adequately protects human health and the environment.

GOAL 4

Improve and expand data and information on hazardous wastes, facilities, and their effects which are necessary for more reliable risk assessments and for the implementation of RCRA and CERCLA by both the Environmental Protection Agency (EPA) and the States.

Complete information on any major national problem is hardly ever attainable, in order to improve waste management and risk assessment, better information is needed on the following:

- The level of generation of all hazardous waste, if federally regulated as such, in the States and for the Nation as a whole, as a function of chemical and physical types, and origin.
- The numbers and capacities of active waste facilities, both onsite and offsite (or commercial), particularly as a function of technology type, types of waste managed, and levels of control for release of waste constituents into the environment.
- The number and location of inactive waste management facilities or open dump sites, and the types and amounts of wastes associated with these sites.
- The range of potential health and environmental effects as a function of waste type, management technology and facility, and type of location.

A major finding of chapter 4 was that the currently available data and information resources concerning hazardous waste, technologies and facilities, and adverse effects are incomplete, inconsistent, and unreliable in various important respects. This does not imply that the data and information currently available are so inadequate that implementation of the current program or its modifications is not possible. With regard to evaluation, however, EPA has noted that its " 'managing for results' program for evaluating the effectiveness of its environmental programs may require better and more timely environmental data from the States . . ."[3]

Several important benefits would result from consequent improvements of data. The facilitation of hazard and risk assessments, **as** discussed in chapters 6 and 7, would be of particular importance. Also, specific technical criteria could be incorporated into RCRA regulations and into certain elements of CERCLA, particularly the National Contingency Plan and the determination of the extent of cleanup at uncontrolled sites (see ch, 5). The current absence of specific technical criteria in regulations may be based on a reluctance **to** present such criteria based on available information, recognizing that changes are inevitable as improved data are obtained. Management systems cannot be evaluated as to effectiveness without adequate data and information bases.

It is important to recognize the problems which EPA has faced thus far in this area. The large burden of initiating the RCRA program, **a lack of** consistent congressional and administrative priorities, the difficulty of obtaining data, the large amounts of data required, and the continuing finding that the data obtained early in the program lacked accuracy are representative. Some mandates for obtaining data and information were given in the RCRA and CERCLA legislation. These, however, suffer from a lack of coordination, completeness, and expeditious implementation by EPA, Also a greater understanding of the limits of the National Manifest System is needed; it deals only with waste transported of offsite, which vary markedly among States and comprise only a fraction (usually 10 to 30 percent) of the total

[3]Lewis S. W, Crampton, EPA Issue Papers, September *1982.*

amount of waste generated. A greater appreciation is needed for the value of regular reports from all waste generators rather than surveys based only on samples which EPA has decided to use.[4] Also needed is greater understanding that data require continued updating and verification, with ongoing analyses, and procedures to facilitate public access to both the data and analyses. Furthermore, coordination of the information collected under the RCRA and CERCLA programs, in other major programs in EPA, and in other Federal efforts could be improved. Finally, it is important to acknowledge that many data need to be safeguarded to protect company confidentiality and proprietary rights, and that a balance must be struck between this need and the right of the public to have access to data and information.

GOAL 5

Improve and expand participation in RCRA and CERCLA by the States through better definition, implementation, and support of both Federal and State responsibilities.

It is essential that policy options be evaluated as to their definition of the role of the States and EPA, and how they might improve and expand participation by the States. It makes no sense whatsoever to shift responsibilities to the States unless there is a corresponding improvement in their resources (financial, technical, and human] to carry out those increased responsibilities. A recent analysis of these responsibilities concluded that:

> EPA lacks the administrative capacity and knowledge of local conditions necessary to implement RCRA by itself; states lack the research capacity to develop complex regulations, Consequently, EPA and the states must share responsibility for implementing the statute under the state programs provisions. Sharing responsibility means tolerating differences. In evaluating state applications for final authorization under RCRA, EPA should construe the requirement that state programs be consistent with and equivalent to the Federal program. This will allow states the flexibility to design their programs to reflect local conditions (and] to be more stringent than the federal program. Sharing responsibility also means fulfilling obligations. EPA has been inexcusably slow in promulgating final RCRA regulations. EPA has made it difficult for states to develop hazardous waste programs; states have no clear idea what differences between state and federal programs will be allowed or even what the federal program will look like. "[5]

It is important to view RCRA and CERCLA as two components of a joint Federal-State program. It was not a goal of this assessment to examine the problems and issues associated with the delegation of RCRA program responsibility to the States or with the role of the States in CERCLA. However, during the course of this study it often became necessary to examine State actions and concerns, particularly as they relate to scientific and technological factors. For example, as discussed in chapter 4, the varying ways in which the States have decided which hazardous wastes to regulate and whether, and how, to exempt small generators is quite important to an understanding of the scope of the hazardous waste problem. The choice of sites and remediation technologies under CERCLA, as discussed in chapters 5 and 7, is also directly related to Federal-State interactions and vitally affects risks to the public.

The Federal hazardous waste program has had many positive effects on State programs, often raising standards, prompting regulatory coverage where none previously existed, providing technical information, and helping to streamline State administration of hazardous waste regulations which are sometimes split among several State groups. However, this

4EPA's policy on annual reporting requirements has shifted several times, but as of a notice in the Federal Register on Oct. 12, 1982, the annual reporting requirement for waste generators and facilities has been replaced by a nationwide biennial survey by EPA directly with waste handlers, The States have raised a number of objections to this policy, including a conflict with congressional intent (sec. 3006 of RCRA), bypassing authorized States who have the responsibility for such collection, and lack of timely improvements in the complete national data base. Letter from Richard A. Valentinetti, President, Association of State and Territorial Solid Waste Management Officials, Nov. 4, 1982, to Rita LaVelle, Assistant Administrator, Environmental Protection Agency,

5Karen L. Florini, "Issues of Federalism in Hazardous Waste Control: Cooperation or Confusion, " *Harvard Environmental Law Review, vol.* 6, *1982,* pp. 307-337.

study, along with hearings during 1982 concerning congressional oversight and RCRA reauthorization, has made it apparent that there are serious problems in Federal-State relationships.

Although the States do not have to accept program responsibility, State-run programs can be made more attractive by provision of adequate Federal funding and efficient administration of RCRA and CERCLA by EPA. * The findings of chapter 7 (concerning problems of the current Federal program) support the contention of many States that they must exercise their right under RCRA to be more stringent than the Federal program, The Federal program, they argue, should be viewed, as intended by Congress, as a regulatory "floor" rather than as a "ceiling. " RCRA limits variations among State programs by making final authorization contingent on State programs being "equivalent to" and "consistent with" the Federal program. However, it appears that EPA may frequently be authorizing State programs that are identical to the Federal program (a "mirror" approach) which States sometimes view as too lax. The States also maintain that the legislative use of the word "program," rather than "regulations," supports their position that equivalency and consistency should be based primarily on the effectiveness of State programs rather than on statutes and regulations themselves.[6]

There are sound technical reasons why some variations in standards and regulations may be appropriate among the States. Differences in hydrogeologic conditions, climatic conditions, population distributions, public attitudes toward acceptable risks, types of industries, and types of waste management facilities already in place are such factors.

The States have much to offer to the national hazardous waste program. There is considerably more practical experience at the State level (although actual data and technological expertise may be lacking in many cases), more intimate knowledge of what exactly is taking place in waste generation and management, and more experience with interpretation and enforcement of waste regulations than at the Federal level. A number of States have considerable experience in permitting of facilities under State statutes, whereas Federal permitting has barely begun.

Furthermore, many innovative programs exist at the State level, but the extent to which these could be advantageously transferred to the Federal level, or to other States, has been little studied. Examples of such innovations include:

- degree-of-hazard approaches to varying levels of appropriate waste regulation, which sometimes conflict with the Federal "floor" approach;
- plans to prohibit the use of landfills for particularly hazardous waste;
- prohibition of the disposal of bulk, and in some States even containerized, liquid waste in landfills;
- fee systems to shift private sector choices toward waste reduction efforts and away from the use of landfills;
- direct incentives for alternatives to land disposal;
- some regulation of facilities that recycle wastes;
- development of workable siting criteria and plans;
- onsite inspectors for waste facilities;
- delegation of decisionmaking authority to county government; and
- extensive, specific provisions for involving the public in regulatory decisionmaking.

If Congress attempts to detail the Federal and State responsibilities under RCRA, various issues require clarification, For example, States

*It should be noted that although most view the position of the States as necessitating receiving RCRA authorization from EPA in order to have a hazardous waste program responsive to public concerns, it is possible for States to allow EPA to administer the Federal program within their States and to also administer their own State program as a separate activity. This would place burdens on the regulated community, but might appear attractive to States if Federal support, both financial and technical, were deemed insufficient, or if the Federal program were deemed too lax.

[6]Letter from Richard A. Valentinetti, President, Association of State and Territorial Solid Waste Management Officials to Thomas W. Curtis, National Governors' Association, Nov. 15, 1982.

are often asked to enforce standards, regulations, and policies that they believe are not in the public interest, and that they believe to be incorrect, misdirected, or unenforceable, Congress may wish to consider modifying or clarifying administrative regulatory procedures, such as the Federal Advisory Committee Act (FACA), so as to involve States differently than the manner in which other interested parties now participate in regulatory development and rulemaking. States could contribute actively, rather than reactively, with Federal recognition that the States have a responsibility to participate in policy formulation, and not merely implementation of federally mandated policies, A recent report to EPA by the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) addresses this problem:

> Despite both the congressional mandate for EPA to seek consultation from the States in the regulatory development process and the current Administration's proclivity toward supporting the New Federalism concept, EPA has been protected from outside State opinion. EPA's use of the FACA law and of the ex parte rule have provided questionable rationales for denying State intervention in the regulatory decision-making process. Reinterpretation of ASTSWMO members (who are State government employees] as EPA principals would also attempt to eliminate FACA/ex parte restrictions so that State participation could occur at any point during the entire regulatory development process. Information flow from EPA to ASTSWMO member States has been hampered ... by the EPA policy to not include ASTSWMO in Federal planning and strategy activities.[7]

One conflict concerns the choice of remedial technologies to clean up uncontrolled sites under CERCLA (see chs. 5 and 7). The Federal bias is toward using low capital or initial cost approaches, for which the Federal program pays 90 percent (or 50 percent in the case of State or municipally owned sites), and that may have high, and highly uncertain, operating and maintenance costs, which the States pay entirely. The States favor approaches that are higher in initial costs, but that deal more permanently with the problems of the sites and are likely to have relatively low operating and maintenance costs. For example, in many cases, waste in uncontrolled sites are transferred to another land disposal site, rather than being treated or destroyed.

Another problem associated with CERCLA concerns funding. Presently no continuing Federal support is provided to State activities for early identification and evaluation of uncontrolled sites for possible CERCLA funding, including the extensive effort required to obtain data to rank sites for the National Priority List, searches for responsible parties, analysis of possible remediation approaches, responding to EPA directives, and support of EPA's enforcement activities, A recent survey of States indicates that about 10 percent of the RCRA grants to the States are being used for these CERCLA activities,[a]

Technical aspects of State programs could be improved by Federal requirements for reliable technical information and guidance. If there is insufficient data from waste generators, States may have difficulty determining whether particular wastes are being managed properly, or whether they are being handled illegally. This is a problem with onsite generation and management currently outside the Federal manifest system, unless there is sufficient reporting requirements to obtain detailed information.

The role of the States in data acquisition is also unclear. States could participate more directly in the critical task of improving the data base (as discussed above) by serving as direct sources of information, in contrast to the current Federal practice of using contractors on an ad hoc basis. Such contractors are often only costly intermediaries, doing little else than contacting the States for information, with too little attention given to organizing data into a common format, and to verifying the quality

[7] Annual report by ASTSWMO to EPA for fiscal year 1982, October 1982.

[a] Of the 30 States providing information, 23 used RCRA funds in fiscal year 1982 for CERCLA activities, these States accounted for 46 of the 115 sites on the original interim Superfund priority list. Personal communication from the Association of State and Territorial Solid Waste Management Officials, November 1982.

and accuracy of the data. It would be useful to have a clearer policy defining the Federal and State roles with regard to acquiring and maintaining data bases. It appears appropriate to consider the States to have the prime responsibility for data, with EPA serving as the institution ensuring consistent definitions, providing uniform formats for data acquisition, acting to validate data, and serving as a central compiler of data obtained from the States.

RCRA grants to the State programs should reflect the large and costly tasks of collecting information and making it useful through analysis, data processing, and computer retrieval (see ch. 4). OTA studies show that, in a number of States, reports and manifest forms containing useful data remain unexamined and unprocessed because of a lack of resources, such as lack of computer facilities.[9] Routine State activities often require complete information bases, from which surveys based on statistical samples can have only limited use. These samples do not provide data on specific facilities requiring inspection and permitting that State officials may not be aware of. Furthermore, statistical results for the Nation do not reveal unique State or regional conditions.

GOAL 6

Moderate the inevitable increases in the costs of Federal and State program administration and regulatory compliance by industry and minimize costs associated with site remediation and compensation for further damages to health and the environment which may result from current practices that could be improved.

As discussed in chapter 7, the private sector annual costs of complying with RCRA and CERCLA are now estimated to be in the range of $4 billion to $5 billion, and total Federal and State costs are about $200 million annually. With the RCRA and CERCLA programs just now in their early phase of implementation, increased costs are to be expected. Private sector costs with the current Federal-State program are estimated to increase to about $12 billion (in 1981 dollars) in 1990 (see ch. 7). Even a modest improvement in the efficiency of the Federal and State programs could save many millions of dollars. One of the greatest uncertainties concerns the extent to which present government policies and private sector management choices will result in the creation of future uncontrolled sites, with consequent releases of hazardous constituents, costly cleanup actions, and expensive liability suits. It is important, therefore, to evaluate policy options for their ability to reduce long-term costs for both government and the private sector.

GOAL 7

Reduce risks transferred to the future, whether several years or to future generations, and reduce costs of waste management that are externalized and shifted to society in general.

There should be minimal transfer of risks and costs to the future, whether it be years or decades, on general grounds of equity. Furthermore, deferrals of optimal solutions inevitably lead to a compounding of the technical nature of the problem, to marked increases in costs, and sometimes to the prevention of any practical solution (as, e.g., in the contamination of a large underground aquifer serving as a major source of drinking water). As discussed above, and in chapters 5 and 6, it must be assumed that use of the environment for disposal and dispersal of various wastes now constitutes a threat for the future because of the high probability of releases of hazardous constituents into the environment.

There are two basic reasons for fully internalizing waste management costs, including the possibility of future remedial actions and compensation for damages to human health and the environment. First, on the basis of equity, it is proper that those persons most responsible for waste generation should pay for proper management, including those choosing to consume products or use services requiring the generation of hazardous waste. Second, if the management alternatives most protective of the public good are to be promoted, then it is reasonable to penalize those alternatives providing lower levels of protection.

[9] Personal communication from the Association of State and Territorial Solid Waste Management Officials.

GOAL 8

Reduce public concerns over the siting of hazardous waste management facilities by improved implementation and enforcement of government programs.

It is obvious that hazardous waste will continue to be generated. Even with reductions in some waste generation resulting from the current regulatory program and greater concerns with future liabilities, there will probably be an overall increase in hazardous waste generation if economic activity increases. Such increases may require new facilities. If there is a shift away from land disposal as the dominant management choice, new treatment facilities will be required. It is also possible that more land disposal facilities may be required, depending on how the current regulatory program (particularly permitting) affects existing facilities, on the level of success in shifting to alternative management options, and on the level of future waste generation. Public concern over permitting existing facilities and siting new ones, therefore, poses a serious problem for improving hazardous waste management.

Public concern over the need for, and siting of, new waste management facilities can be addressed through both technical and institutional approaches. Technical approaches include improved public understanding of alternative management strategies, effective technology options, future capacity needs, varying hazard levels for wastes and facilities, health and environmental effects, hydrogeologic siting criteria, and present and future costs. As discussed in chapter 6, there is no assurance that better information will remove public opposition to siting of new waste facilities, but there is hope that public confidence in government policies can be improved. With increased public confidence, public concerns and private sector needs may be better reconciled,

Five Policy Options

OTA has defined five options that would address both short- and long-term needs and problems of the Federal hazardous waste program. As indicated earlier, with the exception of the status quo option, the remaining options can be viewed as a complementary series of changes that would improve and reorient the program over time, The five options are stated below, followed by a more detailed discussion of each,

- Option I: Continuation of the Current Program.-The current program, together with certain planned changes, is maintained.
- Option 11: A More Comprehensive and Nationally Consistent RCRA Program.—Near-term changes in regulations can be made by making amendments to RCRA. These changes include a redefinition of which wastes are regulated and to what extent, a shift toward limiting land disposal, the introduction of limited class permits, and the greater use of specific technical criteria in regulations. These changes would not alter the structure of the current program, but, they would significantly impact the regulated community.
- Option III: Use of Economic Incentives for Alternatives to Disposal and Dispersal.—This is a near-term program to reduce the use of disposal and dispersal approaches to waste management by providing direct economic incentives for alternatives such as waste reduction, recycling, and treatment. Three key components of a comprehensive incentive program are a fee system on hazardous wastes generated, a means to address capital investment needs, and assistance for research and development (R&D). Such a program could be implemented by either amendment to RCRA or CERCLA or by a new statute,

- Option IV: Development and Potential Use of a Hazard Classification Framework.—This is a longer term program to first study and then possibly adopt some type of waste and facility hazard classification as a systematic framework for regulatory decisionmaking. Such a system can be used for setting priorities, setting monitoring requirements, and determining the appropriate level and type of regulation, including performance standards. It could be implemented by amendment to RCRA, with the first phase consisting of a study to further examine and better quantify potential benefits, as well as feasibility, design, and implementation problems.
- Option V: Planning for Integration of Environmental Protection Programs.—This would be a long-term effort, beginning with a study, to integrate existing environmental programs. Major goals would be the elimination of gaps, overlaps, and inconsistencies in regulatory coverage, and the prevention of RCRA permitting of facilities that improperly manage hazardous waste regulated under other acts. The first phase would consist of a major examination of how such integration could be achieved and the presentation of a plan for integration, including an analysis of the need for statutory changes. This option is consistent with section 1006 of RCRA which directs such integration by the EPA Administrator, but which does not require a submission of a plan to Congress nor a specific time for such integration. In the second phase, Congress would examine the plan and consider necessary statutory changes.

Option I
Continuation of Current Program

This option assumes that the mandates of both RCRA and CERCLA may be met by the current Federal hazardous waste program. It should be recognized that the present program is not static. EPA has indicated several plans for changes and improvements in the near term.[10]

Unlike the other policy options, no unusual implementation problems and costs are associated with this "status quo" option. Criticisms of the option are based on perceptions of current problems, or point to unacceptable risks and costs involved in waiting for the program to "prove itself. " In the following discussion, the current program, the "status quo" option, is evaluated in terms of the eight goals presented earlier.

GOAL 1

Improve protection of human health and the environment without undue delays and uncertainties.

Analysis of the benefits of the "status quo" option relative to this goal clearly presents the conflicts between short- and long-term evaluation. This option, by definition, involves no delays or revisions of the current program, and the current program is certainly providing increased protection than existed previously. Final regulations have been promulgated and permitting is beginning. State programs are being authorized. CERCLA-funded cleanups of uncontrolled sites are taking place. Enforcement actions for both RCRA and CERCLA are occurring. Better information is being obtained.

However, to the extent that the level of protection is lower than it could be, the benefit from this option is less than it could be. On balance, this option is considered to offer a moderate benefit. Criticisms of' the current program have been shaped by past delays and changes in direction and primarily focus on: 1) the speed and extent of its acknowledged advantages relative to what existed previously, and 2) ambiguous signals given to decisionmakers in the regulated community. Uncertainties over

[10]The primary source for future directions of EPA's current program is a letter dated Sept. 7, "1982, from Rita M. Lavelle, Assistant Administrator for Solid Waste and Emergency Response, EPA, to the Honorable Thomas P. O'Neill, Jr., Speaker of the House of Representatives.

the program's eventual effectiveness are related to the following:

1. continued litigation, judicial decisions, or negotiated settlements, that result in changes in policies and regulations;
2. negative public response to new regulations; and
3. adverse impacts on health or environment that were otherwise avoidable, or that clearly would not be prevented by the present program even if it had been in place earlier.

These uncertainties, and other factors detracting from the benefits of the current program, are discussed further in the consideration of the remaining seven management goals.

GOAL 2

Expand the kinds of federally regulated hazardous waste.

This option offers a minor benefit, There is no systematic program or policy to substantially remove current exemptions or to close gaps in regulatory coverage. But certain exemptions are being dealt with by EPA on an ad hoc basis,

The current RCRA subtitle C program regulates only a portion of the Nation's solid wastes that have hazardous characteristics, This situation has resulted primarily from both congressional and administrative exemptions granted to facilitate the initiation of the national program. There are also established procedures for removing wastes from the RCRA lists. The exemption of small generators of hazardous wastes is being examined, and may be refined with regard to both the level of waste required for exemption and the types of waste generated, Similarly, EPA has stated its intention of proposing regulations in 1983 covering the burning of hazardous waste as fuels, now currently exempt from RCRA coverage. For the most part, however, the major exemptions existing in RCRA as mandated by Congress would remain, and those areas being reviewed by EPA may remain unchanged for some years,

With regard to how wastes are regulated, there are for example limited, missing, or uncertain restrictions on land disposal of certain types of waste that present well-known risks. Such wastes include:

1, liquid wastes in landfills;
2. particularly persistent, mobile, and toxic wastes in landfills and surface impoundments; and
3. volatile wastes in surface impoundments; and
4. wastes that have the abilitv to degrade the liners in landfills and surface impoundments.

EPA has indicated that studies are underway to determine the basis for prohibiting land disposal of hazardous waste which are highly toxic, persistent, and mobile where alternative treatment or recovery technologies are reasonably available. Also, requirements for monitoring and control of volatile organic compounds in land disposal facilities are being studied,

Furthermore, the regulation of industrial hazardous waste going into municipal water treatment systems or requiring pretreatment under the Clean Water Act (CWA) has not yet been fully implemented. There is some evidence that regulation of hazardous waste under CWA, but not under RCRA, may lead to the release of hazardous substances into the environment. For the regulated waste list as a whole, there remains considerable uncertainty concerning how and when this universe might increase or decrease without congressional action.

GOAL 3

Encourage alternatives to land disposal.

Only minor benefits in this area seem likely. There is little direct attention currently being given to promoting new management and technology approaches. The current RCRA program emphasizes using traditional command and control regulations for disposal of hazardous waste, with the belief that by making disposal options more stringently regulated and more costly, alternatives to disposal will become more attractive to waste generators. To some extent, this strategy and the "cradle to grave" system works. However, the success of

the current approach relies on the imposition of, or expectation of, more stringent and more costly requirements for waste disposal facilities; the outcome is not yet certain.

An additional factor in the current program (which, some may argue, is more significant than the impact of the control regulations) is the effect of the liability requirements in RCRA and CERCLA. These requirements appear to be significantly impacting management decisions of both waste generators and facility operators. The primary effect is to shift priorities away from land disposal (with its uncertainties and potential liabilities for future release of hazardous substances) toward the use of economically attractive alternatives that more permanently deal with hazardous waste problems. However, there are uncertainties as to the impact of liability requirements because of:

1. the limited time that the liability requirements have been in place and the lack of information about compliance;
2. the varying, often limited policies offered by the insurance industry and the different and evolving procedures they use for evaluating risks;*
3. the perception by some that enforcement efforts are too ineffective to lead to determination of responsible parties;
4. the lack of experience with claims;
5. the very limited actuarial data concerning the risks associated with disposal technologies, with either existing facilities or new facilities, based on compliance with the final regulations;
6. changing and expanding legal theories of liability as a result of legislation and judicial decisions; and
7. the self-insurance provisions.

● There is no standard procedure used by insurance companies to assess the practices and risks of hazardous waste management facilities. Through a number of informal meetings between OTA staff and insurance industry personnel, it has been verified that risk assessment procedures vary substantially. Current procedures ranged from: no site inspection whatsoever; to relatively nontechnical inspections with no physical testing to verify past or present waste management practices, the nature of the waste managed, or the hydrogeologic nature of the site; to very sophisticated assessments involving highly trained personnel and physical testing.

Moreover, there may bean indirect disincentive in current regulations. The performance standards for land disposal techniques are less detailed and, to some extent, less stringent and more flexible than the regulations for incineration. Therefore, the costs of incineration (determined, in part, by the regulations) remain noncompetitive with land disposal techniques. Furthermore, there are no final technical standards for some waste treatment technologies, such as certain chemical and biological treatments, which leads to much uncertainty about future regulation, and makes their commercial development and use difficult.

The current program generally does not regulate hazardous waste that is being recycled or put to “beneficial” use (e. g., waste burned as fuels), except for regulations covering transportation, storage, or generation. Therefore, the present policies can be regarded as providing an indirect incentive for recycling. Alternatively, this minimal level of regulation can be viewed as related to possible release of hazardous substances from such operations. Some justification for this concern exists because of the large number of CERCLA sites which have been selected for remedial attention that were recycling facilities originally.

Furthermore, current land disposal regulations do not distinguish where retrofitting of existing facilities may be both technically feasible and appropriate (see ch. 7). Nor do they consider how certain types of waste may be best managed in existing or new facilities depending on their hazard levels. The lack of restrictions on waste for disposal has two major effects. First, the long-term risks associated with land disposal may be increased, particularly for existing facilities. Second, the market for disposal techniques may be increased at the expense of treatment alternatives with higher direct costs. Also, there are no financial responsibility requirements for corrective action.

In summary, the current program indirectly promotes some use of alternatives to waste disposal. However, to the extent that the full short- and long-term costs of disposal options are still not fully internalized (because of the nature of the regulations and their effect on costs and

markets, as discussed below), there remains an incentive to use disposal or dispersal options. Moreover, the current program does not directly provide counterbalancing incentives for alternatives to disposal, and EPA's R&D programs currently include very limited activities in the areas of advanced technologies and alternatives to disposal. *

GOAL 4

Improve data for risk assessment and RCRA/CERCLA implementation.

Because of the increasing maturity of the current program, with attempts to rectify acknowledged deficiencies in information and analysis, this option provides a moderate benefit. Problems remain, however. There appears to be an absence of a systematic, long-range program for expanding and maintaining a national hazardous waste data base. Coordination of efforts among different groups within EPA and other executive agencies appears insufficient. Responses to congressionally mandated efforts related to data and information have not been timely. Definition of the role of the States in data acquisition and analysis, and the provision of sufficient financial support for such State activities has not been accomplished. Partly as a result of these problems, there is a lack of information concerning unregulated waste that might be regulated in the future.

The limitations on data are related to what some consider to be a very disturbing aspect of current RCRA and CERCLA regulations—i.e., their lack of specificity concerning technical criteria. The regulations are, for the most part, based on performance rather than design, though often a mixture of both. There is concern, however, over the frequent lack of specific technical criteria to establish acceptable performance. Interpretations of many standards and permitting decisions are left to regional EPA administrators and permit writers. In some instances, they may be aided by advisories and technical resource documents issued by EPA. This approach can be defended on the basis that hazardous waste facilities and sites possess uniquely different characteristics. While flexibility is definitely needed, particularly from a State perspective, from a Federal perspective this approach may provide too little assurance that the intended stringency of the regulations will be obtained consistently throughout the Nation.

A particularly critical example of this lack of specific technical criteria is found in the National Contingency Plan under CERCLA where the "How clean is clean?" question is often posed. Although a reasonable process is specified for determining the extent of remedial cleanup, the absence of technical criteria places the CERCLA program in jeopardy. However, EPA believes this approach is appropriate because of the site-specific nature of the problem and the need to move ahead with the program expeditiously. Others believe that standards for allowable levels of release from sites after emergency or remedial action are needed. Such standards should be consistent with either existing Federal and State standards for levels of hazardous substances in the environment, or with available scientific information if regulations do not address the types of chemicals associated with hazardous waste. Much of the concern over this issue is related to the possibility of CERCLA-funded remedial actions that are found to be ineffective at a later date, when the State is responsible and CERCLA funds are no longer available.

Another important example of lack of specificity in RCRA regulations is the case of monitoring requirements. There are few technical criteria, based on hydrogeologic surveys and other information, for establishing the number and location of wells to determine water flows, background levels, and releases from the site. Similarly, there is little detail provided to establish a basis for EPA or State permit writ-

*The phrase "from cradle to grave" used to describe the current RCRA program was created with land disposal in mind. However, it is interesting that in creating a metaphor for "from beginning to end" of "from birth to death" that grave was used to connote the end point of waste management. Considering both the extensive use of land disposal and the likelihood of releases of hazardous constituents into the environment, use of the word grave is somewhat misleading. A more apt and useful metaphor for the waste management cycle would be "from cradle to urn' '—with urn suggesting incineration and true destruction of the waste as the most desirable end point.

ers to decide which chemicals or indicator parameters are to be monitored, and which equipment and methods are to be used.

Data collection and analysis for risk assessment is particularly important for determination of degree of hazard and subsequent regulation. There are two areas for which the determination of hazard or risk levels is being used or is being planned. One is for RCRA regulations, including the tailoring of regulations for some facilities, such as monofills (landfills for single wastes) and neutralization impoundments, specific wastes, provisions for class permits, and the setting of exemptions or prohibitions such as the small generator exemption. The other is in selection of uncontrolled sites for attention under CERCLA. EPA has faced a difficult task in applying hazard and risk assessments at a time when there is limited information, time, and resources, and when methodologies are still being developed. Nonetheless, there is considerable need to evaluate relative hazards and risks. The issue is not whether to attempt these evaluations, but rather which are the best technical approaches to use.

To satisfy Executive Order No. 12291, EPA is conducting regulatory impact analysis for RCRA regulations involving the use of the Risk/Cost Policy Model (sometimes referred to as the WET matrix). A detailed examination of this model is given in chapter 7 and its appendix. OTA is not confident that the structure of the model, its assumptions, or its data bases will lead to accurate results for estimating how regulations should be tailored, what waste should be exempt (such as under the small generator exemption category), or what waste should be prohibited from land disposal. Problems with the model are: the data base for waste now includes only about half of those regulated; the management technologies considered applicable are not consistent with present or possible future uses; diverse human health effects are not adequately addressed; costs for technologies are incomplete, undocumented, and are biased in favor of land disposal; and sensitivity analyses have not yet been performed .11

OTA is also concerned that the model is, in effect, an approach to cost-benefit analysis for RCRA-a balancing of the protection of human health and the environment against costs—which is contrary to congressional mandate. Moreover, in calculating benefits, the Risk/Cost Policy Model totally discounts any benefits from reducing risks associated with environmental damage. The model also makes use of population densities in a manner that could lead to determinations of low, and presumably acceptable, levels of risk for low population-density areas. Population near the site is an unreliable indicator of population at risk because of actual distributions of releases and varying exposures to people. Still, EPA has expressed confidence that the model can be used effectively as a complement to other information being gathered by the agency, including information obtained through its regulatory impact analysis program.

In the National Contingency Plan under CERCLA, a Hazard Ranking System (sometimes referred to as the Mitre model) is used to develop comparative rankings of hazard levels of uncontrolled sites in order to determine how limited resources can best be allocated. OTA'S examination of this system has shown several deficiencies primarily concerning the type of data used, that can lead to false priorities and misallocation of resources. These are discussed in detail in chapter 7. The result is that CERCLA funds may be spent when large numbers of people maybe at some risk, but that no funds are spent when relatively few people, such as in rural areas, are a high risk. Another problem with the model is the difficulty of incorporating data that may be more meaningful.

[11] EPA's Science Advisory Board has reviewed this project. Its findings concerning the technical aspects of the model, for the most part, are in agreement with OTA's concerns, and it recommends continued development of the model. ("Report on the RCRA Risk/Cost Policy Model—Phase 2 Report," Environmental Engineering Committee, Science Advisory Board, October 1982.]

GOAL 5

Improve and expand RCRA/CERCLA participation by States.

There has been a marked increase in the level of both Federal and State activities and Federal and State cooperation is continuing. Nonetheless, the problems discussed previously indicate considerable room for improvement, and only a minor benefit with respect to this goal is likely, The current program is generally viewed by the States as presenting an unacceptable combination of shifting increasing responsibilities to the States without corresponding increases in necessary resources provided by the Federal Government. A potential exists for a sharp downturn in Federal-State relations if funding for State activities under RCRA subtitle C is eliminated, which EPA has indicated its desire to do and which it has already done for subtitle D activities. Lack of participation in policy formulation has also led to many States having substantial concerns over the effectiveness of the regulations promulgated thus far.

OTA has found the following problems to be significant and indicative of the current situation: *

1. States are viewed by EPA as critical to implementing regulations, but not in policy formulation and design of regulations. The result is that States often find themselves in strong disagreement with technical aspects of the regulations. For example, many States disagreed with EPA's small generator exemption based on quantity rather than on hazard level and with EPA's policies on liquids in landfills. Also, many States find land disposal regulations too weak in the monitoring area, particularly the exemption from the ground water monitoring and response requirements. Although States may, and sometimes do, impose more stringent requirements than the Federal program, the absence of strong Federal action may undercut State efforts, and limited State resources restrict the development of separate and more stringent State regulations. In the case of CERCLA, States have expressed considerable concern over the lack of detail in the National Contingency Plan.
2. States have continuing problems because of the decision to remove all Federal grant support for subtitle D nonhazardous solid waste activities, even though these programs are far from complete. Moreover, such facilities are allowed to accept hazardous waste under the small quantity generator exemption. There is considerable concern that some sanitary landfills may, therefore, become future CERCLA sites. However, there are often no funds available to monitor these sites for release of hazardous substances. Some RCRA subtitle C grant funds are being used for subtitle D activities, and EPA does not appear to be carrying out its responsibility under RCRA subtitle D to oversee the State solid waste programs.
3. States have no ongoing Federal grant support for general CERCLA activities related to identifying and assessing sites. CERCLA funds now received are only for specific emergency or for remedial site actions. Some RCRA subtitle C funds are being used for CERCLA activities.
4. States have not received increased Federal grant support, while RCRA activities have escalated sharply. Furthermore, because of the two preceding factors and insufficient State funds, RCRA subtitle C grants are used to carry out other activities. In fact, EPA has indicated its intention to eliminate all grants to the States;* and in

*For detailed comments on Federal-State problems from the State's perspective, see, various testimonies by Norman H. Nosenchuck, as Resident of the Association of State and Territorial Solid Waste Management Officials and Director of the Solid Waste Management Program for New York State; and various congressional hearings, such as Senate Subcommittee on Intergovernmental Relations, Nov. 24, 1981, and House Subcommittee on Natural Resources, Agricultural Research and the Environment, Dec. 8, 1982. Also see, Jacqueline M. Rams, "Federalism and Hazardous Wastes–A Perversion of RCRA Intent?" *The Environmental Forum,* January 1983, pp. 11-16.

*In a meeting between the EPA Administrator and representatives of the National Governors' Association on Sept. 20, 1982, the States indicated that reductions in grants would lead to cutbacks in programs. This would impede delegation to some States, and cause formation of "pollution havens." They also indicated

the fiscal year 1983 authorization process, EPA wanted to reduce State grants, but Congress restored the level of funding.** This is in sharp contrast to an EPA statement in 1980:

> To carry out their responsibilities under subtitle C, the States will have to expand greatly the size of their hazardous waste programs. Program expansion might require a corresponding increase in State hazardous waste management grants.[12]

The 1980 EPA projection for the State grants for fiscal year 1983 (in 1983 dollars) is nearly three times greater than the amount actually budgeted for fiscal year 1983.

5. States have had few direct, formal, and consistent ways to influence, to support, or to contest the data at EPA. They often are expected to use unreliable and incomplete information, or to supply information without having the resources to obtain it.
6. States find themselves in conflict with EPA over the choice of sites for CERCLA funding because of the requirement to provide at least 50 percent of the initial costs for State or local government-owned sites and 10 percent for private sites. Because of limited State funds, government-owned sites may be less likely to be chosen by States for CERCLA attention on the grounds that more sites could get remedial attention by using the available funds as the 10 percent match for CERCLA actions at privately owned sites. There are also indications that a bias exists in favor of selecting sites associated with those industries whose feedstocks are now taxed under CERCLA. Moreover, the choice of remedial technologies for CERCLA sites creates further conflicts because of the State's responsibility to cover all future operating and maintenance costs. States are concerned that EPA will favor approaches with low initial costs, but high continuing costs. EPA has indicated that it will select the lowest cost-effective alternative, and States preferring a higher cost alternative must pay all additional costs.
7. The general character of the program to delegate responsibility to the States favors programs identical to the Federal program. States are reluctant to develop deviations that would jeopardize "equivalency" with the Federal program, but which might be well suited to local conditions and needs.

GOAL 6

Moderate increases in costs to governments for administration and to industry for compliance.

The status quo may appear to provide benefits in these areas. However, there is some concern that the current program, not merely in the content of its regulations, but also in its administration, places considerable emphasis on balancing short-term, immediate costs against protection of public health. It has largely discounted efforts to protect against longer term environmental effects. The structure that provides flexibility for site-specific factors could also lead to excessive responsiveness to local economic interests desiring to minimize management costs. Furthermore, there are no programs aimed at shifting management choices to alternatives that are more costly than land disposal in the short term. There is no means of proving that the current program is or is not, ultimately, a cost-effective approach. Some of the measures being contemplated for "fine tuning" of the program (e.g., tailoring land disposal regulations according to perceived risks and costs) may lead to greater cost effectiveness, but it is not possible to forecast that adjustment of overregulated cases will more than offset ad-

---

State fee systems cannot compensate, and that grants are not a gift, but represent a purchase of services, and that without grants States ought to begin charging for services and data provided. NGA memo from Tom Curtis to Environmental Directors, Sept. 23, 1982,

*When the administration proposed a 20 percent reduction in fiscal year 1983 grants to the States, a study revealed that Federal grants to the States support 69 percent of State hazardous waste program budgets, that 11 States hoped to replace at least part of the reduction in grants, and that 20 States would reduce monitoring proportionately to the grant reduction. "The State of the States: Management of Environmental Programs in the 1980' s," National Governor's Association, June 1982,

[a]'' Operations/Resource Impact Analysis, RCRA Subtitle C" (Washington, D. C.: Environmental Protection Agency, April 1980).

justment of underregulated cases in terms of costs alone, *

GOAL 7

Reduce risks transferred to the future; reduce costs of management shifted to society in general.

It is clear that the current program offers significant reductions in the transfer of risks and costs to future generations than before its implementation. Nonetheless, this option is believed to offer only a minor benefit relative to what is achievable and socially desirable. The current program is generally perceived to broadly sanction land disposal, and there are uncertainties over possible future costs. Uncertainties concerning the choice and effectiveness of remedial actions under CERCLA are also substantial.

EPA has used the qualifier "long term" in its land disposal regulations, but has not made the meaning of this term exact. It is reasonable to interpret the phrase to mean about 30 years, a number in keeping with other language in the RCRA land disposal regulations. There then appear to be ample opportunities for facility operators to adhere in good faith to the regulations and create situations that transfer risks and financial liability to future generations. Not all releases may be detected within 30 years. As noted in final land disposal regulations, EPA itself expects, " , . . most landfill disposal units to leak [eventually], however well designed . . ." The time horizon problem is particularly apparent in the monitoring requirements for land disposal techniques and the ways in which monitoring requirements can be circumvented entirely.

*"An important but uncertain factor, for this and all policy options, is general economic conditions, including levels of industrial capacity utilization, types of industry restructuring, shifts in end-product uses, and the development of new industries and processes. Some of these can lead to lower costs for waste management, while others may increase costs. Nonetheless, it is likely that the costs for hazardous waste management [as either a fraction of *gross* national product or of a waste generator's production costs] are likely to increase in the near term, stabilize, and possibly decrease as waste prevention and control techniques become more pervasive, mature, and efficient, and with reductions in the formation and remediation of uncontrolled sites.

GOAL 8

Reduce public concerns over siting of facilities.

Only a minor benefit is likely. Public confidence does not appear to be improving with the current program. There are no Federal programs that would indicate to the public that alternatives to land disposal are being encouraged. Nor are there strong signals that technical information is being both improved and better disseminated in useful forms to the public. There are no indications of interest in providing direct Federal involvement in the siting area which might complement State efforts. Many States have instituted programs and criteria for siting to alleviate public concerns, but the results are not yet clear. Alternatively, continuing information, analyses, and discussions of the current national regulatory program contribute to public concerns.[13]

Option II
A More Comprehensive and Nationally Consistent RCRA Program

The purpose of this option is to expand the scope and increase the effectiveness of the current RCRA program. The changes discussed below could be carried out by amendment to RCRA, possibly including a schedule for EPA implementation within approximately 6 months to 1 year of enactment. For convenience, all changes in RCRA are presented as one congressional option, although each could be enacted independently. Each of the modifications is described, followed by an evaluation of the option in terms of the eight policy goals presented earlier; then, the costs and problems associated with implementation of the option are discussed.

Specific Changes

Wastes Regulated .—This change concerns the universe of regulated hazardous waste and the

[13]For example: "State of the Environment 1982, " The Conservation Foundation, 1982; "indictment-The Case Against the Reagan Environmental Record, " ten environmental organizations, March 1982; "Environment and Health, " *Congressional Quarterly, 1981;* and "Poisons in the Water, " Sierra Club, October 1982.

extent of such regulation. The findings of this assessment support consideration of the following measures to bring more high-priority waste under regulation in appropriate ways:

1. Closing the gap created by the blanket exemption of hazardous waste generated in relatively small quantities. The objective is to avoid having hazardous waste managed as nonhazardous, solid waste in sanitary landfills. In the near term, if a quantity cutoff is used, the prudent approach would be to use a relatively low one such as 100 kilograms per month (kg/me) instead of the current 1,000-kg/mo value. In the longer term, however, some measure of the level of hazard of the waste could be used instead. Such an approach does not imply adoption of any particular, or complex, methodology for assessing level of hazard. Regulation would be based on known characteristics of the waste that indicate potential harm to human health and the environment upon release of the material into the environment and with significant exposure. However, if it could be demonstrated that relatively small quantities of hazardous waste do not present significant threats, then there could be very minimal regulatory control, e.g., notification and reporting requirements, or modification of RCRA regulations that govern waste generators.[14]
2. Ending the total exemption for hazardous waste used as fuels, or as fuel supplements. Instead, there would be notification requirements for records of what wastes are being burned and where. Also, there would be standards for acceptable levels of release into the environment, and perhaps some monitoring requirements.[15]
3. Ending the total exemption from RCRA coverage of liquid hazardous waste sent to municipal water and sewage treatment facilities. There would be instead notification requirements and standards for acceptable amounts of releases and residuals in effluent waters and sludges, supplementing gaps in pretreatment coverage under CWA. These requirements and standards would be defined for specific chemicals and toxic metals in a manner consistent with types and concentrations of constituents.
4. Establishing a category of "special" hazardous waste consisting of high-volume, relatively . low-hazard waste (many of which are now totally exempted from regulation) to be minimally regulated under RCRA. There maybe only notification requirements for generators of such waste.
5. Developing minimal regulations for the recycling of hazardous waste (or hazardous materials that could become waste), applicable to all operations, not just "third party" recyclers as is currently proposed. Due consideration would be given to avoiding the creation of disincentives for recycling—e.g., by only requiring notification of what wastes are being recycled.
6. Developing lists of hazardous wastes to be prohibited from management in landfills, surface impoundments, and deep wells. These lists should be correlated with technical criteria regarding particularly high

[14] A detailed OTA study of the small generator exemption found that waste produced at a rate below 1,000 kg/mo could amount to 2.7 million to 4 million tonnes annually nationwide. Amounts vary substantially among States—16 States indicated that more than 5 percent of their waste came from small generators. (OTA, "The RCRA Exemption for Small Volume Hazardous Waste Generators," staff memo, July 1982.] A more recent study for New England States indicates that over 15 percent (excluding waste oils) of the region's waste is produced by small generators. (A. D. Little, Inc., "Hazardous Waste Generation in New England," August 1982.)

[15] Current EPA policies on the burning of hazardous waste as fuel are generally not related to the hazards posed by suboptimal burning that may lead to release of hazardous constituents into the environment. For example, some wastes are totally exempt from regulation if they are to be recycled; these are "wastes that are not sludges, that exhibit a characteristic of hazardous waste, and that are not listed in 40 CFR 261.31 or 261.32." Moreover, the determination of whether the recycling is "legitimate or sham" depends primarily on the energy value of the waste, rather than any consideration of the performance characteristics of the burning operation, the hazardous nature of the waste, or risk factors associated with releases and exposures. (EPA, *Memorandum on RCRA Enforcement Guidance: Burning Low Energy Hazardous Wastes Ostensibly for Energy Recovery Purposes,* Jan. 18, 1983.)

risks from possible releases into the environment.

7. Establishing regulatory criteria for hazardous waste which, although substantial scientific information indicates their hazardous character, have not yet been so defined, They have not been listed and, when subjected to current EPA tests and procedures, they do not exhibit any of the currently identified hazardous waste characteristics, For example, a number of industrial wastes containing significant levels of dioxins, chlorinated organics, or pesticides are not now regulated as hazardous wastes and cannot be shown to be toxic by EPA's test for toxicity.

   EPA's extraction procedure (EP) test for toxicity has received considerable discussion and criticism. Its use for defining RCRA regulated waste and for delisting decisions is highly suspect. A recent technical study of the EP test by Utah's hazardous waste management program concluded:

   > The EP test procedures as presently adapted definitely need to be refined and changed. The results from this test are not adequate to make sound waste management decisions. In fact, the EP results obtained are leading to mismanagement decisions with accompanying risks of adverse health or environmental results.[18]

   The study showed how waste with oily phases presented particular problems, that organic waste posed problems, that results are not reproducible, that the acetic acid extraction medium does not model real world conditions, that the test's 20-fold dilution for solid samples produces deceivingly low results, and that false negative results were likely. Some sites in Utah where wastes that are not hazardous, according to the EP test, have been land-disposed and have already contaminated ground water.

   Another example of the limitations of the EP test has been shown for cadmium-containing sludge produced in Illinois. In order to pass the EP test, calcium oxide is added to the sludge. The lime does not alter the cadmium, but it does neutralize the acetic acid used in the test and allows the sludge to be classified as a nonhazardous waste .17

8. Making delisting of hazardous waste more expeditious without, however, compromising protection of the public, This could be done by using clearer, specific criteria for delisting and by limiting times for evaluation by EPA. To some extent, this action could balance the effects of the preceding actions, which lead to more waste being regulated. Delisting provides a means whereby site-specific factors or previously unavailable information might mitigate prior estimates of potential hazard. However, one problem that has become apparent in delisting processes should be controlled. Although constituents causing a waste to be originally defined as hazardous may have been removed, the waste may still contain other hazardous constituents in significant concentrations. Such waste should not be delisted, pending further testing. The use of the EP toxicity test (as discussed above) should be examined, Adopting a procedure for verification of submitted data should also be examined. Attention is also needed to address current delisting activities which maybe delaying the regulation of significantly hazardous waste, such as dioxin.[18]

Limited Class Permits .-The engineering design and performance characteristics of some hazardous waste management facilities may be largely independent of location. Class permits may be appropriate for such facilities. However, such facilities should have little probability of release of hazardous constituents, and such possible release should be easily observable through minimal, mandatory inspection or monitoring, There is some concern over whether permitting by rule would lead to sufficient protection of the public, such that the

[17] W.C.Geissman,letter to Rep. James J.Florio, May 25, 1982.

[18] House Energy and Commerce Committee Report No. 97-570 on H.R. 6307, May 18, 1982, p. 23.

[18] Comments of the Utah Bureau of Solid and Hazardous Waste on the Extraction procedure Toxicity Test," Dec. 1, 1982.

loss of public participation in the permitting process is justified. Furthermore, while use of class permits for tanks and containers may be reasonable, these may have to be limited to aboveground facilities because of the difficulty of detecting leaks in underground facilities. Limited class permits may have to be based on very detailed technical criteria in order to avoid permitting of older facilities having unacceptable design and performance features. (For example, construction materials in older facilities may lack adequate corrosion resistance.) If Congress is to sanction class permitting without sacrificing protection of the public, then the limited nature of the policy should be carefully spelled out legislatively. Class permitting need not involve a cutoff of all public participation. Expedited, minimal permit review can be combined with appropriate notification and an opportunity for the public to be heard as part of the permitting process.

Specific Technical Criteria in Regulations .–There are a number of critical components of RCRA and CERCLA regulations that include little if any specific technical criteria to guide permitting. If Congress is to ensure protection of the public consistently, then it is necessary to direct EPA to establish specific technical criteria through rulemaking, in contrast to reliance on guidance documents. This would correct the current emphasis on allowing Federal or State permit writers to make critical decisions either without such guidance, or without the resources necessary for making decisions and formulating criteria about extremely complex technical matters. Two areas of particular concern are RCRA regulations dealing with monitoring for land disposal facilities and CERCLA regulations dealing with the determination of the extent of cleanup at a remedial site. This is not to imply that EPA is unaware of the problem. Several relevant activities should be noted: draft guidance documents have been prepared by EPA and may lead to specific criteria being used; EPA was under judicial order to promulgate final regulations; and regulations can and may be revised in the future to add more detailed standards.

Benefits of the Option

The above set of changes in the current Federal regulatory program for hazardous waste would yield the following benefits relative to the eight goals for all policy options. That the option could readily be implemented is an intrinsic advantage.

GOAL 1

Improve protection of health and the environment without undue delays and uncertainties.

In general, this option appears to offer a major benefit. Regulation of more hazardous waste, use of more technical criteria in regulations, and reasonable class permits could reduce the probability of release of hazardous constituents into the environment. The option would not restructure the current Federal program. All the modifications in RCRA could be implemented expeditiously within the existing framework in an evolutionary manner. The option presents changes which can be phased in and which would reduce uncertainties concerning possible future regulation. One specific action that would benefit from the earliest possible consideration is the adoption of specific technical criteria for permitting, which has hardly begun. Such criteria could speed up permitting in many respects; current regulations are likely to place considerable burdens on permit writers.

GOAL 2

Expand universe of federally regulated hazardous waste.

This option offers a major benefit. Many existing gaps in regulatory coverage would be closed in appropriate ways. Addressing the delisting mechanism from the viewpoint of waste generators (ensuring that truly hazardous waste are not delisted) balances increased burdens placed on waste generators by accommodating unique site-specific situations.

GOAL 3

Encourage alternatives to land disposal.

Only modest, indirect benefits are likely in this area, Bringing more waste under regulation may create larger markets for alternatives. The use of more specific technical criteria might make land disposal options more stringent and costly.

GOAL 4

Improve data for risk assessments and RCRA/CERCLA implementation.

The option would promote the use of more specific technical criteria in regulations, as well as for the collection of additional information concerning additional waste brought into the regulatory system (even if only for reporting). There are, thus, reasons for expectation of major benefits regarding data collection, risk assessment, and implementation.

GOAL 5

Improve and expand RCRA/CERCLA participation by States.

A major benefit could result because more technical guidance would be provided through the use of more extensive technical criteria in Federal regulations. Also, States that now regulate more waste than the Federal system would have fewer conflicts with the expanded Federal system, and would find program delegation more acceptable, This option would facilitate expansion of the universe of regulated waste for those States that cannot be more stringent than the Federal program. Many States would also welcome class permits and more technical criteria in regulations, which could reduce the burdens on State permit writers. However, this option would not expand participation by States,

GOAL 6

Moderate increases in costs to governments for administration and to industry for compliance.

Only a minor benefit might result. By bringing more waste into the regulatory system, this option increases all costs. To the extent that class permits and more equitable delisting procedures might offer efficiencies, costs might be reduced. If it is presumed that greater regulatory coverage reduces long-term costs to the government for cleanup actions, then the option may offer a long-term cost benefit.

GOAL 7

Reduce risks transferred to the future; reduce costs of management shifted to society in general.

A major benefit in this area would result from the fact that more hazardous waste would become regulated and managed in more appropriate ways than they currently are. More technical criteria in Federal regulations could also ensure that current managers provide appropriate levels of control.

GOAL 8

Reduce public concerns over siting of facilities.

A major benefit could result with public perception that the Federal regulatory system ensures that fewer hazardous waste are escaping regulation altogether and that increased technical criteria in Federal regulations provide a more uniform and acceptable level of protection throughout the Nation, without removing the public's right to participate in the permitting process,

Costs and Problems for Implementation

Some of the specific actions required for implementation are consistent with current EPA plans, although details may differ. * Other actions, such as broadening of the regulated waste coverage and use of specific technical criteria, are not wholly endorsed by EPA, A major problem appears to be the somewhat increased resources required to implement the changes. Critics may contend that with practical implementation just beginning, it is not

* For example, EPA has indicated that it is studying the burning of hazardous waste as fuels in boilers and may issue regulations, but its study will not be completed until early *1984,* and it has begun a study of small generators. EPA plans to propose rulemaking for the first group of class permits in 1983. [47 CFR 239, 5560-5584, Dec. 13, 1982.)

possible to keep the current program moving, while at the same time making these changes. It may also be argued that there is insufficient information available to carry out these changes. Opponents of the option are likely to see an unnecessary increase in the scope and level of the regulations, adding further to the burden on the regulated community. There is some merit to all these viewpoints. There is no way to determine precisely what the costs to government, or to the private sector, would be. A rough estimate of the increase in EPA funding required for implementing this option within 1 to 2 years might be about $10 million. *

Option III
Use of Economic Incentives for Alternatives to Disposal and Dispersal

The objective of this option is to shift the balance from disposal and dispersal of hazardous waste into the land or the oceans to the reduction of waste at the source, recycling, and treatment. Direct economic incentives would be used to accomplish this objective. The following comments from a recent study[19] suggest a need for this option:

> The federal government has done little directly to encourage the adoption of alternative disposal techniques . . . Several of the states are taking a more active role than the federal government,

This option is designed to provide direct incentives. There are, within the current program, regulatory incentives to promote the use of alternatives to disposal and dispersal, including: streamlining permitting procedures for alternative or innovative facilities, requirements to use certain alternatives for specific wastes, and increasing the required level of control for disposal and dispersal approaches. Moreover, the current system is significantly increasing the costs of land disposal, compared even to just a few years ago. While these factors may have beneficial effects, they are often rendered less effective by uncertainties, ambiguities, and contradictions in the regulatory system (as perceived by the regulated community) or because they limit choices in too general a fashion. The use of direct economic incentives can be viewed as a complement to regulatory incentives and to the use of the legal system.

This policy option should be viewed in the context of current legislation concerning hazardous waste management. CERCLA was enacted because of the recognition that unacceptable risks have been inherited from certain past waste management efforts that were too shortsighted. The connection between CERCLA and RCRA has received insufficient attention; too often they are viewed as separate programs, rather than as two components of the Federal hazardous waste program. The need for future expenditures of public funds to clean up hazardous waste sites should be minimized.

Congressional action to implement this option could occur through an amendment to RCRA or CERCLA, or as new legislation. There are no apparent technical or institutional obstacles to adoption, but a major issue would be what types of incentives to provide. Consequently, before discussing here the several types of economic incentives, the concept of a hierarchy of alternative management strategies is examined. The discussion provides a context for considering this option. Second, a comprehensive set of economic incentives are examined, including using a fee system for wastes, a means to address capital needs, and a means to address R&D needs. Third, the option is evaluated on the basis of the eight policy goals. Finally, costs and problems associated with implementation are discussed.

A Hierarchy of Alternative Management Strategies

A major purpose of chapter 5 is to demonstrate the applicability of a relatively large number of alternative technological approaches to hazardous waste management. Such technologies provide means for the reduction of

*This figure is roughly 40 percent of the sum in the EPA fiscal year 1983 budget for all hazardous waste activities excluding grants to the States, administration of the regional offices, enforcement activities, and R&D activities; it is also about one-third of the fiscal year 1983 budget for R&D costs associated with hazardous waste.

[19] "State of the Environment 1982," The Conservation Foundation, 1982.

waste generation, the destruction of waste, and the disposal or dispersal of waste. Different alternatives are appropriate for different wastes and locations. In chapter 4, it was noted that land disposal nationwide continues to be used for most hazardous waste (although it varies substantially among States), and in chapter 5 the uncertainties concerning the use of ocean disposal are discussed.

With the congressional mandate to reduce the risks associated with hazardous waste to acceptable levels for both present and future generations as a constant goal, a cost-effectiveness approach can be used to select appropriate technical approaches for particular wastes. Moreover, the optimum management strategy for any waste will likely consist of several technical steps: reducing the volume of waste, reducing the hazard level through treatment, and disposing or dispersing what remains. It must be recognized, however, that occasionally some treatments might lead to waste residues that present greater problems for disposal than the original waste. The most attractive management strategy is one that matches technological operations with the characteristics of specific wastes to minimize the release of hazardous waste in a cost-effective manner. Greater attention to a hierarchy could lead to greater consideration of the broadest range of cost-effective alternatives for waste management. Available management strategies and specific technological alternatives appear to provide ample choices for waste generators to obtain solutions to regulatory demands.

The following hierarchy provides a framework for understanding the use of alternatives to disposal and dispersal of hazardous wastes:

1. waste reduction at the source—e.g., process modifications;
2. waste separation, segregation, and concentration, through available engineering techniques in order to facilitate identification of the waste and the application of the remaining steps;
3. material recovery, either onsite or offsite, to make use of valuable materials, including the use of waste exchanges so that a (potential) waste for one generator can be made available as a resource for another industry;
4. energy recovery from (potential) waste or its components, perhaps as a fuel supplement;
5. waste treatment to reduce the hazard level and possibly the amount of waste requiring disposal; and
6. ultimate disposal or dispersal (preferably of residues from previous steps, of pretreated waste, and of untreatable waste) in a manner that holds release of hazardous constituents into the environment to acceptable levels.

Such a systematic ordering of waste management options presents a number of advantages. For example, permanent solutions to waste problems are more likely to occur prior to disposal and dispersal. Consequently, fewer risks and costs are shifted to the future. Emphasis on waste reduction could significantly reduce costs of waste management and, in some instances, avoid them altogether. The use of waste as resources, rather than discarding them, at once removes them and provides direct economic benefits. If less hazardous waste is produced and regulated by promoting the use of alternatives 1 through 5 of the hierarchy, and if there are reduced administrative activities (e. g., inspection) for treatment and disposal facilities, then the costs of administering a regulatory program and of remediating uncontrolled sites could be reduced.

Specific factors concerning waste, plant, and companies should of course play their normal role in economic evaluations of alternatives. Moreover, for some waste only management alternatives 5 or 6 will be technically feasible or cost effective. The above listing does not imply that alternatives 2 through 5 do not involve any potential release of waste into the environment; techniques for these options require some regulatory coverage to monitor and hold such release to an acceptable level. For example, energy recovery through the burning of waste as fuels poses problems of releases of hazardous constituents into the environment.

99-113 0 - 83 - 6

Such regulation can provide information useful in enforcement efforts and for understanding how generic types of waste can be managed other than by disposal and dispersal approaches.

The idea of the hierarchy presented above did not originate with OTA. It has been recognized for some time by those concerned with waste management in both industry and government. In 1976, before the passage of RCRA, EPA offered a position statement on effective hazardous waste management that included the above hierarchy as a ranking of preferred alternatives. As recently as 1982, EPA reiterated its support of the 1976 position.[20] Nonetheless, there has been little programmatic support of the concept of a waste management hierarchy. Although RCRA gave some attention to reuse, recovery, and recycling, there have been few programs providing incentives, nor have there been transfers of technology and information encouraging this strategy. As for EPA's R&D activities, in fiscal year 1983 the total effort related to alternatives to land disposal amounted to about 10 percent of all hazardous waste R&D, or $4.4 million.[21] (See ch. 7 for a discussion of all current EPA expenditures.)

There have been no programs explicitly aimed at waste reduction, although increasing costs of waste management (due, in part, to the Federal regulatory program) have indirectly encouraged waste reduction efforts. The indirect approach, however, does not appear to produce positive results extensive enough and fast enough to substantially impact national waste management practices. Some support for this belief has been obtained by an analysis of premanufacturing notices filed by manufacturers of chemicals as required by the Toxic Substances Control Act. Limited information provided on anticipated waste management practices for notices filed during the past 3 years, as shown in table 10, indicate two trends: 1) increasing reliance on some form of waste treatment by itself, and 2) a decline in the use of land disposal by itself and in conjunction with waste treatment. However, the total, combined use of land disposal continues to remain at high levels, and the increase in notices filed may indicate increasing amounts of waste to be produced in the future.

The ineffectiveness of indirect incentives probably will likely remain as long as EPA maintains that land disposal is the most acceptable management alternative. Thus, although EPA has adopted the above hierarchy, its position regarding land disposal has been expressed as follows:

> We believe that most wastes can be satisfactorily managed in the land and that it can be done with a reasonable margin of safety more cheaply in this manner. [22]

Indirect, nonregulatory approaches to this option are of only limited effectiveness. Adequate control of hazardous waste cannot be provided by either market or legal systems, as was concluded in a recent study for EPA:

> Private markets alone cannot be relied on to promote adequate controls on hazardous releases. The common law system creates some

[20] Federal Register, vol. 41, No. *161,* pp. *35050,* 35051, 1976; *EPA Journal,* July-August *1982,* p. *19;* and testimony of Rita M. Lavelle, U.S. House of Representatives, Committee on Science and Technology, Subcommittee on Natural Resources, Agriculture Research and Technology, Dec. *16, 1982.*

[21] The actual *areas* and support levels are: incineration of organics—$2.6 million, cofiring options such as boilers and cement kilns—$1.2 million, advanced thermal technologies such as plasma burning–$140,0()(), physical, chemical, and biological treatments—$150, 000; pretreatment such as solidification—*$300,000.* (Oral testimony, John Lehman, Director of EPA's Hazardous and Industrial Waste Division, House Subcommittee on Natural Resources, Agriculture Research and Environment, Dec. 16, 1982.)

[22] Testimony of Rita Lavelle, House Subcommittee on Natural Resources, Agriculture Research and Environment, Dec. *16, 1982.*

Table 10.—Waste Management Methods Indicated on TSCA Premanufacturing Notices

Year	Treatment only	Treatment and land disposal	Land disposal only
1980	24%	4-1 "/0	30%
1981	29%	29%	410!0
1982	52%	31 %	13"/0

NOTE: Based on examination of May and June submissions for each year. Percentages are for totals of those supplying information for onsite and off site management; totals were 37 for 1960, 68 for 1961, and 118 for 1962. Due to the limited information asked for and provided, it is not possible to know whether all the management choices are for hazardous waste, or for others as well.

SOURCE: Office of Technology Assessment

> incentives for proper waste management, but those incentives are too weak or uncertain to provide the only controls for many types of hazardous waste incidents. [23]

The study did not address the question of whether equitable internalization of the full costs of hazardous waste management can be achieved through a regulatory approach, nor did it consider nonregulatory alternatives which might avoid inadequacies of the market and legal systems. Such questions are becoming increasingly important,

With regard to the use of direct economic incentives, a 1980 EPA study noted:

> Many environmental regulatory programs could potentially employ market mechanisms to supplement or replace the more traditional "command-and-control" approach. There is good reason to believe that in some cases market incentives might be both less costly and more effective than the regulatory approach. *

Many industries have actually adopted the above hierarchy. Their economic evaluations include the longer term liabilities and potential costs associated with the disposal and dispersal alternatives, which are more difficult to quantify than short-term costs. Industries choosing to reduce waste generation or to use treatment techniques may incur greater costs than competitors who choose disposal and dispersal. Adoption of the above hierarchy, even in the private sector, must be based primarily on a philosophical commitment, not on precise quantitative economic evaluations of limited scope, Some industries may want to convey to the public that their firms are "good citizens. " Although use of the land for disposal has continued to receive regulatory attention, many would argue that land disposal has been encouraged (see ch. 7) by regulations that fail to promote internalization of the long-term costs of land disposal, Since current regulations contribute to the lower costs of disposal and dispersal when compared with other alternatives, it can be argued that measures need to be taken to offset this regulatory bias. One approach would be to correct the regulatory bias directly. Another would be to address the need for direct economic incentives for alternatives to disposal and dispersal. The incentive approach contrasts with the traditional command and control regulations which are aimed at uncovering those not in compliance and depend on enforcement actions.

[23] "Evaluation of Market and Legal Mechanisms for Promoting Control of Hazardous Wastes" (draft), Industrial Economics, Inc., September 1982.

* EPA, "Economics In EPA, " Subcommittee on Economic Analysis, Science Advisory Board, July 22, 1980.

Types of Incentives

Considering the objective of minimizing government expenditures, OTA believes that it is impractical to suggest major incentive programs based on direct, budgeted expenditures. Also, the use of economic incentives raises questions concerning the placement of burdens on industry. For such reasons, this option consists of three components: a fee system on generated waste, procedures to respond to capital needs of alternatives, and consideration of R&D problems that might prevent the development of alternatives.

A Fee System.—There is a trend toward State use of fee systems, both to raise revenues and to influence choices among hazardous waste management alternatives, but results of these relatively new programs are mixed. California, New York, Kentucky, Missouri, and Ohio impose fees on waste generators. The CERCLA program, at the Federal level, is based on the collection of a fee on the production of petroleum feedstocks and specified chemicals which produces 87.5 percent of the $1.6 billion fund. Many critics of this approach believe that the fund should have been financed through a "tail-end" fee on actual waste generated, rather than on "front-end" feedstock materials that only indirectly, and to different degrees, lead to hazardous waste generation. A strong disincentive is thus inadvertently established penalizing those choosing to minimize waste generation. However, there was insufficient information on waste generators originally available to facilitate such an approach. When collection under CERCLA expires in 1985, it is likely that substantial sums will continue to be required to clean up uncontrolled sites. EPA's

original estimate in 1980 required $44 billion. There have also been indications from the administration that it is currently disinclined to seek reauthorization of the fee collection program. Continuation of the current CERCLA fee system offers no direct incentive to alternatives to land disposal, although continued experience with CERCLA may prove to be an effective indirect influence on use of such alternatives.

An approach that would satisfy several objectives could be based on the use of the CERCLA funding mechanism for RCRA purposes and using a tail-end system instead of a front-end fee. This would involve shifting the collection of CERCLA moneys (including the post-closure liability trust fund to start in 1983) to hazardous waste generators. * To be effective, fees would have to be reduced, on a unit-weight basis, when: 1) alternatives to disposal and dispersal were used by the generator, either onsite or offsite; and 2) the hazard level of the waste or residue disposed was relatively low.

The concept of a fee on waste generators has been given some support by the recommendation that the Hazardous Waste Compensation Fund "should be established by contributions from, or taxes on, the production of hazardous or toxic chemicals, and crude oil, and by a tax on the deposit of hazardous wastes. "[24] Moreover, EPA itself has said that " . . fee systems make sense because they 'internalize' the cost of pollution, placing its cost at the source, not on the general public, "[25] although EPA seems more interested in State fee systems than in a Federal system. With regard to the present approach to collecting fees on feedstocks under CERCLA and the need to influence current management choices, the senior EPA official responsible for both CERCLA and RCRA administration has said, "It would be more appropriate to put the fee on waste generation. "[28]

Support for a waste fee system also has come from a major industry, which is generally understood to be the largest hazardous waste generating industrial sector:

> CMA has, under the Superfund discussions, recommended a waste end tax. That may be one way to increase the incentives out of landfilling for certain particularly highly toxic materials. Waste end tax as opposed to a feedstock, and I think that probably should still be considered as one of the methods which might be used to move the system gradually from landfilling to the more appropriate, in some cases, technologies.[27]

In considering the problem of Federal funding of State programs, the National Governors' Association has said,

> If EPA wishes fees to replace federal resources, it should lead the way with the development of a uniform fee structure, ...[28]

The critical feature of such a system, is that such a fee should be substantially greater (perhaps double) for disposal and dispersal options, and substantially lower for low-hazard or treated waste (perhaps by half). A fee discrimination would provide the desired economic incentives for alternatives to disposal and dispersal. Moreover, the discriminatory ratios and/or the amounts of the fees on land-disposed wastes might be increased over time, as waste volumes decline and after ample time has been given for adopting alternatives. A zero tax for wastes (or portions of them) recycled for material or energy that would otherwise become hazardous waste would appear equitable and

*Collection of the $2.13 per ton CERCLA tax on hazardous waste received at treatment, storage, and disposal facilities will begin on Apr. 1, 1983. No tax is paid on waste that will not remain at the facility after closure, such as treatment facilities. The tax is not on waste generators directly. Proceeds of the tax will finance the $200 million Post-Closure Liability Trust Fund to pay for post-closure care, remedial action, and damages from releases at qualifying hazardous waste facilities.

[24] "'In juries and Damages From Hazardous Wastes—Analysis and Improvement of Legal Remedies, " report to Congress by Superfund Study Group, September 1982.

[25] Issue papers prepared by EPA for Sept. 20, 1982, meeting between EPA Administrator and representatives of the National Governors' Association, distributed by Lewis S. W. Crampton.

[26] Oral testimony, Rita Lavelle, U.S. House of Representatives, Committee on Science and Technology, Subcommittee on Natural Resources, Agriculture Research and Environment, Dec. 16, 1982.

[27] Philip A. Palmer, testimony on behalf of the Chemical Manufacturers Association, Mar, 31, 1982, House Subcommittee on Commerce, Transportation, and Tourism.

[28] "Work Plan on Environmental Program Grants, " Environmental Subcommittee, National Governors' Association, Dec. 16, 1982.

desirable. * However, there is a need for precise definitions for recycling (as well as for hazardous waste), otherwise a waste fee approach could lead to inappropriate removal of wastes from the system, * *

Can fees on generated hazardous waste raise sufficient revenues? If one accepts the current, frequently used figure of 41 million tons per year of RCRA hazardous waste generation, an average fee of $10 per ton would raise about the same annual revenues as CERCLA presently does. If total waste generation is much higher, as it may be because of a broader universe of waste regulated by States (see ch. 4), or if more wastes are brought under the RCRA program, then fees might be reduced somewhat.

For disposal and dispersal options, with high fees of perhaps $10 to **$20** per ton, costs could increase by less than 10 to 40 percent for a disposal cost range of $50 to $200 per ton, and perhaps by less if the national waste stream is found to be much greater than the currently used figure (see discussion in later section). However, for high-volume, low-hazard waste disposal or treatment may only cost $10 to $20 per ton, and fees should be lower than the average.

Table 11 illustrates a waste fee system that has been proposed in Minnesota. The structure of this system is strongly biased against land disposal, particularly for liquid waste. It also favors onsite over offsite management, a bias often defended on the basis of advantages associated with not transporting hazardous materials, rather than on any intrinsically superior level of management at onsite facilities. This system, it should be noted, is also simple. The use of relatively simple generic waste categories for different fee rates is necessary to facilitate administration of such a system.

Table 11 .—illustration of a Hazardous Waste Generator Tax Structure

Waste management category	T-ax on solid waste ($/metric ton)	Tax on liquid waste ($/metric ton)
Land disposal	42	85
Offsite		
Land disposal after treatment	21	42
Treatment	11	21
Onsite		
Land disposal after treatment	11	21
Treatment	5	11
Recycling/reuse, used crankcase 011	0	0

NOTE In addition to this tax, to support a State Superfund, a hazardous waste generator fee (a minimum fee plus a fee dependent on the quantity of waste generated) was also proposed to support State administrative costs for hazardous waste programs. A provision was Included to exempt small generators

SOURCE Minnesota Conference Report H F No 1176, Mar 19, 1982

New York State employs a simple system, with the following rates imposed on waste generators: $12/ton for hazardous waste disposed of in landfills; $9/ton for waste treated or disposed of offsite, excluding disposal in landfills; $2/ton for waste incinerated or treated onsite; and no fee on waste subject to resource recovery. Unlike the Minnesota system, the New York fee structure is based only on management choice, and does not deal with the degree-of-hazard of the waste. However, it too provides an incentive for onsite management, but to a lesser degree than the Minnesota approach.

Hazardous waste generators in California are covered by two separate fee systems: one supports the operation of the overall State hazardous waste program and imposes a $4/ton fee for wastes that are land disposed (with a limit of $10,000 per month); the other is a State Superfund system that uses a a current base

*There is a view in industry that characterizin recycled hazardous materials as hazardous waste is inappropriate, because they are not discards. However, it is also argued by others that it is necessary to keep such materials in the category of waste because there is still a potential for releases of hazardous constituents during handling, transport, and recycling of such materials. Moreover, there is the likelihood that not all generators of such materials will recycle them, and that those who do recycle them will not always do so.

* • In this regard, the use of deposit-refund types of economic incentives offers a unique advantage, The user of a feedstock, that leads to generating a hazardous waste, pays a deposit that is returned only on transfer of the waste to an appropriate management facility. This approach provides a direct economic incentive for proper management, and is being used very successfully in West Germany for ensuring the recycling of waste oils. *In* contrast to a waste fee approach, in which some parties may be motivated to escape by illegal action, the deposit-refund approach makes improper behavior costly, even without enforcement actions.

rate* of $6.52/ton for hazardous wastes that are land disposed, a rate twice that of the base rate, or $13.04/ton currently, for extremely hazardous wastes that are land disposed, a rate that is 15 percent of the base rate for wastes placed in surface impoundments and for wastes regulated as hazardous by the State but not under the Federal RCRA program, and a rate of 0.1 percent of the base rate for relatively high-volume, low-hazard mining overburden wastes. While the California system recognizes varying hazard levels of wastes, it places no fees whatsoever on any wastes for which the management choice does not involve the use of the land. Thus, there is an incentive to use waste treatments rather than land disposal, but (unlike the Minnesota and New York cases) it provides no direct incentive for waste reduction nor for onsite rather than offsite management.

The underlying philosophy of the waste-fee system approach is to reward those who minimize future risks and costs to society through the use of environmentally preferred alter natives. As existing uncontrolled sites are cleaned up, future uncontrolled sites made less likely, and hazardous waste generation reduced, the fees on non-land-disposed wastes could be decreased. Morever, such an incentive system would encourage efforts to reduce the amounts of waste generated. The uses of the fees collected could be expanded, as has been recommended,[29] to deal with injuries and damages directly associated with mismanagement of hazardous wastes. Fees could be collected by States, and it might be advantageous to distribute a specified percentage of those collected by a State to the State program. This could promote the replacement of varying State fee programs with a uniform national system, at least for federally regulated wastes. Such a uniform system could minimize potential effects on interstate commerce, including the transport of waste to, or the location of waste generators in, States with low fees or none at all.

Capital Needs.—A major obstacle to the adoption of measures to reduce waste generation or hazard levels is the need for capital investment for new or modified equipment or facilities, either by waste generators or commercial waste managers. A Federal loan program could be instituted, which offered low interest rates, and perhaps long terms for repayment, for capital expenditures on existing or new facilities directly related to waste or hazard reduction. Alternatively, the Federal program might guarantee private sector loans, or make available tax free bonds to finance loans. Technical guidelines could be established and the administration of loan evaluations and approvals could be shifted primarily to the States. Unexpended CERCLA funds, either those under the present program (which are currently quite large) or more likely under a new program as described above, might be used as a source of funds for loans. A fixed fraction of such fee-generated funds might be designated for these types of loans. One recent study which examined using government loan incentives for resource recovery equipment in the electroplating industry concluded that such a program could be quite effective.[30]

Another means of addressing capital needs is the use of tax credits. A special, time-limited investment tax credit to spur capital investments could be offered if directly related to reduction of waste or hazard levels. Although this is a traditional approach to achieving a desired goal of society, it has received criticism because of the loss of revenues to the government. However, the case of hazardous waste presents a particularly good example of how spending promoted by a tax benefit could, in the long-term, markedly reduce government expenditures. Moreover, a special tax credit of 10 percent (in addition to any broad investment tax credit) likely would lead to reductions in

*This base rate is adjusted annually, on the basis of changing amounts of wastes generated and the distribution in the different wastes classes that are taxed, so as to produce a total of $10 million annually for the State Superfund.

[29]"Injuries and Damages From Hazardous Wastes-Analysis and Improvement of Legal Remedies," a report to Congress in compliance with sec. 301(e) of CERCLA, September 1982. (By an independent group of attorney s.)

s@' Hazardous Waste Management in the Great Lakes Region: Opportunities for Economic Development and Resource Recovery" (Washington, D. C.: U.S. Department of Commerce, National Bureau of Standards, September 1982).

government revenues of at most several hundred million dollars annually over a 5- to 1(1-year period, An interesting possibility would be to use some fraction of the fees collected to compensate the Treasury for all or part of the lost tax revenues. The electroplating industry study also concluded that a special investment tax credit for resource recovery investments could be effective.

A number of States have used tax incentives to deal with capital needs for improved hazardous waste management. Some examples have been noted in a recent study.[31] Wisconsin exempts machinery and equipment used for treating hazardous waste from the State property tax. North Carolina excludes real estate and equipment used for waste disposal and resource recovery from its property tax and it also offers accelerated depreciation on resource recovery equipment. Michigan exempts from property taxation the value of any improvements in old facilities for the purpose of waste reduction. Oregon offers a 100-percent tax credit for pollution control facilities associated with recovery of energy or of substances with economic value, However, it is not yet clear how their programs have influenced waste management decisions.

Assistance for R&D Efforts. -Alternatives to disposal and dispersal meet another obstacle in that technologies such as process modification or for treatment of particularly difficult wastes require applied R&D efforts before becoming commercially feasible. Increased Federal support of private sector R&D, including pilot plant efforts, could be very useful. Relatively small sums might produce very large benefits. In order to allay objections to using Federal funds, it might be possible to structure R&D assistance so as to recover the Federal investment, perhaps through long-term, low-interest loans to be repaid upon successful commercialization of the technology. Profit sharing and exclusive licensing arrangements with payments to the government are also possible. Illinois commits a portion of the revenues obtained from fees on waste for R&D projects.

[31] "A Survey and Analysis of State Policy Options to Encourage Alternatives to Land Disposal of Hazardous Waste, " National Conference of State Legislatures, July 1981.

Benefits of the Option

To what extent would adoption of government incentives for using alternatives to hazardous waste disposal and dispersal achieve the eight policy goals? An intrinsic merit of this option is that congressional action could be taken in the near future, and implementation could also take place within a few years, with a goal to replace the current system of collecting fees under CERCLA which expires in 1985,

GOAL 1

Improve protection of health and the environment without undue delays and uncertainties.

Major benefits could result from lowering of the probability of releases of hazardous constituents into the environment (assuming adequate regulations and enforcement for treatment alternatives to land disposal). Implementation of this option would not interfere with the existing regulatory program. The main effect would be to shift regulated parties out of the regulatory system when they no longer produce waste, or to shift the type or extent of regulation because generators produced different amounts or types of waste that required different waste management options. It would become preferable to be regulated as a recycling or energy recovery facility, with a minimal reporting requirement, rather than as a disposal facility.

GOAL 2

Expand universe of federally regulated hazardous waste.

This option does not address this goal. Any effects would be indirect and difficult to predict.

GOAL 3

Encourage alternatives to land disposal.

This option's major benefit would be to achieve this goal as much as any public policy

could. However, economic incentives for alternatives to disposal and dispersal should not lead to a relaxation of the current regulatory program. Stringent regulations and effective enforcement would still be required.

GOAL 4

Improve data for risk assessments and RCRA/CERCLA implementation.

A moderate benefit might result, since the fee system could provide motivation for the collection and continued maintenance of complete and reliable data on waste generators.

GOAL 5

Improve and expand RCRA/CERCLA participation by States.

Insofar as the fee system would contribute to funding for both the Federal and State programs, a major benefit relative to this goal could result. The administrative burden placed on the States could be reduced, as less waste and fewer waste generators would be regulated. Although there could be an increase in State activities from the administration of an incentive program, adoption of a Federal fee system could remove the burden of existing State fee systems while providing greater revenues because of a broader range of waste regulated. A recent study of State fee systems, most of which have not been in effect very long, concludes that relatively small sums are being collected, with only 5 States having fees imposed on waste generators, 14 with fees on transporters, 18 with fees on waste management facilities, and 17 with no fees and no desire to implement any.[32] However, another study concluded that only 7 State hazardous waste agencies (out of a total of **18 States** with any type of fee) collect and keep fees, with the others placing the fees collected in State general funds.[33] This points to a potential benefit of a Federal fee system affecting all States that provided funds for operation of State hazardous waste programs.

GOAL 6

Moderate increases in costs to governments for administration and to industry for compliance.

Clearly a waste fee system would impose higher near-term costs on waste generators, although it could contribute to a reduction in future liabilities. Governments would benefit from a source of funding for administering their hazardous waste programs, and from fewer facilities to regulate due to waste reduction, but would incur new costs in administration of the economic incentives program. With incentives, less waste generated, and fewer regulated facilities, long-term regulatory compliance costs in the private sector and governmental costs might decrease (although this is somewhat uncertain). Costs associated with adverse impacts on health and the environment would eventually decrease because of lower waste generation, reduced hazard levels of wastes, and use of management options that could permanently remove risks.

GOAL 7

Reduce risks transferred to the future; reduce costs of management shifted to society in general.

There would be a major benefit associated with decreases in the amount of hazardous waste generated and placed in the environment, as well as in the hazard levels of wastes ultimately disposed in the environment. Greater internalization of costs would result because the waste fee system would transfer the liabilities associated with possible future releases, remediation actions, and possibly compensation to waste generators.

GOAL 8

Reduce public concerns over the siting of facilities.

Because most public concern is focused on problems of land disposal, this option offers a major benefit through its objective of shifting waste management from land disposal. Moreover, greater public attention to alternatives

[32] "A Study of State Fee Systems for Hazardous Waste Management Programs," U.S. EPA, July 1982.

[33] "The State of the States: Management of Environmental Programs in the 1980's," National Governors' Association, June 1982.

would promote better understanding of the differences between land disposal and the various alternatives, and of corresponding differences in type and probability of releases. Moreover, an ensured means of funding State programs could improve public confidence in the effectiveness of such programs.

Costs and Problems for Implementation

Until specific incentive programs are developed, it is impossible to estimate protracted administrative costs, However, the incentives considered above have been chosen because, for the most part, they would not lead to substantial outlays of budgeted Federal funds. Additional funds for EPA to perform analyses and devise a plan during a 2-year period might be about $5 million, * including funds to work with the States to assess their involvement.

It maybe suggested that other nonregulatory approaches to providing incentives for alternatives to land disposal exist and are more effective than a fee system. Two others frequently considered are based on the legal system and on insurance procedures. The essential problem with relying on the legal system concerns uncertainties of the system. Waste managers must perceive a high probability of costly legal damages from release of hazardous constituents. In the absence of such perception, reliance on government enforcement actions or private party suits to return previously externalized costs to waste managers is uncertain. Legal findings and judgments in the procedure also introduce uncertainties. While current environmental statutes may facilitate legal actions, and enforcement efforts may be somewhat effective, there is little evidence to suggest that legal approaches can provide expedient and widespread feedback effects for waste management choices.

RCRA'S financial liability requirements have already increased the use of insurance options. Here too there are considerable uncertainties over whether such distribution and assessment of risks is expedient in affecting management choices. There are very few actuarial data to assist insurance firms in structuring costs, little experience with such claims, and considerable difficulty in making risk assessments of facilities. As with reliance on the legal system, insurance approaches offer more remedial than preventive benefits for hazardous waste release. However, use of the legal and insurance system are necessary and should be viewed (as should the regulations themselves) as complements to a fee system.

There are few concerns over the use of loan guarantees or tax credits, and assistance for R&D efforts, particularly when compared to the more far-reaching use of a Federal fee system. The most frequent argument against the use of economic incentives is that they would require significant administrative efforts. While this is true, increased government resources needed to administer an incentive program, in terms of numbers of workers and skills required, could result in a net advantage, Because of an anticipated reduction in both waste and management facilities requiring regulation, fewer technically skilled personnel would be required.

Opponents of a Federal fee on generated wastes also raise the problem of inadequate capacities for land disposal alternatives, However, there is evidence that available facilities for such alternatives have substantial unused capacities.[34] And if waste is reduced at the source such obstacles are overcome. One of the most critical factors associated with adequate

*The basis for this figure and for the estimated costs for options IV and V is based on OTA'S estimate of the level of effort and typical costs as follows: an average cost of $100,000 per senior professional per year, including $60,000 for compensation, $20,000 for administrative support, and $20,000 for research support. Also, these estimates are consistent with EPA's costs for performing major analytical efforts such as regulatory impact analyses that have had an average value of *$373,000* ("Improved Quality, Adequate Resources, and Consistent Oversight Needed If Regulatory Analysis is to Help Control Costs of Regulations, " GAO, November, 1982.)

[34]For example, in a recent study for EPA of nine major offsite, commercial waste management companies, capacity utilization for incineration decreased from *83* percent in *1980* to *78* percent in 1981, for chemical treatment from 49 to 56 percent, and for resource recovery it remained constant at 24 percent. ("Review of Activities of Major Firms in the Commercial Hazardous Waste Management Industry: 1981 Update, " Booz-Allen & Hamilton, May 7, 1982.]

capacities for alternatives to land disposal involves investments by the waste management services industry or waste generators. Such investments by the private sector to build more facilities are unlikely when bias in the Federal program continues to contribute to lower costs for land disposal options. A Federal fee system could provide (particularly if announced some time before implementation) the necessary certainty for the private sector investment in facilities.

Results concerning the technical and economic feasibility of offering alternatives to land disposal from a California study are encouraging:

1. 75 percent of the hazardous waste disposed of in the most secure landfills could be recycled, treated, or destroyed;
2. most additional waste management capacity needed to recycle, treat, or destroy waste could be developed in less than 2 years; and
3. the additional cost of recycling, treating, or incinerating highly toxic waste would have a minimal effect on industry.[35]

Another California study concludes that new plants would produce half the hazardous waste currently produced by similar activities.[36] This indicates the potential for waste reduction efforts, even in existing plants.

Another ongoing study concerned solely with hazardous waste reduction at the source concluded "estimates of the impact on the toxic waste problem through reduction at source range from 30 to 80 percent—an exciting challenge and opportunity that deserves nationwide attention. "[37]

If a Federal fee system is chosen by Congress, it would most likely replace the current scheme used under CERCLA. While there might be broad public support for this approach, opponents quickly point out that increased fees on waste generators could be burdensome to industry. There is the prospect of reduced profits and failure of marginally successful establishments, unless the added costs of waste management were passed on to the ultimate consumers of the products. However, some evidence exists that additional costs to consumers would be small, as waste management costs probably contribute at most only a small percentage (probably 1 to 3 percent) of the costs of production or of final prices. Even a high fee on land disposal of waste would, therefore, not affect final prices substantially. There is also some evidence that increased costs to consumers related to improved protection of health and the environment would be acceptable. *

Another concern is that a Federal fee system could prompt more illegal dumping of hazardous waste. However, as has already been noted, effective enforcement efforts always remain a necessity. Control of illegal dumping, moreover, is not merely a matter of regulatory enforcement–the issue is effective "policing" efforts, since illegal dumping of hazardous waste is now accepted as constituting criminal behavior.

It has been suggested that it would be possible to rely on the States to adopt such an approach, it is not realistic to believe that all the States will or can do so, or that they will adopt similar programs. In order to achieve consistent and equitable treatment of hazardous waste generators nationally, and to avoid the formation of "pollution havens" in States without such fees, a Federal system is appropriate. The reasoning is essentially the same as that used to first justify the creation of the Federal hazardous waste regulatory system.

However, it may be effective to have the States administer a Federal fee system. States are in the best position to obtain and maintain information on waste generators and their

[35] California Office of Appropriate Technology, "Alternatives to the Land Disposal of Hazardous Wastes: An Assessment for California, " *1981.*

[36] "Future Hazardous Waste Generation in California," Department of Health Services, Oct. 1, 1982.

[37] Joanna D. Underwood, Executive Director, Inform, The *New York Times,* Dec. 27, 1982.

*A recent major opinion survey on public support for environmental legislation found that 60 percent interviewed favor giving priority to environmental cleanup "even if companies have to charge more for their products and services. " (As reported in the Washington Post, Nov. *11, 1982,)*

management practices. It would help offset the States' concerns that they would be required to dismantle their fee systems, at least for federally regulated waste. Some States may find a Federal fee system more acceptable if they were assured a key role in its administration and use of some fee revenues for support of State programs. Having a reliable source of funding for State programs is an important issue. EPA has indicated its desire to reduce or eliminate grants to the States. To compensate for this loss of revenues, EPA is encouraging the use of State fee systems as well as a variety of fiscal approaches for States to obtain the required matching funds for Superfund cleanups. However, the latter, such as sale-leasebacks of State assets, use of State bonds, and lease-purchases, present problems of loss of tax revenues, administrative difficulties, and uncertain gains in funds. *

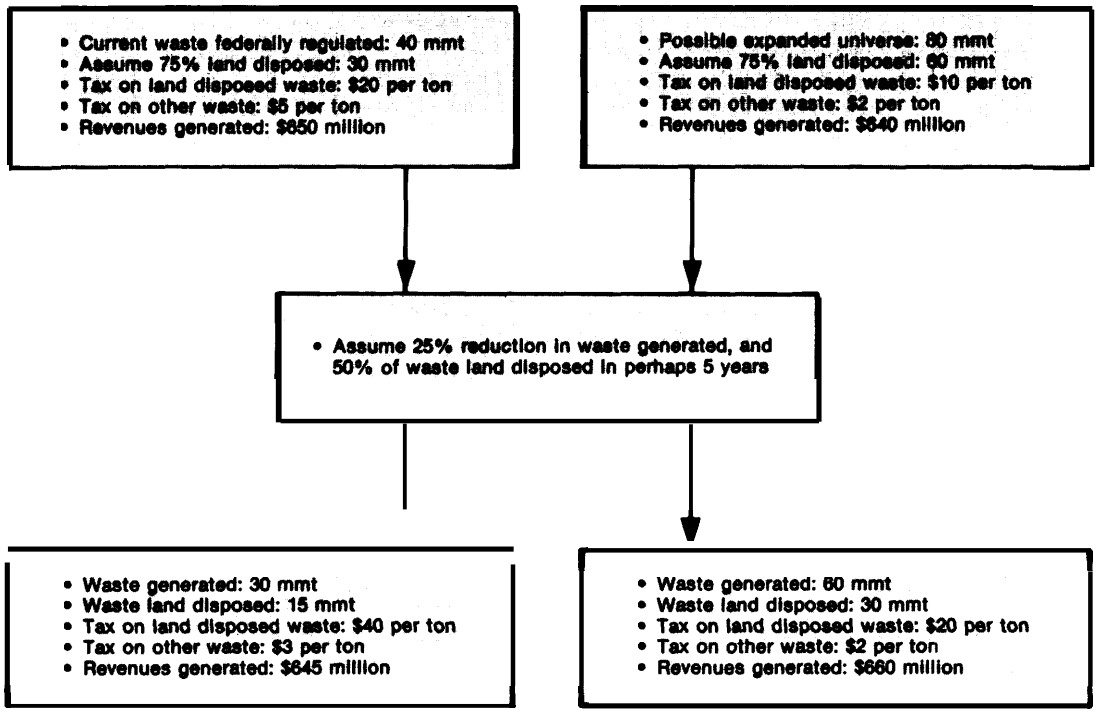
Some may believe that any fee on hazardous waste should be placed on management facilities rather than on waste generators, For onsite waste management there would be no difference, However, for waste managed offsite placing the fee on facility operators may not achieve the intended goal of influencing waste reduction and treatment choices which are or should be made by generators, For example, facility operators may not pass the fee on to waste generators, may vary the amount passed on among generators, or may cut waste management costs (and its effectiveness) to offset fees in order to gain advantage over competitors. For facilities performing a variety of operations (recycling, treatment, and disposal), there may be an incentive to misrepresent the amounts of waste managed in those ways with the highest fees. Finally, with a fee imposed on facilities there may be pressure to levy the fee on the basis of the rates charged (usually a percent) and perhaps only for offsite operations. However, such an approach has the counterproductive effect of making facilities more attractive than they already are because of lower costs resulting from poorer design, operations, or monitoring capabilities. Moreover, there is no reason to remove onsite facilities from the fee system; with the exception of waste transportation, they present the same problems and potential costs to society as offsite facilities and, most importantly, account for most of the hazardous waste managed.

If a waste fee system is used to generate funds used for CERCLA activities, should the entire burden of the past be borne by present waste generators? This same concern applies to the current CERCLA funding mechanism. It can be argued that shifting fees from feedstocks to waste is probably more equitable, since there is no certain link between feedstocks and waste generated or mismanaged. A partial remedy would be to continue present procedures, and to use general Federal funds to contribute to CERCLA costs. Nevertheless, it must be anticipated that those industries generating large amounts of hazardous waste will find a new Federal fee on them objectionable.

A legitimate concern is that a successful fee system would eventually reduce the amount of waste generated, thus requiring increases of fees on remaining waste in order to maintain funds for all the purposes already discussed. This situation might motivate government to unnecessarily bring more waste under regulatory control. On the other hand, waste generators could be more motivated to attempt to have their waste delisted, Another possibility is that generators would concentrate their wastes, lowering fees, but increasing waste hazards, There are no simple solutions to these potential problems. It is unlikely, however, that waste reduction efforts would be so rapid or extensive that the amount of waste generated nationally would fall so low that fees on remaining waste would become unacceptable. Some calculations, based on simplified but realistic assumptions, are shown in figure 3 to illustrate possible fee levels and changes over time, while maintaining total revenues, A fig-

*EPA's study on "Increasing Purchasing Power of State Funds for Hazardous Substance Response, " is expected to be completed in the Spring of 1983. It is concerned with the inability of States to obtain the required matching funds for CERCLA cleanups, In early drafts it is noted that 22 States, accounting for two-thirds of the sites on the National Priority List, have a continuous, reliable method of financing remedial actions. But "the vast majority of these States have raised less than one-fourth of the estimated matching monies needed. "

Figure 3.— Illustration of Changing Federal Waste Fee System Over Time



SOURCE" Office of Technology Assessment

ure of $650 million has been used in this illustration because it approximates what would be required to fund current CERCLA activities, fund State hazardous programs, and provide some limited funds in the victim compensation area. * Over time, the system likely would reach some equilibrium (including reduced manufacture and consumption of products associated with hazardous waste generation), and fees would be reduced because of less administration of the programs and less cleanup of uncontrolled sites.

Lastly, there are potential indirect economic effects that are difficult to predict. There might be a negative effect on the international competitiveness of U.S. exported products because of increased costs brought about by fees. There are ways to minimize or prevent such problems. Provision of capital and R&D assistance to waste generators enables them to reduce waste, and thereby eliminate waste fees. Proposed fee systems should be announced sometime before implementation so that industries could anticipate increases in costs and take appropriate actions in time. Finally, the government should increase efforts in the international community (through, e.g., the Organization of Economic Community Development and the United Nations) aimed at educating foreign governments about the long-term benefits of improved hazardous waste management, although European practices to a large extent already rely more on options other than land disposal. With regard to imports that might achieve some competitive advantage in the domestic market because domestic manufacturers are paying a hazardous waste fee, it has been suggested that (in addition to the remedies noted above) some type of import duty

*"Use of waste generator fee revenues for any victim compensation use raises a number of issues. There is a concern that claims related to personal or property damages could be "unbounded" and that waste fees might be raised continually to generate sufficient funds for this purpose. While there may be a need for provide funds for victim compensation, it is generally understood that it is extremely difficult to prove scientifically the causal link between a hazardous waste condition and some personal or property damage. Thus, there is concern that very large claims could be made on the basis of some type of "no-fault" approach.

or fee equivalent to what domestic manufacturers pay could be levied. However, this could be objected to on the basis that it represents a form of trade protectionism.

In addressing the legitimate concerns of those most affected by imposition of fees, it is important to recall the underlying principle of the fee system: those who are responsible for generating hazardous waste (both generators and consumers) should pay for the proper management of the waste, government activities that may be needed to clean up such wastes, and for the damages to health and the environment that may ultimately result from such waste. Moreover, a fee system that affected consumer prices could lead to a more balanced public perspective of hazardous waste, The demand by the public for generators to apply more stringent and costly controls would be balanced by the need of the public to consider the "hazardous waste-intensiveness" of products. It should also be noted that even treatment alternatives to land disposal pose some risks to both health and the environment and, hence, there is justification for fees on waste so treated. No technology used to manage hazardous waste can guarantee zero release of hazardous constituents (see ch. 5).

Some argue that imposing fees on hazardous waste would cause price distortions in the marketplace, but use of a fee system can be viewed as a remedial policy action required to correct both an economic distortion and an inequity already existing in the marketplace. The market currently shifts risks and costs to people (now and in the future) not directly deriving the benefits from products or services causing the risks and costs. Yet management choices under a fee system could affect the competitiveness, success, and failure of individual firms resulting in distributive or geographic economic effects. The varying abilities of firms to adjust to a fee system requires the need for policymakers to evaluate appropriate community and worker adjustment programs, and to include means to address the capital and R&D problems examined earlier as complements to a waste fee system. By anticipating the need for capital and R&D assistance, it would be possible to minimize adverse economic effects on industry.

Option IV
Development and Potential Use of a Hazard Classification Framework

This option provides for the development and assessment of a hazard classification framework for risk management that if feasible and beneficial, could be introduced into the RCRA regulatory program. The framework would be based on detailed technical criteria establishing several different ranges, or classes, of hazard levels. There would also be a corresponding classification system for facilities to deal with risk management. The waste and facility classification would provide the means to:

1. set priorities, such as determining what areas need to be addressed first in obtaining more accurate and reliable data;
2. establish different levels of monitoring requirements; and
3. establish appropriate levels of regulatory control, including restrictions on certain technologies and facilities, exemptions from full regulatory coverage, and different levels of performance standards for RCRA regulations covering the operation of waste management facilities.

Although using classifications seems to suggest considerable complexity and drastic changes in the regulatory structure, neither is required, What is envisioned is a means to structure the evolving RCRA regulatory program by improving its scientific base, For example, some solid wastes regulated under subtitle D of RCRA would be brought under subtitle C control, but, for almost all these wastes, there would be minimal regulatory requirements (e.g., reporting and notification requirements). Similarly, some low-hazard waste currently under subtitle C might receive less regulation than they now receive, and perhaps some removed from the hazardous category altogether. Some high-hazard waste would receive more stringent regulation. For most haz-

ardous waste, however, the classification approach would have little effect.

Congressional action could be accomplished by amendment to RCRA, by initially directing EPA, or another agency, to develop a waste and facility classification system and a plan for its implementation. Such an analytical effort could take several years and would require additional Federal appropriations of perhaps $5 million to $10 million. * Presumably, no new data would be acquired for this initial study phase (for which health and environment effects data is an expensive undertaking), but rather existing data bases would be used. The second level of congressional action would consist of an evaluation of the study, and a decision: 1) to either move ahead with implementation; 2) to pursue a second, more detailed study, possibly involving the acquisition of new data, followed by integration of the hazard classification framework into the RCRA program; or 3) to discontinue the option, Implementation, or a second study, could take several years, and the costs are difficult to estimate,

In the following discussion, the elements of this option are summarized. The appendix to this chapter contains a detailed discussion of one approach to using waste and facility classification. No attempt has been made by OTA to design an actual classification system; those now available are discussed in chapter 6. Second, the option is evaluated relative to the eight policy goals described earlier. Third, the costs and problems of implementation are discussed.

Brief Summary of a Hazard Classification Framework

The key elements of this particular application of the hazard classification concept are presented in figure z. The approach is compatible with the hierarchy of alternative management strategies presented earlier, particularly with the goal of reducing the amount and hazard level of wastes.

Elements of the Approach.—Several important elements, each requiring reliable information to be obtained by the Federal program, form the basis of this scheme. Some of the information may be currently available in varying degrees of completeness and accuracy. The collection of other necessary data may require substantial effort. There are three elements of the system:

1. The critical characteristics of those constituents of the waste that largely determine its hazard classification.— Classifying waste is a major undertaking that requires a careful analytical framework and substantial amounts of information on a very broad variety of factors, including: concentrations of hazardous constituents, toxicities, their mobility through various environmental media, environmental persistence or bioaccumulation, and various safety characteristics, It is not sufficient to merely use information on the most hazardous constituent, or the one present in the largest amount, to fully assess a particular waste, There is currently no standard procedure to describe the hazard level for a physically and chemically complex waste, although there are indications that it is technically feasible to develop one (see ch. 6).
2. Consideration of those factors used to determine facility classes.—
   a. The chemical and physical characteristics of the waste that limit treatment and disposal options. This information would indicate whether the waste is aqueous or nonaqueous, inorganic or organic, and whether it is a liquid, sludge, or bulk waste with a high solid content. It also would be necessary to know if the waste contains toxic metals, known toxic organics, corrosive acids, explosives, or highly ignitable substances.
   b. Information on the broad range of technology options that are commercially available and technically feasible. Considerable information is needed on the designs of technologies, actual performance characteristics, problems related to operation and maintenance, and requirements for

● The total EPA fiscal year 1983 R&D budget related to hazardous waste is about $3o million. Thus, $10 million over 3 years would amount to 11 percent of EPA's hazardous waste R&D budget.

trained personnel. Problems related to patented and proprietary information may have to be addressed.

c, Performance standards for various technology options, used for setting the level of effectiveness (risk reduction) of the technology, or the level of acceptable release of hazardous constituents from the facility. For waste treatment operations, performance standards may be given in terms of changes to be effected in various critical characteristics of the waste. After incineration, for example, the percent of one or more waste constituents destroyed, perhaps in conjunction with acceptable levels of emissions, can be used. (This is similar to what is used now,) It is important that waste classification and its linkage to facility class be technically sound in order to avoid "technology forcing" when, in fact, available technology can achieve desired levels of protection. For disposal operations, performance standards may be given in terms of acceptable levels of release over specified periods of time. Standards would vary with levels of hazard.

In general, different types of performance standards will be required for different technologies and may be required for different levels of hazard. Selection of performance standards depend on the regulatory functions that are deemed most important. What is attractive from the perspective of ease of enforcement or compliance may not be as attractive to those concerned with risk management.

3. Matching of waste and facility classes. —This is the key step—ensuring that levels of risk are consistent across both waste and facility classes. For a particular waste class, different technologies within the same facility class should offer similar risks.

How Classification Differs From Other Approaches.– The framework described involves no new concepts. Rather, it integrates known facts and principles into a framework for government management and regulation of hazardous waste. The phrase "degree of hazard" does not necessarily imply the use of hazard classification. In this classification approach, common characteristics are assigned values and are used to group wastes and facilities so that those within a group have similar characteristic levels of hazard and control. Neither does such an approach imply the use of fixed, rigid categories. New information or changes in policy can affect the definition of new criteria, redefining the classes in the system.

It must be emphasized that all suggested uses of hazard classification assume that only **a few** classes would be required and are practical. Usually envisioned are high, medium, low, and no hazard (essentially a decision to consider the waste as an ordinary solid waste) waste classes and with corresponding facility classes. Therefore, the classification approach is more a "coarse tuning" than a "fine tuning" that may be achieved through risk assessments of individual wastes and facilities. Compared to the broad range of variations possible with current permitting decisions (for land disposal options, rather than for treatment facilities), the classification approach offers permit writers a fixed number of federally determined classes for wastes and facilities. It is possible, however, to integrate technology and site-specific factors into the use of systems based on hazard classification. A permit writer could change the classification of a waste and, consequently, the level of regulatory control required for a facility, because of technology and site-specific factors that lead to risk reductions, A facility might utilize some type of pretreatment of the waste that reduces the performance standard required to achieve acceptable levels of releases. Or the facility may be in a location in which any releases would be so dispersed prior to any exposure to a vulnerable receptor that a lower performance standard would be acceptable. Such options are limited by the number of hazard classes available and the corresponding regulatory requirements, including performance standards, monitoring requirements, and criteria for acceptable sites.

Furthermore, the classification approach, in contrast to the current program in which most wastes are considered equally with respect to regulatory requirements, implies that better defined and substantiated technical criteria and standards are required—a set for each hazard class. This is necessary in order to link the level of regulatory control (facility class) with distinct hazard class.

The waste and facility classification approach differs somewhat from risk assessment approaches which estimate probabilities and levels of potential harm. Although there is no standard type of risk assessment, it appears that in most likely applications, the emphasis would be on the determination of numerical levels of risks for adverse effects on health and the environment. Risk assessments usually require substantial information concerning actual situations, or at least such a focus, including how particular people or components of the environment will respond to specific types and levels of exposure. However, it is also possible to carry out risk assessments for generic categories of wastes, locations, and technologies (see ch, 6 for a discussion of risk assessment and ch. 7 for a discussion of EPA's Risk/Cost Policy model which employs this approach). Classification systems rely more on general scientific and technical information in the determination of potential and generic adverse effects for defined classes of wastes and facilities.

Classification may also be contrasted with more qualitative approaches that simply may list waste as having different degrees of hazard, without presenting clear, detailed criteria for determining such differences. The listing approach (which is used in the current program) provides little guidance for dealing with emergent future questions; it is largely ad hoc in nature. Classification approaches, on the other hand, provide consistent, yet flexible, procedures capable of dealing with new situations. While a classification approach requires greater initial investment of resources as compared to alternative approaches, it may offer more long-term benefits once developed.

Illustration of the Classification Approach.—Two types of questions are usually raised concerning the hazard classification approach. What types of data are used to distinguish different waste hazard classes? What are the regulatory implications of establishing different waste hazard classes? Table 12 provides examples of how the classification approach can be developed and used, but it is emphasized that the examples shown are strictly for illustrative purposes only and do not constitute any endorsement or recommendation by OTA,

Benefits of the Option

Benefits of the hazard classification approach are described below in terms of how eventual implementation of a suitably examined system might satisfy the eight goals for all policy options. A problem with this option is that a number of years are required for both analysis and implementation. Therefore, estimation of potential benefits tends to be more speculative, and there are greater uncertainties because of what might take place before the option is fully implemented.

GOAL 1

Improve protection of health and the environment without undue delays and uncertainties.

There are major uncertainties as to when a classification system might be implemented, and what would be included in such a system. Because the current program is moving in the direction of using hazard levels to establish regulatory coverage and stringency, this option can be viewed as a means of systematizing a program that is evolving in a somewhat ad hoc manner. Once a simple classification system is developed and applied, it may offer the benefit of reduced delays and uncertainties because of the availability of technical criteria and procedures which can be used to deal with new situations. The validity and usefulness of the hazard classification approach from a waste management perspective has been summed up as follows:

> One school holds that, if it is hazardous by definition of the regulation, then it should go

Table 12.—Illustrative Examples of a Potential Hazard Classification Framework[a]

Examples of scientific criteria for waste definition[b]	Examples of varying levels of regulatory control, and restrictions on waste management practices[c]
High hazard	
1) Acute toxicity:	
Oral rat LD_{50} < 5 mg/kg	Limited to Class I facilities; cannot be placed in surface impoundments, landfills, injection wells, land farms
Aquatic LC_{50} < 1 mg/kg	
2) Chronic toxicity:	No monitoring exemptions
Equivalent concentration of persistent compounds > 1.0%	Incineration DRE > 99.99; can only be burned in industrial boilers
	Cannot be stored more than 30 days without permit
Toxic metals 100 to 10,000 × DWS	No exemptions for small generators
Suspected bioaccumulative carcinogens	Recycling facilities to be permitted
Medium hazard	
1) Acute toxicity:	Limited to Class I and II facilities; cannot be disposed above or within 5 miles of a ground water aquifer
Oral rate LD_{50} 5 to 500 mg/kg	
Aquatic LC_{50} 1 to 100 mg/kg	Incineration DRE > 99.9; cannot be burned in residential boilers
2) Chronic toxicity:	Can be stored up to 90 days without permit
Equivalent concentration of persistent compounds 0.01-1.0%	Small generators exempted up to 10 kg/month
	Recycling facilities permitted
Toxic metals 100 × DWS	
Suspected nonbioaccumulated carcinogens	
3) Corrosive, reactive, ignitable	
Low hazard	
1) Acute toxicity:	Limited to Class III facilities, and to Class I and II facilities for which no reactions with wastes are likely
Oral rat LD_{50} > 500 mg/kg	
Aquatic LC_{50} > 100 mg/kg	Incineration DRE > 99.0; can be burned in industrial and residential boilers
2) Chronic toxicity:	
Equivalent concentration of persistent compounds < 0.01%	Can be stored up to 180 days without permit
	Small generators exempted up to 100 kg/month
Toxic metals 100 × DWS	Only reporting requirement for recycled waste and recycling facilities
3) Corrosive, reactive, ignitable	

DWS—drinking water standards
[a]The examples shown are strictly for illustrative purposes only, and do not constitute any endorsement or recommendation by OTA.
[b]Source Adapted from system In Washington, See discussion in ch 6
[c]Source Off Ice of Technology Assessment

only to a permitted hazardous waste management facility. Another school argues that there are degrees. Therefore, different types of hazardous wastes should go to different types of facilities. I happen to believe that the last argument makes a great deal of sense. This implies that we should have different classes of disposal facilities for different classes of hazardous wastes .38

GOAL 2

Expand the kinds of federally regulated hazardous waste.

This could be a major benefit. One of the primary objectives of classification is to equitably and appropriately regulate waste posing different types and levels of hazard, There could be less resistance to bringing currently exempted waste under regulation if the regulatory structure accommodates low-hazard waste at a lower level of stringency.

GOAL 3

Encourage alternatives to land disposal.

A major benefit could result from regulatory restrictions and controls better matched to varying threats. Such restrictions could limit the use of land disposal to low-hazard waste or to waste that cannot be handled in any other way. A clear and consistent framework could also contribute to greater certainty with, regard to markets for various management alternatives, and could make capital investments in new alternative facilities more attractive.

GOAL 4

Improve data for risk assessments and RCRA/ CERCLA implementation.

[38]H. Lanier Hickman, "Too Much or Too Little, " *Waste* Age, November 1982,

A major benefit is likely, if hazard classification leads to determination of better priorities for data needs, particularly concerning health and environmental effects. A Federal classification system would also provide the impetus for establishing a national data base for hazardous waste.

GOAL 5

Improve and expand RCRA/CERCLA participation by states.

A modest benefit might be obtained. Several States have attempted to use hazard classification approaches (see ch. 6), but progress has been slow. The attempts have been simple systems, for the most part, limited both by data and resources. More generally, many States have expressed their desire to see the degree of hazard concept used systematically in RCRA regulations. Other States are likely to have legitimate concerns over the adoption of a classification system that added, rather than reduced, regulatory complexity. How "practical" it is to use the classification approach could only be resolved by a thorough study in the initial phase of this option. Eventually, the option could lead to the provision of additional technical support and an improved data base for the States.

GOAL 6

Moderate increases in the costs of governments for administration and of industry for regulatory compliance.

Governmental costs might increase or decrease, depending on the extent the classification approach created institutional efficiencies, rather than technical complexities. Another uncertainty is whether the approach might lead to substantial efforts to "reclassify" waste and facilities, analogous to, and perhaps more extensive than, current delisting efforts. Compliance costs for industry would be company-specific. While many of today's management practices might be unaffected, currently underregulated waste would be regulated more stringently, while others currently overregulated would be regulated less stringently. However, long-term costs associated with health and environmental damage, remediation efforts, and compensation could be reduced because of the greater protection against harmful release of waste.

GOAL 7

Reduce risks transferred to the future; reduce costs of waste management shifted to society in general.

To the extent that this option would reduce underregulation and total exemptions of waste, and would better ensure that land disposal would be used for waste and locations for which future hazardous release were unlikely, it would offer a major benefit by reducing the probability of future release of hazardous constituents.

GOAL 8

Reduce public concerns over the siting of facilities.

A modest benefit might result if public confidence in the Federal program is improved with the perception of a more comprehensive regulatory system and a correction of underregulation of waste. The option would create a Federal role in the broad area of siting facilities by providing a mechanism for linking facility location to the hazard level of waste, the type of technology employed, and the performance standards required of the facility. However, it would not necessarily change the present situation, with the States having the primary responsibility for land use and the siting of specific facilities. There would be continued public participation in siting and permitting of facilities. The emphasis on appropriate types and levels of monitoring for facilities would also have a positive effect on public concerns.

Costs and Problems for Implementation

The major cost and problems associated with implementation of the hazard classification approach is the need to obtain an adequate data base concerning wastes, technologies, and health and environmental effects. However, there is continuing improvement of these types of data. Adoption of classifications would

greatly assist in integrating available information, and in determining priorities for obtaining new data. A major objection to the approach in the regulated community might be the perceived lack of flexibility. Another legitimate concern would be that a waste with a high-hazard classification could, in a particular situation, present less of a risk than that indicated by the hazard classification. This objection could be dealt with by providing a technically sound basis for classifying facilities, and for linking facility class to waste hazard class.

Nonetheless, the classification approach does *imply* setting different, or more, standards and criteria than are employed currently. This is the primary tradeoff in comparison to an apparently simpler system that does not emphasize setting different levels of regulation control with respect to level of hazard. The complexity of the current system is "hidden" in both listing procedures that are largely ad hoc in nature, and in permitting procedures which contain considerable uncertainties because of the critical role of individual permit writers.

OTA estimates that designing a waste and facility classification system and assembling existing data on health and environmental effects, and on technological capabilities, might require $10 million over a 5-year period. One reason for this relatively small estimate is that considerable data exist, but have not been collected and organized sufficiently for the purposes of hazard classification. During this phase, there should be substantial interaction between EPA and the States.

After consensus among EPA, the States, industry, the public, and Congress with regard to the system, the second phase could take several years. Its costs are difficult to estimate, but they could be substantial. It is possible that the detailed analyses might reveal that the complexities of the system would be overwhelming, either intrinsically or because of the impossibility of reaching a consensus between the regulated community and the regulators on specifics of classification, OTA considers that an attempt to design a technically "perfect" system will lead to paralyzing difficulties, and that the task is to simplify the design without introducing a level of arbitrariness that will be unacceptable to the regulated community.

To address these concerns, it would be fruitful for the initial study to examine:

1. alternatives for translating waste hazard and facility classification into effects on regulatory control levels;
2. means to set and change boundaries that define waste and facility classes; and
3. means to arbitrate disputes concerning wastes and facilities close to class boundaries.

Option V
Planning for Greater Integration of Environmental Protection Programs

The purpose of this option is to integrate administratively (and, if necessary, statutorily) a number of existing environmental programs that affect hazardous waste management and regulation. Policies and programs that lead to inefficient overlapping regulations, gaps in regulatory coverage, and inconsistent regulations would be addressed. Insufficient integration among different programs within EPA and other executive agencies may be leading to duplication of effort or unawareness of the extent of data and technical resources available.

A number of hazardous waste activities are now regulated under different statutes. Within EPA alone several different groups administer activities related to hazardous waste. There are also programs in several other executive agencies related to hazardous waste that do not appear to be highly integrated, The language in RCRA that mandates integration with other acts has proven too inexact, and EPA's efforts in this area do not appear to have a high priority. Ocean disposal or dispersal falls under the Marine Protection, Research, and Sanctuaries Act. Some injection wells used for waste disposal fall under the Safe Drinking Water Act and some under RCRA. Hazardous waste streams destined for municipal water treat-

ment plants fall under CWA. A number of aspects of regulating releases into the air or water from management facilities fall under the Clean Air and Clean Water Acts, Some wastes are regulated under the Toxic Substances Control Act (TSCA). A recent study for EPA concluded:

> A number of Federal statutes govern aspects of the hazardous waste problem. The statutes in combination do not cover many of the major sources and types of hazardous waste releases, however.[39]

Congressional action for this option would consist, first, of mandating a comprehensive study of integration by EPA or some other agency, including formulation of an integration plan. The second phase would consist of congressional examination of the study and plan. If deemed necessary, legislative action would then implement the plan.

The existence of overlapping jurisdiction to regulate hazardous waste activities is not necessarily counterproductive, confusing, or undesirable. The goal should be twofold: 1) ensuring that waste that might pose risks to health and the environment do not escape regulation, ' and z) promoting the integration of hazardous waste control and other pollution control with legislation so that they can support each other, consistent with the statutory requirements and goals of each program.** There is now no mechanism for ensuring that facilities disposing of similar waste but regulated under different acts will be consistently regulated, or that a facility permitted under RCRA is not also disposing of other hazardous waste without a permit that are regulated under other acts. *

Although both RCRA and CERCLA are managed within the same division of EPA, there appears to be little coordination of efforts between the two programs. The following three examples illustrate additional problems associated with inadequate integration in the current Federal program. In the first two examples, the problem stems, in large part, from the original congressional acts. In the third example, dealing with interagency cooperation, the problem stems from poor administrative procedures.

Three Examples of Inadequate Integration

Regulation of PCBS under TSCA and RCRA.–Ten days before passage of RCRA, Congress enacted TSCA imposing requirements on the disposal of polychlorinated biphenyls (PCBS). A recent study of the problems associated with having two regulatory programs covering a class of hazardous waste noted that "EPA, of course, is well aware that it has been administering two closely related regulatory programs (out of different offices within the agency), but the agency has made little effort to integrate them. "[40] The disposal rules for PCBS under TSCA relate to concentration but RCRA regulations do not. TSCA regulations have established a separate permitting system for approved incinerators and landfills for disposal of PCBS, Relatively few hazardous waste facilities have received permits for such disposal of PCBS. Some RCRA-permitted facilities may have the technological capabilities required under TSCA to manage PC; BS. The same study notes:

"'Evaluation of Market and Legal Mechanisms for Promoting Control of Hazardous Wastes" (draft), Industrial Economics, Inc., September 1982.

*A particularly important example is the problem of hazardous release into the air that may not now be receiving adequate regulation. Such releases, for the most part, are not now regulated under the Clean Air Act. With regard to hazardous air pollutants, in the past 12 years EPA has listed only seven substances, promulgated final regulations for four, proposed regulations for one, and is involved in litigation to compel it to regulate the other two. EPA has noted "If the objective is to secure control of hazardous air emissions that pose a significant danger to public health, the current statutory framework needs change. The current regulatory scheme . . . fails to provide criteria for the necessary tough technical and scientific decisions. " Issue Papers prepared by EPA for Sept. 20, 1982, meeting between the EPA Administrator and representatives from the National Governors' Association, released by Lewis S. W. Crampton.

"*An important example is the intended use of TSCA to stop the production of new chemicals that would lead to hazardous waste too difficult to manage, and to provide an early warning of new types of hazardous waste to the RCRA program so that they can be regulated. At present, there is no indication that TSCA is serving these functions.

*Another discrepancy among the several environmental programs is the duration of facility permits; for example, RCRA permits currently are valid for 10 years, while a 5-year period exists for permits issued under CWA, although EPA has indicated its intention to change the latter to 10 years.

'Mitchell H. Bernstein, "PCB'S vs. RCRA Hazardous Wastes—Separate Regulatory Regimes, " Tle *Environmental Forum,* November 1982, pp. 7-11, 36.

> Under the present bifurcated system of review, however, those facilities will also have to go through a separate approval process in order to accept PCB'S for disposal—a burden which may well operate as a major disincentive for the expansion of the PCB disposal market.

Another difference between TSCA and RCRA is that, under TSCA, States and local governments are less capable of enacting their own more stringent requirements for disposal of PCBS, From the perspective of waste generators, TSCA presents the problem of environmental engineers and managers in industry being forced to track two different programs within EPA. And, from the perspective of Government efficiency, within EPA there are two programs dealing with a very similar area of regulation, but headed by different assistant administrators, staffed by different technical experts and legal advisors, and making different administrative interpretations.

Liability Insurance Rules Under RCRA and CERCLA. —RCRA directs EPA to set standards for financial responsibility of treatment, storage, and disposal facilities (TSDFS). Under current rules, insurance coverage or self-insurance is required only until closure of a facility. The current requirement is for $1 million sudden occurrence minimum/$2 million annual aggregate, and $3 million/$6 million nonsudden minimum coverage. A recent study observes that:

> the minimum insurance requirements set by" EPA for TSDFS appear inconsistent with other hazardous substance legislation which Congress intended to complement RCRA. CERCLA or Superfund required liability insurance or self-insurance of at least $5 million for vessels carrying hazardous substances. It is unclear why much less coverage is required for hazardous waste TSDFS that may handle large volumes of waste and may be in or near densely populated areas.[41]

A second area of concern is the apparent gap in insurance regulations for closed hazardous waste facilities. Under RCRA the coverage for facilities is required until closure. For some types of facilities, particularly landfills and impoundments where wastes remain after closure, the risks may become greater after closure than during operation of the facilities. Under CERCLA there is the Post-Closure Liability Trust Fund, derived from a tax on hazardous waste remaining at facilities after closure (beginning in September 1983). Most importantly, this fund accepts full liability for the site 5 years after a disposal facility is closed in accordance with the regulations. However, if release of hazardous substances into the environment occur within the 5-year period, CERCLA does not assume liability. A gap in government-assured protection for potential impacts from release of waste, therefore, can result in two ways: 1) the 5-year gap created by RCRA and CERCLA regulations, and 2) possibly an indefinite period of noncoverage if a site is found to be leaking before the CERCLA fund assumes responsibility. Because RCRA regulations for land disposal facilities cannot guarantee indefinite, long-term protection against releases of hazardous materials into the environment (see ch. 5) these gaps in financial responsibility requirements should be addressed.

Cooperation Between EPA and the U.S. Geological Survey (USGS) .—One of the greatest concerns is that land disposal of hazardous waste can result in contamination of ground water supplies. Much of the focus of EPA's land disposal regulations is on ground water protection. The technical complexities of ground water contamination, including its detection, monitoring, and remediation, pose substantial problems. Technical expertise in this area is very limited, and data are incomplete. However, the USGS has had a Toxic Waste-Ground Water Contamination program for some time that could have contributed substantially to RCRA and CERCLA regulatory efforts.

After EPA promulgated its land disposal regulations, USGS noted:

> present technology is not adequate to develop regulations to protect the public from hazardous waste contamination in a cost effective manner. Major technical questions are yet to be answered regarding the behavior of specific wastes under different hydrogeologic condi-

[41] Eric Nagle, "RCRA Liability Insurance Rules—Evolution and Unresolved Issues, " *The Environmental Forum,* November 1982, pp. 16-20.

tions and on the safety, suitability, and economics of restoration and disposal methods.[42]

The expertise, experience, and data possessed by USGS could serve as a greater resource for EPA's hazardous waste activities. It would be inefficient for EPA's Office of Research and Development to duplicate USGS's efforts. USGS has a number of ongoing programs that can serve the needs of both EPA and the States in implementing RCRA and CERCLA. Studies on the behavior of contaminants in ground water aimed at improving disposal methods, appraisals of existing ground water quality, and identification of areas suitable for hazardous waste disposal are some. The last effort offers a particularly attractive opportunity with regard to facility siting. USGS could pursue a program to produce a national locations map with hydrogeologic characteristics, minimizing the risks of contamination from hazardous waste facilities.

Two Steps Toward Integration of Environmental Programs

There are two phases to this option, and both should anticipate the need for effective public participation in order to address concerns over changes that might lead to delays. First, EPA (or perhaps some independent body) could develop a plan for the improved integration of programs related to hazardous waste. The plan would also focus on statutory changes required to implement a comprehensive integration, with emphasis on the permitting of facilities. * The study also should examine obstacles to integration which occur at the State level, the costs of integration at Federal and State levels, probable improvements in protection of human health and the environment, and impacts on waste generators.

The second phase would include congressional examination of the study and plan, and an examination of how administrative and statutory changes could be achieved. Congress could also examine changes in EPA organization that would be necessary to integrate, and if such integration would require legislation.

"'Management Information Plan FY 1984," Toxic Waste-Ground-Water Contamination Program, USGS, Sept. 27, 1982.

*These statutory changes need not–and probably would **not**—involve integrating the various environmental laws themselves.

GOAL 1

Improve protection of health and the environment without undue delays and uncertainties.

The closing of gaps in coverage and greater consistency among regulatory programs could provide major benefits, without interrupting ongoing environmental protection efforts,

GOAL 2

Expand the kinds of federally regulated hazardous waste.

A minor benefit could result from closing of gaps in regulatory coverage.

GOAL 3

Encourage alternatives to land disposal.

This option does not address this goal in a significant way.

GOAL 4

Improve data for risk assessments and RCRA/CERCLA implementation.

A minor benefit could result, chiefly by better ensuring that data obtained in one program are made available to other programs.

GOAL 5

Improve and expand RCRA/CERCLA participation by the States.

A moderate benefit could result if integration resulted in improved administration of hazardous waste programs and improving the technical support of State programs.

GOAL 6

Moderate increases in the costs of governments for administration and of industry for regulatory compliance.

Compliance costs for waste generators might increase due to greater regulatory coverage, but integration would reduce future costs for both industry and government. There would be fewer government groups to deal with, simplified permitting, and simplified monitoring of facilities. Similarly, government costs of administering the regulatory program might be reduced by greater use of multipurpose data bases, reduced paperwork, and fewer field personnel. Even if direct costs were increased due to increased regulatory activities, there could be long-term reductions in the costs associated with adverse health and environmental effects.

GOAL 7

Reduce risks transferred to the future; reduce costs of waste management shifted to society in general.

To the extent that gaps in regulatory coverge would be closed, and significant hazards controlled, this option could reduce future risks substantially. At present, some hazardous wastes are certain to find their way to the lowest cost option—which may exist, in part, because of loopholes in the regulatory structure. Although such loopholes are often closed at some point, their use over time can present serious threats to future generations because conditions are created that eventually lead to high probabilities of releases of hazardous constituents. The option does not address the externalization of costs significantly.

GOAL 8

Reduce public concerns over the siting of facilities.

A substantial benefit might result if the public views the study and implementation of integration activities as a move to make government programs more effective and efficient. On the other hand, a major reorganization could also raise public concerns. Such concerns could be reduced by meaningful public involvement during the study for integration, and this participation could be ensured by including such a requirement in the congressional mandate for the study,

Costs and Problems With Implementation

Serious objections to this option are likely, There may be fears that such an ambitious goal is simply impractical and that it could cause delays in ongoing activities. If the initial study is thorough and with sufficient resources, these objections may be minimized, A detailed study over a 3-year period with funding of perhaps $5 million might be sufficient. * Having an independent organization, rather than EPA, to conduct the study may offer the advantage of greater objectivity and impartiality.

It would also be necessary to clearly establish that no new regulatory program would be instituted until after extensive congressional examination of the proposed plan, over perhaps a 2-year period, with ample opportunities for public comment. Problems could arise in the form of conflicts among congressional committees concerning changes in jurisdiction proposed in the integration plan. There might also be opposition to integration for hazardous waste from those with interests in other environmental areas.

Integration from the limited perspective of hazardous waste management may be in conflict with attempts to integrate all environmental protection programs. For example, EPA is now conducting a pilot study to control toxic pollutants from all sources in the Philadelphia area. This study is part of EPA's integrated environmental management program which attempts to weigh risks across air, water, and land media. However, as this OTA study has found, there are inadequate data to support such detailed risk assessments. Moveover, the integrated approach could easily tradeoff any protection from hazardous waste because of limited funding and substantial risks from other sources of pollution. There have also been attempts to develop consolidated permits for facilities regulated under several acts,

*Several current major EPA studies, such as its risk/cost model and its study of small generator exemption, cost about $1 million to $2 million for several years of work.

Summary Comparison of the Five Policy Options

This comparison presents the relative benefits of all five options in a convenient form and is intended to facilitate the comparison of the five options apart from the consideration of costs and time involved. Options II through V can be viewed as a series of complementary actions, taken progressively over time, or as separate individual actions offering particular benefits relative to one or more of the eight goals. Moreover, while option I (status quo) and option II (modifications in A) are mutually exclusive, options III, IV, and V are compatible with option I. Options II through IV appear to require approximately the same level of initial appropriations, about $5 million to $10 million each. There are, however, no means of reliably estimating longer term costs, or cost savings for government, industry, or the general public. The five options have been presented in order of increasing time required for preliminary studies and implementation. If immediacy of implementation is an important consideration for some policy makers, then clearly options I, II, and III are the most attractive,

The policy options have been compared in two ways. In neither comparison, however, has any attempt been made to demonstrate that any one option is "best," or even that one option is better than another. In addition to the eight goals, considerations of time and cost, along with specific objections to particular options, can make any option either more or less attractive.

Table 13 summarizes in brief narrative form the key advantages and disadvantages of each option. Table 14 presents an evaluation of how each option, relative to the others, satisfies each of the eight goals. This evaluation is necessarily somewhat subjective and judgmental.

Table 13.—Key Advantages and Disadvantages of the Five Policy Options

Key advantages	Key disadvantages
L Continue current program	
• Current program stabilized and resources already invested utilized	• Protection of public health and environment may be weaker than possible and desirable
• Participation by States improved	• Risks and costs may be unnecessarily transferred to the future
• Short-term private and public sector costs moderated	• Land disposal continues to be used extensively
IL A more comprehensive and nationally consistent RCRA program	
• Protection of health and environment i m proved and made more consistent nationally	• Short-term private and public sector costs increased
• More hazardous waste controlled	. Progress of present program could be slowed u n less additional resources are provided
. Data base improved	Ž Technical resources and data may be insufficient
//L ***Economic incentives for alternatives to land disposal***	
• More waste reduction and treatment	• Near-term costs to industry increased
• Costs for improved protection more equitably distributed	• Uncertain effects on firms, communities, and international competitiveness
• Public concerns over siting alleviated	. Il legal dumping may increase
IV. Development and potential use of a hazard classification framework	
• More waste regulated at levels consistent with hazards posed	• Major effort needed to i m prove data base
• Fewer risks and less costs transferred to the future	• Unnecessary complexity may be introduced
• Improved technical support for State programs	• Long-term costs for implementaiton uncertain
V. ***Planning for greater integration of programs***	
• **Gaps,** overlaps, and inconsistencies i n regulatory coverage reduced	• Considerable administrative and institutional difficulties
• Reduced transfer of risks and costs to the future	. Possible interruptions in ongoing programs
• Public confidence in Federal program improved	• Congressional action on necessary legislative changes may be complex

SOURCE: Office of Technology Assessment

Table 14.—Comparative Ranking of Policy Options for Each Policy Goal

Goals	Most effective				Least effectlve[a]
1, Improve protection of human health and the environment without undue delays and uncertainties	II	III	I	Iv	v
2. Expand universe of federally regulated hazardous waste	II	Iv	v	I	III
3. Encourage alternatives to land disposal	III	Iv	II	I	v
4. Improve data for risk assessment and RCRA/CERCLA implementation	II	Iv	I	v	III
5. Improve and expand RCRA/CERCLA participation by States	III	II	I	Iv	v
6. Moderate Increases in costs to governments for administration and industry for compliance	I	Iv	v	II	III
7. Reduce risks and costs transferred to the future; reduce costs of management shifted to society in general	III	II	Iv	v	I
8. Reduce public concerns over siting facilities	III	II	v	Iv	I

Policy options
I Continuation of current program
II A more comprehensive and nationally consistent RCRA program
III Economic incentives for alternatives to land disposal
IV Development and potential use of a hazard class classification framework
V Planning for greater Integration of environmental protection programs
[a]Least effective does not imply total lack of effectiveness all rankings are strictly for ordering options and do not imply any absolute level of effectiveness

SOURCE Off Ice of Technology Assessment

In presenting the five policy options, OTA is aware of the need to justify additional Federal expenditures and possible increases in short-term costs to the private sector. Current public and private sector costs for hazardous waste management are substantial, approximately $4 billion to $5 billion annually. Regardless of any policy action, these costs will increase markedly in the future as both the RCRA and CERCLA programs become more fully implemented and possibly as the expected economic recovery leads to an upturn in hazardous waste generation.

The total appropriated funds for options II through V might be **$50** million. This represents about **25** percent of one year's total Federal and State expenditures for hazardous waste activities. It also represents about 1 percent of the current total public and private sector annual costs of administering and complying with RCRA and CERCLA,

There are considerable uncertainties concerning long-term costs to public and private sectors for implementing options II through V. Nonetheless, there is reason to believe that both the short- and long-term costs of carrying out all four policy options may be more than offset by the potential benefits, only some of which can be viewed in strictly economic terms, The chief areas of potential cost savings are: reductions in the number of hazardous waste sites requiring very expensive cleanup and reductions in damages to people and to the environment which entail substantial costs for treatment, remediation, and compensation. Relatively small percentage savings imply substantial absolute dollar savings. For example, if all four options led to a net savings of only 1 percent in the future annual national costs associated with hazardous waste (currently about $4 billion to $5 billion and rising), the savings in 1 year would exceed the initial costs of implementing the options. It is possible that in the long term, implementation of the options could lead to considerably greater economic benefits.

Four Scenarios

As discussed in the previous section, it is possible to implement various combinations of the five policy options. The purpose of the following discussion is to illustrate four such combinations. The scenarios have been developed by making certain simplified assumptions about varying perspectives on the need and methods for improving the current Federal program.

SCENARIO I

Current RCRA regulations are adequate, but alternatives to land disposal need encouragement. Options I and III are adopted.

Many believe that the current RCRA regulations are satisfactory and should be given an opportunity to prove themselves effective, Changes in the regulatory program, they argued, are unnecessary and counterproductive to the extensive efforts made since the passage of RCRA. Nonetheless, it is also generally recognized that from a long-term perspective, unnecessary risks and costs may be transferred to the future by disposing of many hazardous wastes in the land. There is equal concern that congressional action in this critical period of development should be expeditious and well defined.

Accordingly, this scenario consists of adopting option I (maintaining the current RCRA regulatory program) and also adopting option III (providing direct economic incentives for alternatives to land disposal). Option III is compatible with option I, since it involves nonregulatory "market" methods of reducing future releases of hazardous constituents. Option III consists of three critical components:

1. a system of fees or taxes on waste generators (to replace the current funding mechanism for CERCLA) based on quantity of waste, level of hazard, and management practices, in order to promote choices of alternatives to land disposal;
2. methods for meeting the capital needs of waste generators and commercial facilities that are initially required in efforts to reduce waste generation and to implement treatments reducing hazard or volume levels; and
3. support for R&D efforts that may be necessary before waste and hazard reduction can be accomplished commercially.

SCENARIO II

Specific changes are needed to strengthen RCRA, and an effort is needed to integrate and streamline the entire Federal hazardous waste program which has evolved in a piecemeal fashion. Options II and V are adopted,

The choice of option II is based on the desire to improve the existing RCRA regulatory program. The specific actions included in option II would close a number of existing gaps in regulatory coverage of waste, restrict certain waste from land disposal facilities, introduce more technical criteria to set nationwide standards, improve the delisting process, and would introduce limited class permitting. However, to address broader concerns over gaps, overlaps, and inconsistencies in regulatory coverage, option V would also be adopted. Option V moves beyond the analysis of RCRA regulations to examine problems related to insufficient integration between RCRA and CERCLA, among the various environmental protection statutes, and among the various executive agencies having programs associated with hazardous waste, These two options combine both short- and long-term approaches to obtaining a more effective, efficient Federal hazardous waste program.

SCENARIO III

The current RCRA program needs improvement and a nonregulatory approach is also needed to shift waste management choices away from land disposal toward waste reduction and treatment efforts. The most expeditious congressional actions are required. Options II and III are adopted,

Option II would result in the improvement of RCRA regulations to better provide short- and long-term protection of health and the en-

vironment. However, uncertainties concerning the effect of the regulations on shifting management choices away from land disposal, along with enforcement problems, would probably remain. To complement the regulatory approach of option II, option III is used to introduce direct economic incentives for alternatives to land disposal. The combination of these options would reinforce the connection between RCRA and CERCLA. Federal fees on hazardous waste, increased for land disposal and for waste with high-hazard levels, can be used to fund CERCLA and State hazardous waste programs. With a fee system, full life-cycle costs of waste management could be internalized by increased costs to responsible parties and to consumers of hazardous waste-intensive products.

SCENARIO IV

The current RCRA regulatory program should be maintained, but some long-term efforts to improve the program should also be pursued. Adopt options 1, IV, and V.

Options IV and V are compatible with the current program in the near term, since both involve initial studies before changing the current program. The introduction of hazard classification at some future time does not imply any fundamental change in the RCRA regulatory structure. Similarly, a plan for regulatory integration resulting from option V would not require a restructuring of RCRA regulations. Both options IV and V can be viewed as evolutionary refinements of the current program, and their adoption would not jeopardize the stability of the present program.

Appendix 3A.–Hazard Classification in a Risk Management Framework

In the past 6 years, EPA has attempted to design a regulatory structure responsive to a variety of wastes, hazards, and treatment/disposal methods. A review of the evolution of regulations suggests that different approaches were considered by the two administrations (Carter and Reagan). For the most part, the EPA framework has considered each element of risk management in a piecemeal way. There has been an absence of integrated data on waste composition, environmental fate of waste constituents, and technological alternatives for treatment and disposal. Although this approach resulted in the promulgation of regulations, the issue of how best to respond to varying hazard and risk levels is not yet settled. During the congressional consideration of RC RA, the degree-of-hazard concept received considerable attention, but EPA was not required to use it.

To date, various lists of wastes have acknowledged different hazard levels to only a limited degree. Various aspects of the regulations also acknowledge different hazard levels. The need to "tailor" RCRA regulations to varying hazard and risk levels is seen clearly by EPA. The best approach, however, remains an area of debate. Recently, EPA has pursued a risklcost approach (discussed in ch. 6 and its appendix) toward implementing the degree-of-hazard concept in a more comprehensive and formal way.

The purpose of this discussion is to examine in more detail the use of hazard classification as a key component in a comprehensive risk management framework that would offer a means to "fine tune" RCRA regulations.

The Need for Using Degree of Hazard

In reviewing the problems discussed in chapter 6, two general issues have emerged:

1. The regulations have been developed in general, nonspecific terms in recognition of the broad variety of wastes and the site-specific nature of facilities to be permitted.
2. For regulations that do not recognize differences among hazards and risks, tradeoffs must be made between ensuring appropriately stringent regulations for waste with highest hazards and incurring unreasonable costs for managing less hazardous waste. Thus, in the long run, medium-hazard waste may be regulated adequately, but low- and high-hazard waste and low- and high-risk management

practices may not receive appropriate control, High-hazard waste may be underregulated, and low-hazard waste may be overregulated.

The current RCRA program provides one set of regulations and standards, with limited recognition that specific wastes and facilities may require deviations that can be accommodated at the permitting stage. There are some indications that the risk/cost model may be used to "fine tune" the basic set of regulations for certain generic situations. Thus, this model might complement the variance procedures at the permitting level. [D]

In chapter 5, a general risk management framework was discussed. The elements of this general framework include hazard evaluation for wastes and facilities, risk estimation, evaluation of tradeoffs, assessment of management options, and choosing an appropriate course of action. Drawing from that general outline, this discussion presents a suggested decisionmaking framework designed specifically to account for varying levels of hazard for waste in their management, through the use of both waste hazard and facility classes. The factors determining different facility classes (for existing or planned facilities) include the performance capabilities (actual or anticipated) of the facility with regard to controlling release of hazardous constituents, monitoring programs, management procedures, training programs, the hydrogeologic characteristics of the site, the physical routes of potential transport of releases, the proximity of potentially affected people or sensitive components of the environment, and locally available resources for emergency response.

As was shown in figure 2, the framework is dynamic. Continuing collection of information and accumulated experience in permit writing can lead to adjustments in hazard classification of facilities and wastes. However, once a permit is issued (for 10 years under RCRA) changes in the system would have little effect on the permit holder, unless the permit holder voluntarily requested and received review and relief. At the permit writing stage, information about actual wastes and facilities are used to confirm or deny the judgments by the facility operator or waste generator concerning the appropriate Federal facility class, and possibly the waste hazard classes. Experience at the permit writing stage produces information for making regulatory policy changes concerning waste and facility classes, for establishing data and research priorities, and for improving the Federal data base.

If the permit writing authority is provided with a small number of waste and facility hazard classes (with specific technical criteria for technology performance standards, monitoring programs, and site requirements), choices can be made concerning levels of risk. This facilitates a "coarse tuning" of the regulations within the limits imposed by having several waste and facility classes. The regulatory "tuning" process consists of matching waste hazard classes to the facility class. This contrasts to the current system with one primary set of standards from which the permit writer can, for some types of facilities (e. g., landfills), make many deviations and exceptions (analogous to selection on a continuous band of options). However, for other types of facilities (e.g., incinerators), the current system may offer very little flexibility.

The permit writer's primary decision depends on fitting the real situation into a small number of options for regulatory control. The permit applicant is required to supply data consistent with the parameters used to classify waste and with the criteria used to define the corresponding levels of regulatory control. It should not be inferred that the illustrated framework can guarantee good permit decisions. A poor choice among the limited options available with the hazard classification approach could prove to be as detrimental as poor decisions made in the current system by the permitting authority.

How Hazard Classification Differs From Other Approaches

There are four approaches to implementing the degree-of-hazard concept. The listing approach is the simplest but may be the least adequate. From available information, lists of wastes are prepared to represent degrees of hazard. Use of this approach by EPA and some States indicates there remain considerable uncertainties as to the exact criteria used to establish the lists, or to obtain delisting, This list approach does not expeditious and effectively dealing with wastes that have not yet been listed, or with those candidates for delisting, Lists are often too generic and do not recognize major differences among individual waste constituents. At the Federal level, lists have not been related to differences in regulations and standards. Moreover, listing alone does not integrate the effects of different technologies and site-specific factors into a comprehensive risk management framework.

EPA has moved toward the development and use of the risk/cost model as a means to introduce more quantitatively the degree-of-hazard concept. It ap-

pears that the deficiencies inherent in the listing approach have been recognized. Using cost, however, as a means to balance risks appears contrary to the intent of RCRA: the cost component of this approach is not required for implementing the degree-of-hazard concept. It is the use of risk assessment that differentiates levels of hazard for wastes and the contribution of technologies and site-specific factors that determine actual levels of risk for a facility. The substantial increase in the amount of data required for the risk assessment approach makes it somewhat unique. It is necessary to obtain information beyond an understanding of the basic characteristics of the waste and indications of adverse human health and environmental effects. In risk assessment, considerable data on actual human health and environmental effects are preferable, although other data, such as animal effects, may be used out of necessity. There must also be considerable information on those factors necessary to assess risks, which include, for example, specific information on the transport and fate of releases into the environment, and on the responses of particular components of the environment to the release dosage. Although this approach can be precise, it lacks predictive capabilities. New situations require extensive data and analysis.

EPA may introduce the use of the risk/cost model as an adjunct to the flexibility achieved through permit writing. Permit writing is another way to introduce the degree-of-hazard concept into the regulatory framework. The main objections to using permitting as a primary means to achieve variations in level of regulatory control are: 1) many permit writers nationwide can be making decisions that are inconsistent with others, leading to inequities among facility operators, varying levels of public protection, and possibly the formation of "pollution havens;" 2) permit writers may lack access to technical data or the technical skills necessary to make satisfactory decisions about whether requested deviations from the primary set of RCRA regulations adequately protect health and the environment; and 3) with many individual decisions being made concerning variations in regulatory control, it is difficult for the public and policymakers (including Congress) to evaluate whether statutory requirements of RCRA are being completely met.

Hazard classification approaches are in contrast to the complex risk approach, the simple listing approach, and the decentralized permitting approach. The basic aspects of hazard classification are: 1) data on waste are used to describe adverse effects of exposure to hazardous constituents; 2) it is possible to classify wastes by similar levels of hazard; 3) it is possible to classify facilities of different technologies to afford a certain level of hazard reduction with regard to waste handled, or a certain performance level for controlling releases of hazardous constituents; and 4) waste hazard classes are matched to facility classes to achieve appropriate regulatory control. Decisions must be made concerning what types of data and what specific values are to be used in establishing the different classes of wastes and facilities. This is not necessarily simple, nor are the boundaries (values of different parameters) that define different classes rigid. A new waste can be classified as long as there are data corresponding to the boundaries for the classes.

It is emphasized that all suggested uses of hazard classification assume that only a very few classes would be required and are practical. Usually high, medium, low, and no hazard classes are envisioned. To some extent, therefore, the classification approach is more "coarse tuning" than the "fine tuning" achieved through risk assessment. Compared to the variations possible with permitting decisions, the classification approach offers permit writers an opportunity to select from a small number of choices. For example, a permit writer could change the classification of a waste (and therefore the level of regulatory control required for the facility) because of the concentration of a hazardous substance in the waste, or because of technological and site-specific factors. A facility with some type of waste pretreatment might require a reduced performance standard to achieve acceptable levels of release, A facility may be in a location in which any release would be so dispersed prior to any exposure to a vulnerable receptor that a lower performance standard would be acceptable. With hazard classification it is possible to integrate technological and site-specific factors into the use of varying hazard levels of waste. Options, however, are limited by the number of hazard classes available, and by the corresponding regulatory requirements, such as performance standards, monitoring requirements, and criteria for acceptable sites.

Objectives of an Integrated Risk Management Approach

Any integrated approach directed toward the hazardous waste problem should address certain key issues, These include:

1. consideration of degrees of hazard and risk in relation to waste and management practices;
2. assessment of the potential to reduce either the amount or hazard level of hazardous waste through the use of appropriate technology;
3. development of effective designs for monitoring strategies at all types of facilities; and
4. a means for addressing severe public opposition to siting of new hazardous waste facilities by providing a technically sound basis for evaluating management proposals.

The framework illustrated in figure 2 would address these issues and provide an integrated approach for data collection, hazard and risk estimations, evaluation of tradeoffs among risk, costs, and benefits, The specifics of how the issues are addressed are discussed subsequently. The outcome then can be used in making decisions concerning:

1. criteria for permitting and monitoring,
2. regulatory and policy changes, and
3. data and research priorities.

This decisionmaking framework emphasizes the need to classify waste by degree of hazard and to integrate data for risk evaluation associated with specific management approaches.

This framework is a tool with which government officials could formulate effective appropriate regulations for the treatment and disposal of hazardous waste. It is not a formal classification system for actual regulation of waste management. * If implemented as the basis for decisions within a governmental agency, it could provide the scientific and technical bedrock for sound decisions about regulation of hazardous waste. It also could provide government agencies, either Federal or State, with a tool for addressing public opposition to siting and management approaches. The objectives of this framework are:

1. to provide a consistent decisionmaking framework for achieving the goals of protection of human health and the environment,
2. to provide a mechanism for establishing criteria and priorities for reaching this goal, and
3. to maximize flexibility for officials to develop appropriate regulations for the management of waste.

● The design and selection of a hazard classification system would require considerable attention to specific factors used to assess a number of different types of hazards, and then the selection of several critical values for these factors in order to establish boundaries between hazard classes. This study has not attempted to design or select a specific classification system, but, as considered in chapter 5, there appears to be sufficient evidence to indicate that a workable classification system could be developed with existing information.

Hazard Classification Considerations

In considering the degree-of-hazard concept, three characteristics of wastes are important: the chemical and physical forms that affect its treatability, characteristics of constituents that determine the hazard potential itself, and the concentrations and chemical forms of the constituents, Classifying wastes according to these characteristics and the hazard levels that each pose to health or the environment is discussed in chapter 6.

Afterward, data would be analyzed to determine both immediate and protracted hazards. The immediate hazards can be determined by assessing characteristics of reactivity, chemical incompatibility, ignitability, and corrosiveness. Long-term hazards can be determined from the toxic qualities of a waste and its constituents and from those characteristics that influence its distribution and fate in the environment-e. g., volubility, volatility, persistence, and bioaccumulation.

Development of hazard classes from specific criteria will not be an easy task, but will not be impossible. An ideal system might have four classes: high, medium, low, and no hazard. The criteria for each could be based on toxicity, genetic impairment, chemical and physical factors contributing to persistence and bioaccumulation, safety factors, and concentrations. As discussed in chapter 5, models are available that incorporate these elements, and these could serve as a basis for further criteria development.

The study prepared for OTA. (see the discussion of case study in ch. 5) concludes it is possible to distinguish among wastes even using the inadequate data base currently available. Although the waste selected in the study are considered by EPA as being equally hazardous, it was possible to further categorize them into four levels, using classification models developed by the States of Washington and Michigan. The first step in the risk management framework, i.e., estimating degrees of hazard for the RCRA universe of waste, can be achieved in a limited way now. With a concerted effort to develop the necessary hazard criteria and appropriate characteristics and effects data for waste and constituents, a better estimation of degree of hazard for waste will be possible,

The classification of wastes would provide options for permit writers that reduce the technical burdens on them by providing established technical criteria to choose among. Without classification, permit writers face a large task of determining what factors to consider and then determining what the

factor values signify in terms of hazard and risk. Difficulties associated with interpreting varying data would not be a major problem in classification. Initially, certain judgments would be necessary concerning the class in which a waste should be assigned. However, as more data are collected and new information incorporated within the data base, classification could be revised as necessary. It should be emphasized that before any hazard classification would be used in the RCRA program, considerable data will have been obtained from several years of permit writing. Because the classifications will shift one set of regulations and standards to perhaps three sets, such changes would not necessarily cause more disruptions in the regulatory process than would the risk/cost policy model or other attempts to "tailor" regulations. It is conceivable that some of the main, existing standards would correspond to the medium-hazard class, in which the majority of regulated waste would exist. Moreover, current regulations eventually will be changed as new data are incorporated in the evaluation of risks and assessment of tradeoffs.

An advantage of a waste classification system is that all potentially hazardous wastes are evaluated and the system becomes inclusive, rather than exclusive. The current problem of fluctuating status with respect to RCRA definitions would be largely removed. All wastes would be considered but each would be recognized for its specific hazard level.

The Link Between Waste Hazard Classification and Risk Estimation

The chemical and physical characteristics of waste strongly influence the technologies to treat it. Important physical characteristics include its form: solution, a solid, or a sludge. Important chemical characteristics include its origin: organic or inorganic. Waste can be further characterized as acid or alkaline, concentrated or dilute. Each influence the combinations, sequences, and cost of treatment and disposal options. Because of their physical and chemical diversity, treatment and disposal alternatives are diverse. No single treatment or disposal process can be considered exclusively appropriate or technically correct.

Many technologies have application in the management of hazardous waste. Some are applicable to several physical and chemical forms of waste; others have more limited application (see ch. 4). Three general practices are treatment to reduce hazard levels, containment to isolate waste from humans and the environment, and dispersion to reduce concentrations.

In the second element of the hazard classification framework, degree of risk is identified for each of these three categories of management practices by the permit writer who uses the classifications, assesses the risks of facility design and operation, and analyzes the potential environmental fate and distribution of waste that may be released from the facility.

As discussed in chapters 6 and 7, current models are inadequate for determining real-world risks associated with particular waste and management options. The models used should be capable of incorporating information about facility design, include changes in operational parameters that affect the potential release of material from the facility, and include estimates of possible exposure to humans and ecosystems. If this effort relies on simple models and indicator factors that do not reflect the real situations, the result will have limited utility in the decisionmaking process. Most models now proposed by EPA are very limited in scope and do not reflect the behavior of waste in the environment nor the potential level of exposure to organisms. Thus, effort must be devoted to developing assessment models that are multilevel oriented—not an easy task.

A review of the scientific literature suggests that many usable models do exist. Some evaluate the potential distribution of constituents within a variety of ecosystems and have the capacity to incorporate real elements and actual compound data. Other models use design and operation data for a facility type to determine the effluent under various operating conditions. By combining these two types of models, estimates of expected risks for different facility types and even for different designs of one type of facility could be formulated.

As with estimates of degree of hazard and classification of waste, the incorporation of this type of risk analysis in a decisionmaking framework has certain advantages. Because regulations would not be a direct result of the analysis, temporary misinformation would not have critical effects on the actual management of hazardous waste. Rather, the outcome of this step of the framework would be put directly into the third step: evaluating tradeoffs between perceived risks, costs of changing facility design, costs of specific regulatory changes, and the benefits that could be expected. By maintaining an ongoing assessment effort, new information can be included into the decisionmaking process as it becomes available.

Regulatory Decisions and Tradeoffs

The third step of the process involves evaluation of all risks, costs, and benefits associated with each management option within a hazard classification. Relying on the results of hazard classification and risks estimation, tradeoffs among management options, risks, costs, and benefits of each can be used to decide whether a waste should be classified differently, or whether a facility compatible with certain waste hazard classes could accept waste from a higher hazard class (clearly there would be no regulatory problem in using a facility compatible with a high-hazard class for wastes from lower hazard classes).

It should be emphasized that current assessment models—e.g., risk-risk and cost-benefit—have serious limitations. These are discussed in chapter 5. As long as these limitations are recognized and included in the decisionmaking process, such tools can be used. In this particular case of tradeoffs in management options for hazardous waste, some of the limitations associated with assigning dollar values to lives saved may be eliminated by assessing only for the potential for release of hazardous constituents from a facility. Guidelines would have to be developed to assure that each tradeoff evaluation was accomplished in reasonably compatible and uniform ways so that the results could be compared. Although further development of tradeoff models is necessary, limited use of current models is possible and would help in reaching decisions about alternative options for management of hazardous wastes.

Application of the Risk Management Framework

Application of the framework requires that data about the potential hazards posed by wastes and constituents be evaluated with data about the risks associated with different facility classes. This evaluation is done by developing the technical basis for matching waste classes with corresponding facility classes. The objective is to obtain the appropriate levels of regulatory control for the waste classes. The technical basis for such correlations is the use of health and environmental effects to assess how certain levels of control over release for certain wastes provide a consistent level of risk—across the different waste and facility classes.

This classification framework recognizes that wastes vary in the level of hazard inherent in their makeup and that for any facility type there can be variations in design and operation parameters that result in different levels of potential risk. The outcome of this risk management framework would have multiple uses. A major goal of this framework is to streamline the regulatory process by establishing a link between hazard class and minimum Federal performance standards for all applicable technologies.

Developing Criteria for Permitting and Monitoring Processes..–As regulations are written currently, the Regional Administrator or State permitting authority has discretion for determining the suitability of any facility and monitoring effort. This discretion recognizes the site-specific nature of a facility. The risk management framework illustrated in this discussion provides a means to develop such criteria based on technical information rather than judgments by the permitting authority. For example, specific application of any management option can be restricted in two ways: lack of technical feasibility and permitting monitoring requirements. In the former, there are some applications that are constrained because the technology will not change the hazard level of the waste, contain it sufficiently, or disperse it in concentrations that are not harmful to health or the environment. The use of a waste classification approach does not remove the necessity for the permit writer to decide what the applicable technologies are. The classification merely provides the set of details for determining the appropriate facility class--the level of regulatory control (i.e., performance standards, monitoring requirements, etc.) as indicated by the facility class for a specific waste class. For example, some highly concentrated solutions of toxic, polycyclic aromatics cannot be degraded with naturally occurring microorganisms; thus, Iandfarrning of these types of waste is not appropriate. Use of improved biotechnology methods have resulted in development of certain microorganisms that can degrade such waste under controlled treatment conditions. Even though standards for landfarming may exist, the facility operator and the permit writer must decide whether the technology is applicable to that specific waste, Presumably, suitable guidelines could be offered. Similarly, certain sludges cannot be burned adequately in some industrial boilers because of the limitations of the feed control mechanism and the lining of the combustion chamber, but these same wastes can be incinerated in a rotary kiln incinerator. Thus, within a technology category (e.g., biological degradation and thermal destruction) and facility class, the limitations for application of a specific treatment (e.g., Iandfarming, advanced biotechnology treatment, or industrial

boilers and rotary kilns) can vary as a function of the chemical and physical form of the waste.

A central concept supporting facility classification is the use of variations in performance standards for different technologies, Currently the regulations rely heavily on this method, but do so in the absence of any analysis of the preferred types of standard for specific technologies. There are several ways to define a technology performance standard, The common objective is to exert control over the release of hazardous substances into the environment.

Debate over the appropriate method for setting technology standards and for establishing acceptable levels of release is not unique to RCRA. At least six different approaches have been considered for use in implementing other environmental acts, Several of these have been considered in the rulemaking process under RCRA. These approaches require specifying: 1) a numerical standard for allowable concentrations of some contaminant remaining after treatment (the point at which these numerical standards come into effect can vary, e.g., at the point of emission, or as an ambient standard for land, air, and water at points of potential use); 2) specifying a percentage reduction of the concentration of a contaminant remaining after treatment, relative to its original concentration; **3)** a time period during which waste must be contained in the waste management area; 4) specifying facility design and operating standards; 5) a nonspecific health and environmental performance standard– e.g., human health and the environment shall not be adversely effected by the migration of contaminants; and **6)** specifying a ratio of quantity of emissions released per unit of raw material used in an industrial process, This latter type of standard has not been considered by EPA for incorporation into RCRA regulations.

Although these six approaches are presented as wholly separate concepts, there are instances where the technicalities surrounding their implementation blur the distinctions. For example, current incinerator regulations under RCRA specify a 99.99 percent destruction and removal for specified organic constituents within the waste stream, During the process of specifying the organics, original concentration(s) and incinerability in the waste stream must be considered, This is necessary because destruction of 99.99 percent of a very low-initial concentration will result in emission concentrations in the stack gas that may be far below the limits of detection.

No single standard can address all the variables governing releases of waste contaminants to the environment because of the differences in the types of technologies used to treat or to contain the waste. Releases from treatment alternatives such as chemical conversion or thermal destruction are fairly immediate, and their duration is generally related to the duration of the process itself. Further, the qualities and amounts of the contaminants released can be adjusted somewhat through control of the treatment process. For containment alternatives, such as landfills, releases occur over a longer period of time. During operation, there can be releases to the air and to the subsurface when the final cover to reduce infiltration of rainwater is not in place. There can also be releases that occur long after the landfill has been closed—e.g,, as a result of a breach in the lining material. Further, as the leachate recovery system is only required to operate during the commercial life of the facility, and since the effectiveness of landfill cover maintenance in preventing infiltration of water into the landfill throughout the 30-year post-closure period has not been determined, there may also be migration of leachate from the bottom of the cells as liquid pressure increases on the liner, The extent to which these releases can be minimized depends on the design of the landfill and its materials of construction.

Thus, landfills are an example of a technology whose performance can be improved by the specification of certain design, operating, and location standards. The idea of using classification to streamline the regulatory process is based on establishing a credible and accurate link between a waste class and a facility class that in turn is based on minimum performance standards for a variety of technologies. However, it should be recognized that the greater stringency required for higher hazard classes will make some technology options impractical or unattractive. For example **the use of** landfills for high-hazard waste would be made difficult by the very stringent performance standards and monitoring requirements associated with that class.

Specific data requirements required in permit applications for all facilities would be developed to include all aspects of the framework:

1. providing suitable data for a determination of the hazard class for waste to be treated at the facility,
2. indicating choice of appropriate treatment or disposal options and including all information relevant to design and operation,

3. identification of all potential releases of significantly hazardous waste constituents to the surrounding environment, and
4. providing adequate information with which predictions of potential significant contaminants can be made,

By incorporating these data into the risk management framework, the permitting authority can select the suitable class of performance standards, monitoring programs, and establish a reporting and inspection schedule to assist the responsible agency (Federal or State) in its enforcement efforts,

Establishing Data and Research Priorities.-One out-come is to use the results to identify those areas that require more data—e. g., additional data needed on the fate of constituents in a landfill. Thus, funds could be allocated toward gaining the needed information. Research priorities might be identified– e.g., the evaluation may identify a class of waste or type of facility that pose an unacceptable threat to health and the environment. The responsible agency, State or Federal, could then develop research efforts to determine new ways to deal with this particular class of waste, or they could develop incentives to encourage industry to identify improved management options—e,g., in the form of reducing the generation amount of this class of waste, in developing better treatment process, or in devising new uses for the waste.

Identifying Areas for Regulatory and Policy Change,– Specific regulatory restrictions are another way of limiting application of a specific technology. In the environmental area, these restrictions are usually the result of a policy decision which evaluates the environmental effects of the use of that option. For example, regulations promulgated under the Marine Protection, Research, and Sanctuaries Act restricts the dumping of radiological and chemical warfare waste into the ocean because of the adverse effects they would have on the ocean, not because of any technical unfeasibility of hauling and dumping such waste at sea.

The risk management framework provides a context within which areas that may need regulatory change can be identified using all available information, An assessment of whether to ban certain materials from landfills can be accomplished using this framework. A review of those wastes classified as highly hazardous and the available treatment technologies could result in a decision to ban them from land disposal because other suitable options do exist, rather than maintain the option of using landfills with the higher level of stringency required for this hazard class. In contrast, if there is a particular subclass of highly hazardous wastes that cannot be treated in any other way, than specific controls focused on those wastes can be required in the regulations for land disposal.

Policy changes can be similarly determined using the risk management framework. For example, the current EPA regulations include several wastes that are exempt from control. Some exemptions are statutorily mandated, others were granted by EPA. A review of the waste in low- or no-hazard classes and of the technologies that are used to treat or dispose of these wastes may indicate that controls in terms of performance standards or stringent monitoring requirements may not be needed. EPA may decide as a matter of policy that certain wastes must be tracked offsite through the manifest system and the final deposition (for waste managed onsite also) simply reported in both generator reports and facility management reports.

Data Collection .–The success of this framework lies with compilation of valid data about all aspects of waste management. Without a well-developed data base, sound judgments at an-y step of the framework will not be possible. The collection process must be continuous as improvement in the decisionmaking process will depend on new and better data. Data from all parts of the framework are fed into data collection efforts,

Addressing the Key Issues in Waste Management

The risk management framework presented here addresses the major issues in the current examination of the Federal RCRA program in the following ways:

1. the major focus is to estimate degree of hazard for wastes, classify them, and establish facility classes based on degree of risk (or control) associated with a specific technology and facility location;
2. the framework facilitates identification of waste that could be reduced and technologies that provide greatest reduction either in hazard level of the waste or in risk for exposure to health and the environment. Over time, policy changes can be considered to reduce the waste generated or to encourage development of technologies that reduce hazard and risks;
3. by correlating the hazard, waste, and the facility class, effective monitoring requirements can be formulated; and
4. a means for addressing public opposition to siting of new facilities by providing a sound basis for evaluating propclsals is also incorpor-

ated in this framework. As discussed in chapter 5, public fears are motivated by a number of things: fear for health and safety, lack of confidence in governments and industry, and the absence of technically based siting criteria. If a decisionmaking framework is developed by Federal and State authorities, it would provide a signal to the public that governments are intent on establishing technically sound regulations, collecting data, establishing sound criteria for permitting and monitoring, and ensuring consistent environmental protection nationwide.