
CHAPTER 2

Introduction

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Introduction

Background

Uncontrolled or careless management of industrial waste, with consequent releases of hazardous constituents into the land, water, and air, is generally understood to present a substantial threat to both public health and to the environment. Prior to passage of the Resource Conservation and Recovery Act (RCRA) by Congress in 1976, few States had regulatory programs for hazardous waste. Moreover, Federal programs concerned with air and water quality caused some changes in industry which increased the generation of solid, hazardous waste, Clean air and water regulations also promoted the use of pollution abatement facilities which themselves produced hazardous residues, Experience with more conventional forms of industrial and municipal solid wastes provided few solutions for managing more complex and chemically stable hazardous waste,

National awareness of solid and liquid hazardous waste problems increased dramatically in the mid to late 1970's with widespread concern over mismanaged waste, indiscriminate dumping of uncontainerized liquid waste, and infrequent, but highly visible transportation accidents. Mismanaged waste created serious problems both by the release of harmful substances into the environment and because of the direct exposure of waste handlers and the public to such waste.

It also became clear that even well-intentioned and accepted management of hazardous waste, particularly the use of landfills, surface impoundments, and lagoons, could result in a substantial threat, This threat resulted from the potential, but difficult to assess, slow leakage of waste constituents, or leachate (resulting from the interaction of water or other solvents and waste), through the soil and into underground water supplies, which were or could become sources of drinking water, A sense of urgency regarding hazardous waste

issues was also prompted by several other important factors. These included:

- an increase in public sensitivity to the toxic properties of many substances which sometimes were long-lasting;
- an increase in attention to the real or potential links between toxic substances and human and animal cancers; and
- an increase in public demands for protection from pollution of all types.

It became evident that the proper management of hazardous waste, whether newly generated or previously disposed of, posed substantial challenges, Studies revealed that some hazardous waste generated and disposed of decades before had led to undetermined, but possibly very large amounts of dangerous substances distributed in and on the land in many areas of the Nation, Moreover, some previously abandoned disposal sites with uncontrolled releases of waste into the environment were not effectively addressed by RCRA, which was primarily concerned with proper management of present and future hazardous waste. Because of the many hazards posed by uncontrolled hazardous waste sites, both active and inactive (particularly those abandoned sites whose ownership was unknown), Congress passed the Comprehensive Environmental, Response, Compensation, and Liability Act of 1980 (CERCLA), which became better known as Superfund. Problems associated with the identification of especially threatening uncontrolled hazardous sites became prominent, including locating them, characterizing their contents, detecting the nature and extent of releases into the environment, substantiating actual or potential adverse impacts on health and the environment, and developing cleanup techniques and plans,

Since the passage of RCRA and CERCLA, a number of additional problems have arisen.

Defining the scope of both the past and present hazardous waste problem, promulgating effective regulations and standards, developing management alternatives for industry, and establishing Federal and State regulatory programs are some. Virtually all interested in the hazardous waste regulatory system have voiced concerns over poor definition of the problems, delays in implementing solutions, changes in direction of the system, and uncertainties of future policies and programs.

Some delays, of course, were to be expected because of the scope of the problem. Almost all industrial activities (as well as many commercial, governmental, and institutional activities) produce some type of hazardous waste. The economic development of the United States during the 20th century has been accompanied by and, to a significant extent, based on the rapidly rising use of technology, including synthetic organic chemicals. These synthetic chemicals often pose difficult problems because of their stability, resistance to natural degradation, and sometimes hazardous properties. Every year many new chemicals are invented and put into use. Although both technology and new commercial chemicals have contributed to the growth of the Nation's industrial productivity, many associated raw materials, byproducts, and wastes require careful handling because of acidic, caustic, flammable, explosive, carcinogenic, mutagenic, or other properties. While industry has been relatively

successful in limiting accidents to workers during production or industrial use, the consequences of inadequate disposal of industrial hazardous waste has emerged as a critical national problem. Hazardous wastes are highly complex, with characteristics specific to industry, process, product, or site.

Improved management of hazardous waste implies greater costs to industry and, eventually, greater costs to the public, either directly or indirectly. The alternative, however, would surely lead to higher costs in the future and unacceptable effects on human health and environment. As costs of waste management increase, there are greater economic incentives to reduce waste generation and to retrieve materials and energy of economic value from materials previously regarded as useless. However, increasing waste management costs can also increase illegal dumping of hazardous waste and increase the need for effective government enforcement programs to detect such illegal practices. The investment expended either to reduce wastes or to recover them depends on weighting the exact costs and liabilities of waste management incurred by the waste generator. Having the hazardous waste regulatory program pass from the planning to implementation stage at a time of severe national economic problems has increased the need for developing the most cost-effective approaches to waste management,

Major Issues and Uncertainties

There are two broad areas of concern to policymakers, one related to factual information and the other to policy questions. First, there are a number of uncertainties of fact in the three main areas: wastes, management facilities, and adverse effects of both on public health and environment. The formulation of effective and equitable regulations requires information on the intensity of the threats posed by wastes and on their remedies. Factual questions that have remained unanswered, and which have influenced the scope of this report, include the following:

- How much hazardous waste is there? What is being generated, by what industries, in what locations, and of what chemical and physical types?
- Where is the hazardous waste? What are the locations, amounts, and types of hazardous waste that have been managed in ways that lead, or may lead, to the unacceptable or uncontrolled release of harmful constituents into the environment?
- What hazardous waste management facilities currently exist to receive waste? What is their distribution by location, tech-

nology, level of control, and capacity? How much hazardous waste is being transported? How much waste is being managed on the site of the generator v. being handled in commercial or offsite facilities?

- What are the technological alternatives for waste management? What options exist for reducing hazard levels through treatment, for disposal to contain waste, for dispersal to render waste harmless, for cleanup of uncontrolled sites, and for reduction of the amounts of waste to be managed through process modification, end-product substitution, and recovery/recycling? To what extent are these alternatives technically feasible, cost effective, and available with or without further study? What encourages or discourages their development and use?
- What types of monitoring techniques and programs can be used to detect releases from hazardous waste sites? How should monitoring programs be related to types of waste, facilities, and locations? How should information from monitoring programs be used in a systematic fashion to ensure fast remedial response if necessary?
- What are the threats from hazardous waste? What are the specific adverse impacts on humans and ecosystems exposed to particular types of waste that maybe or are released into the environment? How do waste constituents move through the environment, remain stable or degrade?

In addition to questions of fact, there is a second broad area of policy-related questions. There are difficult issues involving societal values, tradeoffs between short- and long-term solutions, costs, and equity. Given limited resources and information, what types of policies, regulations, and standards can best strike an acceptable balance between protecting the public and minimizing financial and regulatory burdens on the private and public sectors? There are difficult questions concerning risk reduction in the near term v. the transfer of risks to future generations. Moreover, policy-related issues often involve technical problems that are often difficult for any but specialized

technical experts to understand. If there are important gaps and uncertainties concerning basic information, which there are, then the examination of policy issues is particularly difficult. Important policy-related issues include the following:

- What wastes should be regulated as hazardous? What compositions, physical states, amounts, and properties should be used to define hazardous characteristics? If some States choose to be more stringent than the Federal hazardous waste program, as they can be under RCRA, and use broader definitions or listings of hazardous waste, what problems may arise for the private sector and for formulating and implementing Federal policies? To what extent do wastes which have hazardous characteristics, but which are regulated as ordinary solid waste rather than hazardous waste, pose serious threats to the public?
- Should the fact that different wastes pose different levels of hazard be used in regulatory programs? Can a workable degree-of-hazard system that classifies waste (and, possibly, facilities and locations) be used to set different levels of control, standards for acceptable levels of release, and stringency of monitoring programs? Can such a system be used to limit uses of different technological alternatives, such as determining waste unsuitable for landfills, and uses for existing v. new facilities?
- To what extent can risk assessments be used? Can existing information on potential adverse effects on health and environment be used in risk assessments? Should costs of management alternatives be used with evaluation of risks? If the information needed for such analyses is unavailable or unreliable, would requiring such analyses be effective or only delay action?
- Do current regulations permit the market to operate in ways that ensure the full internalization of costs for alternative management approaches? Does the current system provide incentives for development of alternatives that may provide greater

protection to the public? Are the costs for long-term monitoring of facilities containing hazardous waste (that may possibly remain hazardous forever) and the possible costs for remedial action being properly accounted for in today's waste management cost structures?

- To what extent is public opposition to new hazardous waste facilities justified? Is this opposition commensurate with what is now known about the risks involved? Would better information on wastes, technologies, facilities, and potential effects reduce public opposition? Are the processes, including public participation, and technical criteria used for siting new facilities appropriate?
- What criteria can be used for determining the extent of cleanup of an uncontrolled site? Is there sufficient attention being given to all the alternatives and to the relative advantages and disadvantages for both the short and long terms? Do current policies provide an incentive for alternatives that have low capital cost, but high operating and maintenance costs?
- What are the effects of having many different laws that influence hazardous waste management and regulation? Is it efficient to have different laws, administered by different agencies or different groups within an agency, to govern different categories of technological alternatives, such as ocean dumping, injection in deep wells, and other facilities on the land? Do clean air and water regulations adequately address the types of constituents likely to be released from hazardous

waste? Does the law concerned with production of toxic chemicals provide an appropriate means to reduce the generation of toxic waste?

- To what extent do current programs promote development of new alternatives to more traditional environmental regulations? Is the current use of financial liability requirements likely to lead to more efficient self-regulation in industry? Are there economic incentives that would be more effective than traditional regulations in fostering improved management?
- What is the proper and most efficient balance of responsibilities between the Federal and State programs? To what extent can State programs be equivalent and consistent with the Federal program, and yet responsive to varying State needs and circumstances? Do the States have sufficient financial resources to carry out their increasing responsibilities? Are the States being given a fair opportunity to shape the policies that they are being asked to implement? Is the Federal program providing the type and extent of technical information useful to all States?

These lists of questions and issues are by no means complete. They serve to illustrate the scope of present-day concerns about the present and future direction of hazardous waste policies. Moreover, these questions indicate the orientation of the present study, which is concerned primarily with examining Federal programs and alternatives that can reduce the risks of hazardous waste management in an expeditious and cost-effective manner.

Objective, Scope, and Structure of the Assessment

Objective and Scope

RCRA as amended requires the Environmental Protection Agency (EPA) to issue and enforce regulations governing the disposal of solid and hazardous waste. It allows the States, if they choose, to assume primary regulatory and enforcement responsibility for solid waste

in general, and for the subclass generally termed hazardous waste. Financial assistance to States, municipalities, and regional authorities is authorized by RCRA in order to facilitate planning, management, and standard setting required for authorization to be shifted from the Federal to the State level.

The magnitude of the task facing EPA was generally recognized to be great. Six years after passage of RCRA, however, a consensus has also emerged, particularly as Congress considered reauthorizing RCRA in 1982, that progress has been slow. Both Federal and State regulatory frameworks for dealing with solid and hazardous waste remain uncompleted. Delays and uncertainties concerning the regulation of waste have created problems for the industrial sector, for both generators and disposers of waste. Public concern has not abated.

CERCLA provides a funding mechanism for corrective actions taken at a variety of inoperative or abandoned waste sites and for cleaning up accidental releases of hazardous materials. Here too there is general recognition that progress has been slow.

This assessment by OTA is designed to assist Congress in its examination of appropriate measures to prevent harm from those solid wastes defined as hazardous. As requested by Congress, this assessment focuses on:

- analysis of the technologies that can improve hazardous waste management through:
 - reduction of the volume or hazard level of waste generated;
 - better management of the risks associated with waste treatment and disposal; and
 - the cleanup of uncontrolled waste sites;
- analysis of the potential benefits and costs of a framework based on scientific criteria to judge the relative degree of hazard of wastes and risks from management facilities; and
- evaluation of current regulatory programs, particularly with regard to technical information and issues.

It should be understood that this is an analytical study to provide a basis for policy discussion and examination of legislative options by Congress, and not an attempt to write new or revise existing regulations for the executive branch or for the States. However, Federal and State roles in hazardous manage-

ment for both the near and long term are considered.

The scope of this assessment is limited in the following ways:

1. Within the definition of solid waste, which includes a range from household discards and municipal sewage to highly radioactive waste, the focus of this study is nonnuclear industrial hazardous waste associated with subtitle C of RCRA. No attempt has been made to analyze the generation and management of hazardous waste at Federal facilities, although it is generally understood that very large amounts of waste which are similar to industrial hazardous waste are generated in Federal facilities, including numerous Department of Defense installations.
2. The primary emphasis of this study is the management of waste in existing or future facilities, although the problems associated with closed facilities and past practices of abandoned facilities as considered in CERCLA are dealt with to some extent.
3. This analysis is concerned with examining the procedures for assessing the nature, intensity, and monitoring of adverse effects on health and the environment resulting from release of hazardous waste or their constituents into the air, land, or water. Major attention, however, is not given to substantiating, documenting, or critically evaluating the many data associated with real or potential adverse impacts.
4. The issues and technical problems associated with transportation and accidental release of hazardous waste are not considered, except to the extent that some technical and policy approaches may help to minimize transport of waste.
5. Although technical compliance with regulations is an important area of concern, strictly administrative and legal enforcement activities associated with regulations are not analyzed in any major way; however, their importance is found to be critical.

Public opposition to the siting of new hazardous waste facilities has been widespread in recent years. Means for dealing with public opposition to siting and public participation in State and local decisionmaking are briefly examined. The role of the Federal Government in siting of new hazardous waste facilities is now minimal, but options for more involvement are discussed.

Methodology and Structure of the Report

In preparing this assessment, OTA has utilized a number of means to obtain appropriate information without, however, attempting major acquisitions of new data or complete inventories of data. Instead, OTA used and performed critical analyses of available data bases, cooperated with the States in some limited surveys for critical information, and used a case study approach in a number of instances to provide a representative basis for analysis,

Other than chapter 1, the summary of the entire report, and this chapter, there are five additional chapters, briefly described below.

Chapter 3 presents eight goals for evaluating policy options, and five policy options for Congress to consider. The first option is a continuation of the current program. The second is based on a series of near-term changes in the current regulatory system, probably through amendments to RCRA. The third option is to offer Federal economic incentives for alternatives to waste disposal or dispersal in the environment. The fourth option calls for a study to develop a waste and facility classification approach for a comprehensive risk management and regulatory framework. The fifth option is an integration of the many Federal environmental programs that affect hazardous waste management and regulation. The five options, for the most part, are not mutually exclusive, but can be viewed as a series of complementary steps over a period of time. All options are analyzed for their benefits relative to the eight policy goals, and for the costs and problems associated with their implementation. Additionally, four scenarios are used to illustrate how several options may be combined.

Chapter 4 analyzes the available information on hazardous waste generation and treatment and disposal facilities. The linkage between information and the complex nature of the national hazardous waste problem is examined. An analysis of the current data base for hazardous waste is given. The discussion examines information needs of parties concerned with hazardous waste, and the consequences of having incomplete or unreliable information. This material forms an important basis for the other chapters, particularly with regard to data limitations that sometimes make policy-oriented analyses less quantitative than desirable.

Chapter 5 reviews the broad range of technologies now available and assesses those likely to be developed for hazardous waste management. A hierarchy is used to present management strategies, ranging from waste or risk reduction to disposal or dispersal in the biosphere. Technologies are compared and examined for suitability to particular wastes, their costs, and the technical issues relevant to regulation. The use of the oceans for waste disposal or dispersal, and the cleanup of uncontrolled sites are also discussed.

Chapter 6 examines "state-of-the-art" information and theory on the assessment and management of risks, and the diversity of current views on these issue areas. The primary purpose of chapter 6 is to provide a base for evaluation of current and alternative policies by defining several technical issues that policies are expected to address, including monitoring and siting of facilities.

In chapter 7 the current hazard management and regulatory system at both the Federal and State levels is reviewed and analyzed. Another purpose of this chapter is to assess the extent to which the current system is addressing the issues discussed in chapter 6, and at what costs. The Federal and State roles and programs are reviewed and discussed separately. A number of problems related to implementation of the current regulations are also examined.