Chapter 5

Waste Reduction in the Federal Government

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INTRODUCTION

The implementation of a voluntary, yet regulatory waste *minimization* program under the Environmental Protection Agency's (EPA's) Office of "Solid Waste is a consequence of amendments that were passed by Congress in 1984 to the Resource Conservation and Recovery Act (RCRA]. Throughout the discussion of current government and industry activities in this report, OTA has attempted to show how waste *minimization,* as it is evolving, is not necessarily *waste reduction.* In fact, focus on waste minimization can shift attention away from waste reduction.

RCRA and the other national environmental protection legislation and programs of the last 15 years have been based on *pollution control.* Implementing waste reduction, a concept of environmental protection that emphasizes *pollution prevention,* may require both a new legislative mandate and a new administrative effort. Significant difficulties could also arise in the implementation of waste reduction if the concept is strictly confined to those hazardous wastes covered by RCRA.

The first section of this chapter discusses these aspects of waste reduction, starting with an examination of the evolution of a pollution control culture under the existing media environmental programs and a discussion of the problems this traditional approach represents for the adoption of effective waste reduction. This chapter then reviews the portions of the 1984 RCRA Amendments that are the basis for the waste minimization regulations now in effect and analyzes possible outcomes of the resultant voluntary program in terms of waste reduction.

The last section covers supplemental activities (e.g., research and development and technology and information transfer services) in the Federal Government that may be of assistance to companies and State and local governments that are attempting to shift from pollution control (or, waste management) to pollution prevention. These services are scattered throughout the Federal Government and are not always identified as waste reduction. A separate waste reduction program could provide coordination to pull these services into focus to enhance their benefit.

BUILDING TOWARD A WASTE REDUCTION ETHIC

The current national environmental statutes and programs implemented by EPA constitute a *waste management by media* approach to environmental protection, Pollutants are deposited into the Nation's air, water, and land as an end result of activities such as manufacturing and transportation, The strategy employed to protect the environment has invariably been to try to affect that disposal by controlling those pollutants, individually by media, *af'ter* they have been produced and have the potential to move among media.

During the first 15 years of Federal environmental protection, this strategy of waste management by media has supported and enhanced the growth of a *pollution control culture.* Policymakers, regulators, industry, engineers, and environmentalists have become accustomed to thinking solely in terms of waste management. While economics and health issues and national goals in competition with public health and the environment play a variable part, the standards developed under the environmental programs are primarily based on an analysis of the tech-

nical capabilities for controlling those substances that are produced. Little parallel consideration has been given to pollution prevention by assessing and altering the activities that create the pollutants. Despite an increasing interest in waste reduction today, pollution control still appears to be the path of least resistance in environmental protection.

The Evolution of the Pollution Control Culture

The concept of pollution prevention was added to RCRA with the 1984 amendments on waste minimization. waste reduction, however, is not a new idea. Neither is recognition of the cross-media transfer of pollutants.

Pollution prevention has been a part of the Clean Air and Clean Water Acts since the early 1970s. While pollution control is given priority in these acts in the setting and application of air and water regulations, each allows for the use of alternative approaches. Each makes explicit statements equating environmental protection with pollution control and prevention. The first goal of the Clean Water Act, to eliminate the discharge of pollutants, is only physically possible if pollutants are eliminated at the source (i.e., by waste reduction). In setting effluent guidelines, the act allows the use of "process and procedure innovations, operating methods, and other alternatives. "[1] Title I of the Clean Air Act, which covers regulations for industrial sources, is named Air Pollution Prevention and Control. Throughout, the phrase *prevention and control* is repeatedly used. In setting regulations based on air quality criteria, the act in many places allows waste reduction options. [2]

Despite the seeming flexibility of these statutes, pollution prevention has not often been pursued. The more obvious path has proven to be pollution control. Pollution control is easier to pursue because it tends to use generic technology: wastewater treatment; scrubbers, electrostatic precipitators, and baghouses; cement walls; and steel drums. All must be adapted in varying degrees to each particular process that produces the pollutants but scientific principals and operations are well understood and outcomes can be reliably predicted. Pollution control is also easier because it does not involve penetrating into the confidentiality of or disrupting industry processes. Nor does it threaten product quality. Although regulations rarely require the adoption of specific technology, it is often simpler for a firm to adopt the control technology used to set regulations than to devise alternative methods.

Pollution Control's Beginnings

Legislative activity of the 1970s and the comprehensive assumption of Federal responsibility for environmental protection was a result of pollution problems that were identified in the 1960s. The immediate environmental crisis needing solution was an accumulation of problems that had been created in the past. The Nation's water was polluted, the air was dirty, and the land was overburdened with trash. Recognition of this crisis instilled a point of view that has persisted since: a perspective on pollution that focuses on its place of disposal or point of release, Since those early years, extensive measures have been taken to solve the problems created by pollutants; few have been taken to address the creation of pollutants. Wastewater treatment, a known civil engineering technology, quickly became the major clean water technology in the 1970s. Similarly, familiar techniques such as building walls as barriers were initially adopted for the Superfund cleanup program in the 1980s.

It is illuminating to note that in 1970, *before* major environmental legislation was passed, the first report of the Council on Environmental Quality included the following statement about the complexity of environmental problems and inadequacy of the pollution control approach:

> , . . the sources of air, water, and land pollution are interrelated and often interchangeable, A single source may pollute the air with smoke and chemicals, the land with solid wastes, and a river or lake with chemical and other wastes. Control of air pollution may produce more solid waste, which then pollute the

[1] Clean Water Act, Section 301(b)(2)(A).

[2] The waste reduction aspects of the individual environmental statutes are analyzed more fully later in this chapter.

land or water. Control of the water-polluting effluent may convert it into solid wastes, which must be disposed of on lands

The suggested solution was to have: "A far more effective approach to pollution control."[4] It was thought that this could be gained through the coordination of media problems that would come about with the organization of the Environmental Protection Agency.

The 1970 report makes little specific mention of pollution prevention. It analyzes water and air pollution, solid wastes, and pesticide use and presents a series of recommendations for each. Only in the discussions of water quality and pesticides does pollution prevention appear. Often prevention is mentioned within the context of research needs. For instance:

> Water pollution, like other forms of pollution, is a problem of materials balance . . . Attention must be given to technology assessment to prevent future pollution and to choose alternative courses that will reduce it.[5]

The situation was very different in the case of pesticide problems, where pollution prevention was a major finding. Proposals for more effective regulation included measures to assure adoption of less persistent or less toxic materials and to limit the availability of certain types of pesticides.

Pollution Control and Cross-Media Shifts

Despite recognition that the environment must be perceived as a single, interrelated system, EPA was organized by individual media rather than by functions.[6] The discussion about a need for a multimedia focus continues today.[7]

[3]Council on Environmental Qua lit}', *Environmental Quality 1970,* "Appendix H: Message of the President Relative to Reorganization Plans Nos. 3 and 4 of 1970, July 9, 1970, " p. 295.

[4]I bid., p, 295.

[5]1 1)1(1., p. 59.

[6]See Alfred Marcus, "Environmental Protection Agency," *The Politics of Regulation,* James Q. Wilson (ed.) (New York: Basic Book\, I! 80).

[7]See The Conservation Foundation, *Controlling Cross-Media Pollutants* IWashington, DC: 1984); and Barry G. Rabe, *Fragmentation and integration in State Environmental Management* (Washington, DC: The Conservation Foundation, 1986). Also, Christine Mlot, "Multimedia Maneuvers," *Science News,* Feb. 23, 1985; Rochelle L. Sta nfield, "Pollutants That Just Won't Go Away Pose Challenge for EPA and States, " *National Journal,* Dec . 8, 1984.

The current division among media is not always distinct. The Clean Air Act authorizes programs that deal with air emissions, Water as a medium is covered by three statutes: the Clean Water Act (discharges into U.S. waters), the Marine Sanctuaries Act (protection of coastal and ocean waters), and the Safe Drinking Water Act (sources of drinking water), The Resource Conservation and Recovery Act is generally understood to deal with the medium of land, but while it sets standards for land disposal of hazardous wastes—primarily to protect groundwater —it also does so for incineration, which inevitably involves air emissions. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) also deals with land issues through its controls on the use of pesticides. The Comprehensive Environmental Response, Compensation, and Liability Act (C ERCLA or Superfund) provides for the cleanup of polluted land and underground water resources. The Toxic Substances Control Act (TSCA), like FIFRA, focuses on chemical substances, the use of which can affect all media.

Pollutants are released into the environment as solids, liquids, or gases and do not follow paths set forth by statute, Once released their physical or chemical forms can change, and they can be transported some distance from their source by air or by water, The effect of environmental regulations and their implementation is often to shift pollutants among media—in some cases out of the realm of regulatory control. For example: both wastewater treatment plants and air pollution control devices produce a sludge which can be a hazardous waste and may or may not be regulated under RCRA; tall smokestacks required under clean air regulations to disperse emissions long distances are now suspected of being a source of acid rain; surface impoundments (settling ponds), for which RCRA sets operating standards, are a source of volatile organic compound (VOC) air emissions.

Shifting is not in itself an inherently bad practice. The impact of any particular form of a hazardous substance can vary with its presence in different environmental media, But determination of risk must be made individually, in-

eluding analyses of how the pathway will increase or decrease the potential for harm to human health or the environment. While shifting may solve a problem in one medium, it can create a problem in another. Prudence and limited resources with which to make determinations of risk would dictate that shifts be avoided whenever possible.

Shifts among media are possible and legally sanctioned because the environmental statutes differ from one another in a number of critical respects, They are inconsistent in the substances covered and in the way in which they are to be analyzed and regulated. Some statutes require that the economic impacts of regulations be considered; others do not. The rigorousness with which scientific evidence must be applied to the analysis of risk to human health and/or the environment differs among statutes. Even the language used in statutes and adopted in common use varies, as shown in table 5-1. Some definitions are specifically given by statute; others are set forth by regulation.

The regulatory philosophy of both the Clean Air and the Clean Water Acts has been to limit the amount of designated chemicals, compounds, or classes of chemicals released into the Nation's air and water, Regulated substances can still be produced and do not have to be destroyed. Both programs legally sanction industrial releases below permitted limits. The list of regulated chemicals and/or industries (sources) has never been the same for both water and air, allowing shifts between these media,

Hazardous wastes classified under RCRA have not been regulated in the same way as water and air pollutants. RCRA does not limit releases; it sets standards for the management (treatment, storage, and disposal) of whatever is produced. RCRA regulations apply to all industrial categories but unequally depending on the amount generated. The body of substances defined as RCRA hazardous wastes has always been much larger than those regulated either as air or water pollutants. Many RCRA hazardous wastes are not regulated under the Clean Air or Clean Water Acts as air or water pollutants although they can be the same chemical or compound. Therefore, if it is technically possible and economically beneficial, a regulated RCRA hazardous waste can be legally emitted into the air or water. Also, chemicals that are limited in terms of disposal by air and water regulations can be managed in unlimited amounts as RCRA hazardous wastes. These provisions create perfectly legal opportunities for shifts between RCRA (i.e., land disposal) and the air and water.

Growing evidence that the RCRA management practices for land disposal were failing to protect health and the environment is forcing a change in the RCRA system. The 1984 RCRA Amendments mandated EPA to impose a series of land disposal bans based on chemical classes. So far, EPA's approach toward setting these regulations has been based on the earlier water and air philosophy. Limits are being proposed for *permissible* water-borne releases from land disposal facilities.

The Pollutional Control System

The pollution control culture was graphically summed up in 1985 by the Administrator of EPA, Lee M. Thomas, who said:

> The current statutory structure arises from a general environmental strategy that has been accepted–consciously or not–by nearly everyone who has worked for environmental protection in this country. Let's call it the strategy of the cork,
>
> It consists of putting a regulatory cork in every pollution source you can find as quickly as you can. At first the corks may be somewhat loose and some pollution escapes. But with advances in technology they can be pushed in tighter. Of course, as we have seen, the pollution will tend to squirt out in new and unexpected places. The solution is a new set of corks, and the process of jamming them in begins all over again. The idea is that if you get enough corks, and put enough pressure behind them, pollution will eventually be eliminated. e

[8]Lee M. Thomas, "A Systems Approach: Challenge for EPA, " *EPA Journal*, September 1985, p. 22.

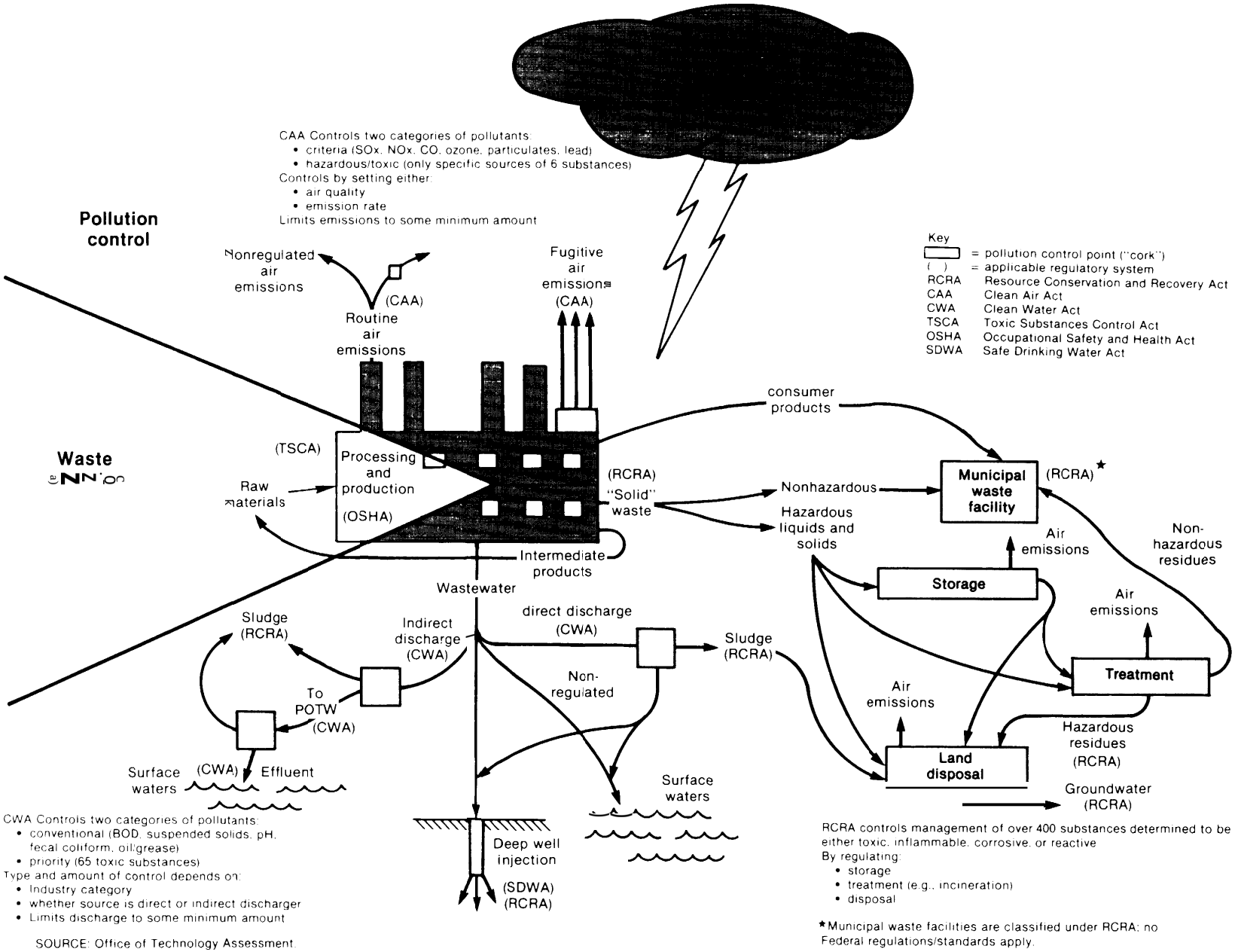
Table 5-1 .—Statutory Definitions of Hazardous Waste Terms

Terms by program	Statutory deflnltlon	Notes
Clean ***Water:***		
Conventional pollutants	Includl ng but not llmtted to pollutants classified as biological oxygen demanding, suspended sollds fecal conform. and pH [Section 304(a)(4)]	List appears In 40 CRF 401 16, with 011 and grease added
Toxic pollutants	those pollutants, or combinations of pollutants, including disease-causing agents, wh{ch after discharge Wl ll, on the basis of Information available to the Admlnlstrator, cause death, disease, behavioral abnormal ltles, cancer genetic mutations, physlolog}cal malfunctions (Includlng malfunctions In reproduction) or physical deformations, In organisms or their offspring [Section 502(13)]	
	Table 1 of Committee Print 95-30 of the Committee on Publlc Works and Transportation of the House of Representatives to be publlshed by Admlnlstrator Revisions to llst must take Into account tox!clty of pollutant, persistence, degradabdtty usual or potential presence of affected organisms In any waters and their Importance, and nature and extent of effect on organisms [Section 307(a)(l)]	List of 65 substances appears In 40 CRF 401 15 Commonly referred to as ‘ prlorlty’ pol lutants
Hazardous substances	such elements and compounds which, when discharged In any quantity Into or upon the navigable waters of the United States present an Imminent and substantial danger to the public health and welfare, Includlng, but not limlted to fish, [Section 31 l(b)(2)(A)]	A llst of hazardous substances as !dentlfled by the regulatory system appears In 40 CFR 1164
Clean Air:		
Air pollutants	emlsslons which In h~s [the Adm\nlstrator’s] judgment, cause or contribute to al r poll utlon which may reasonably be ant(clpated to endanger publlc health or welfare [Section 108(a)(l)(A)]	Often referred to as “crlterla” pollutants because of the alr quality crlterla document that must be Issued prior to regulat Ion
Hazardous alr pollutants	An alr pollutant to which no ambient air quallty standard IS applicable and which In the judgment of the Administrator may cause, or contribute to, an Increase In mortality or an Increase In serious Irreversible, or incapacitating reversible, Illness [Section 1 12(a)(l)]	Commonly referred to as “toxic” alr pollutants
RCRA:		
Hazardous waste	any solld waste or comblnatlon, which because of Its quantity, concentration or physical, chemical, or Infectious characteristics may (A) cause or stgntf!cantly contribute to an Increase In mortal lty or an increase in serious trreverslble, or Incapacltatl ng reversible, Illness, or (B) pose a substantial present or potential hazard to human health or the environment when Improperly treated, stored, transported, or disposed of, or otherwise managed [Section 1004{ 5)]	Lmt of reportable quantlt!es of hazardous substances IS In 40 CFR 261
CERCLA:		
Hazardous substances	(A) any substances designated [by] SectIon 31(b)(2)(A) of the Federal Water Pollut~on Control Act, (B) any element. compound, mfxture, solutton, or substance designated pursuant to section 102 of this Act, (C) any hazardous waste [regulated under] Sect Ion 3001 of Solid Waste Disposal A“ct (D) any toxic pollutant listed under Section 307(a) of Federal Water Pollution Control Act, (E) any hazardous alr pollutant I!sted under Section 112 of the Clean Alr Act, and (F) any Imminently hazardous chemical substance or mtxture Illsted under] SectIon 7 of TSCA [Section 101(14)]	List of reportable quantities of hazardous substances IS In 40 CFR 302
TSCA:		
Chemical substances and m Ixtures	any organic or Inorganic substance of a particular molecular density (not excluded by subparagraph B) [Section 3(2)(A)]	To regulate must make a flndlng of “unreasonable nsk of Injury to health or the environment”

SOURCE Cr,mp!lwl by the Off Ice of Technology Assessment, 1986 from enwronmental statutes and 40 CFR

F’igure 5-1 shows a hypothetical industrial plant with its ‘ regu1atory corks in p1ace, releases that are either legal sanctioned or not regulated, and cross-mcdia shifts of pollutants. As the figure shows, the pollution control side ef the plant is a complex maze. The application of waste reduction can reduce that complexity.

Figure 5-1.—Waste Reduction v. Pollution Control



SOURCE: Office of Technology Assessment

Environmental Protection Under the Pollution Control Culture

The dominance of pollution control in protecting the environment begs the question of effectiveness. Most people would agree that improvements have been made in the areas of conventional air and water pollutants and that high uncertainty exists in terms of unregulated and toxic substances.

The General Accounting Office in 1982 asked the question, "What have we accomplished?" It replied:

> Overall, there has been progress toward meeting established goals. The air is significantly cleaner, more wastewater now receives the required level of treatment, and most drinking water meets national standards. The job, however, is still far from complete.[9]

The Conservation Foundation reported in *1984* that since *1982:*

> Air quality has continued to improve . . . Water quality, on balance, has remained constant, as has been true for the past decade. As with air, this finding is based on the traditional measure of pollution and does not take into account pollution from toxic substances. There are simply not enough monitoring data to know whether the toxics problem is getting better or worse.[10]

Statutes are only as good as the regulations that follow. Once set, regulations must be complied with to be effective. Effective compliance depends on whether control devices have the technological capability to operate efficiently and routinely over time, Considerable time often separates the enactment of a statute and the promulgation of regulations.[11] Reasons commonly cited for this are: administrative delays, the technological complexity of setting regulations, the inadequate scientific base now available with which to determine health risks, and lawsuits that have been brought by both regulated industries and affected communities. Compliance with regulations is based on an analysis of the risk, by those being regulated, of not complying. This risk increases as the perceived level of enforcement activity increases. The compliance rate will also be proportional to the penalty for noncompliance.

Analysis of regulatory effectiveness for policymakers at the Federal level is complicated by a paucity of data. On a national basis, data are available that show the trends over time in the emissions of conventional air pollutants. Similar data are not available for hazardous air pollutants, conventional or toxic water pollutants, or RCRA hazardous wastes.[12] This is so despite the fact that environmental regulations impose innumerable reporting and recordkeeping requirements on industry (see ch. 4).

Air Quality

Conventional air pollutant data is obtained from continuous monitoring equipment operated by State and local governments and various Federal agencies. Some 250 million air pollution measurements are included in EPA's National Aerometric Data Bank,[13] and this information is compiled and published annually. The compilation published in 1986 shows that in 1984 emissions totaled 184 million metric tons. Total suspended particulate were 7 million metric tons; sulfur dioxides, 20 million metric tons; carbon monoxide, 75 metric million tons; nitrogen dioxides, 20 million metric tons; and volatile organic compounds (VOCS), 22 million metric tons. Over the period 1975-84, emissions of these pollutants decreased from between 6 and 33 percent. Lead emissions, recorded at 40 million tons per year in 1984, have declined 72 percent over the same period. In

[9]U.S. Congress, General Accounting Office, *Cleaning Up The Environment: Progress Achieved But Major Unresolved Issues Remain*, GAO/CED-82-72 (Gaithersburg, MD: July 21, 1982), p. i.

[10]The Conservation Foundation, *State of the Environment: Assessment at Mid-Decade* (Washington, DC: 1984), p. 9.

[11]For instance, while the statute was enacted in 1972, pretreatment standards for indirect water discharges are still not complete. Standards have been set for only six hazardous air pollutants after 15 years.

[12]For an overview of national environmental monitoring, see Rochelle L. Stanfield, "NO One Knows for Sure if Pollution Control Programs Are Really Working," *National journal,* Mar. 23, 1985, pp. 643-646.

[13]U.S. Environmental Protection Agency, *National Air Quality and Emissions Trends Report, 1984, EPA-450/4-84-001* (Research Triangle Park, NC: Office of Air Quality Planning and Standards, April 1986), p. 1 6.

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the report this dramatic decline is attributed primarily to the lowering of lead content in gasoline and the introduction of unleaded gasoline. Both of these are waste reduction, rather than pollution control measures.

No national data exist for emissions of specific hazardous air pollutants; there is no regular monitoring program. No time series data are available for these pollutants. The data that do exist are arrived at by such techniques as taking grab samples at specific locations and extrapolating the data received to the national level. Separate EPA estimates of annual releases of hazardous air pollutants give different results because methodologies and substances included vary. A study on control techniques for VOCS estimated annual emissions from industrial sources at 24.7 million metric tons.[14] Another report that attempted to pool available nationwide data on just 86 hazardous air pollutants estimated these emissions to be about 4,5 million metric tons per year.[15]

RCRA Hazardous Wastes

OTA, in its 1983 report Technologies *and Management Strategies for Hazardous Waste Control,*[16] said that about 255 to 275 million metric tons of hazardous waste under Federal and State regulation are generated annually. A national survey on the generation of RCRA hazardous wastes was released by EPA in 1984. It estimated that 264 million metric tons were generated in 1981.[17] No national trend data are available for this universe of pollutants. The Chemical Manufacturers Association has surveyed its members for the last 4 years but only 324 chemical plants have responded in all 4 years. In the 1984 survey, 725 plants reported generating 253 million metric tons of hazardous waste.[18]

Water Quality

The only national data on conventional and toxic water pollutants are models that predict the outcome of different levels of effluent limitations and compilations of permits that have been issued. These data do not show what is being discharged but only what industries have been permitted to discharge. Permit holders are required to monitor their actual discharges and submit Discharge Monitoring Reports regularly to EPA Regional Offices or State offices. The Regional Offices are responsible for the management of the monitoring data but they are generally years behind in doing so, The data are not systematically aggregated into national statistics,

The above discussion shows that national data is so disparate that it can only be used to provide a sense of the magnitude of multimedia pollutant releases. In addition, the data—by itself—indicates little about the consequences of discharges to public health and the environment.

Waste Reduction: Multimedia Pollution Prevention

The importance of waste reduction to environmental protection has been acknowledged in the national policy statement of RCRA which states: " . . . the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible, " As OTA has shown throughout this report, however, the primacy given to this concept over waste management is already being diluted by the various ways in which the regulatory term waste minimization is being individually defined and carried out under current regulations.

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[14] U.s. Environmental Protection Agency, Office of Air Quality Planning and Standards, "Control Techniques for Volatile Organic Compound Emissions From Stationary Sources, " draft report, July 1985.

[15] Tom Lahre, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, "Characterization of Available Nationwide Air Toxics Emissions Data, " June 13, 1984. The report discusses the difficulties of aggregating such data and their reliability.

[16] U. s. Congress, Office of Technology Assessment, *Technologies and Management Strategies for Hazardous Waste Control,* OTA-M-196 (Washington, DC: U.S. Government Printing Office, March 1983).

[17] U. s. Environmental Protection Agency, *National Survey of Hazardous Waste Generators and Treatment, Storage and Disposal Facilities Regulated Under RCRA in 1981,* EPA 5301SW-84-005 (Washington, DC: Office of Solid Waste and Emergency Response, April 1984], p. 2.

[18] Chemical Manufacturers Association, " Results of the 1984 CMA Hazardous Waste Survey, " January *1986.*

In short, although the concept of waste reducton is officially sanctioned, it is already being overwhelmed by the pollution control culture. To counter what appears to be an inevitable trend, waste reduction requires leadership and visibility. Neither is being provided yet by the Office of Solid Waste (OSW) at EPA where the responsibility for waste minimization now lies. There, the focus is solely on waste management, on avoiding the land disposal of RCRA hazardous wastes. Waste minimization has become one of several tools to achieve that goal rather than a goal itself. When asked about the significance of the 1984 amendments to the Resource Conservation and Recovery Act, the director of OSW said: " . . . it really makes it crystal clear that Congress wants the Agency to move away from land disposal to other *forms of disposal. '19*

Government spending on waste reduction reflects the general lack of priority for pollution prevention, As table 5-2 shows, government spent almost $16 billion in 1984 on pollution control. OTA estimates that government spending on waste reduction totaled only $4 million in fiscal year 1986. This amount will more than double if Congress approves the Department of Defense's request for $30 million in fiscal year 1987 for its new waste minimization plan. (An estimated 20 percent of that budget may go toward waste reduction.) Even then, overall spending on waste reduction will be less than 1 percent of that spent for pollution control.

Implementing a goal of pollution prevention (i.e., waste reduction) may only be possible when responsibility lies outside the existing media programs. A waste reduction program, especially one based on a nonregulatory approach,[20] need not rival the size and cost of the current regulatory media programs. Along with its own legislative mandate, provisions and resources of the existing programs could be used to implement a waste reduction program. Within either a regulatory or nonregulatory format, a separate waste reduction program could provide the basis for a shift from pollution control to pollution prevention. A separate waste reduc-

19"Making the New RCRA Work: An Interview with Marcia Williams, " *EPA Journal*, April 1986, p. 3. Italics for emphasis.

20The pros and cons of a regulatory vs. a nonregulatory program are presented in ch. 2 of this report. Also, in ch. 6, waste reduction activities at the State level which are predominantly nonregulatory are discussed.

Table 5"2.—Government Spending on Pollution Control v. Waste Reduction
(millions of dollars)

Type and source of spending	Total budget	Estimated percent for waste reduction	Annual expenditures
A. Pollution controP			
Pollution abatement			$12,275
Regulation, monitoring, and R&D			3,443
Total			$15,718
B. Waste reduction			
Federal Government:			
EPA			$0.8
Report to Congress (WM)	$0.550	x 50 = $0.175	
ORD WM R&D	0.235	x 10 = 0.02	
R&D HW grants	1.0	x 50 = 0.5	
DOD waste minimization program	5,0	x 20 =	1.0
TVA waste rnanagment	20	x 5=	0.1
State governments:'			
Based on 10 existing programs	7.0	x 25 =	1.8
Total			$3.7

aFederal, state, and local data for 1984 Department of Commerce news release, Aug 5, 1986
bOTA estimate for fiscal year 1986.
cSome State program funds are provided by EPA.
KEY: WR = waste reduction, WM = waste minimization, and HW = hazardous waste.
SOURCE As noted

tion program could also serve as an instrument to make the multimedia approach a priority within EPA.

Actions that generate air and water pollutants can be as amenable to waste reduction as are those producing RCRA hazardous wastes. However, with statutory authority covering only RCRA hazardous wastes, there is little reason to believe that industry or EPA will move beyond the regulations and consider air and water pollutants in their waste minimization programs,[21] While most State waste reduction programs focus on RCRA hazardous wastes, a few have taken a multimedia approach (see ch, 6),

Given this concentration on only one of the three regulated waste streams generated by industry and the inconsistencies that exist between the substances covered and the methods of regulation under RCRA and the clean air and clean water programs, the current *waste minimization program might actually contribute to an increase in air and water pollution.*

waste reduction, however, cannot by itself prevent all of the Nation's environmental problems. Some amount of hazardous wastes will always be generated. Some wastes will require land disposal because they cannot be recycled or completely destroyed. Some will be emitted unavoidably into the air and released into the water. Thus, it is important that the current pollution control regulatory system be held in place and its effectiveness increased through stronger enforcement activities. In the absence of prescriptive waste reduction regulations, the pollution control regulations become indirect incentives that encourage some in the private sector to adopt waste reduction.

The effective operation of a waste reduction program can also be hampered by existing statutes and regulations. The sanctioned, permitted release of pollutants under the air and water programs creates a problem for the measurement of waste reduction and may eliminate some of the incentive. Does waste reduction occur, for instance, when an existing raw (untreated) pollutant stream is reduced while the discharge or emission remains the same as it was because the standards legally sanction the rate of release? Any change in the outflow may cause a plant to become involved in permit revisions. A plant that makes a significant change may become subject to stiffer water or air regulations. Thus, current environmental protection statutes may be barriers to pollution prevention since no firm willingly adopts practices that will cause it to make costly revisions in its regulatory status.

[21] ~~For~~ instance, few' of the industry documents that O'I'A has obtained describing corporate waste minimization plans go beyond RCRA hazardous wastes; some explicitly exclude air and water regulated wastes from their plans. Most of the waste reduction case b istories now published focus on RCRA hazardous wastes.

WASTE MINIMIZATION: STATUTE AND REGULATIONS

The Hazardous and Solid Waste Amendments of 1984 set new national policy about the generation of hazardous waste. This policy and the waste minimization provisions that amended the Resource Conservation and Recovery Act (RCRA) now serve as the basis for Federal action to reduce the generation of hazardous waste,[22]

[22] The Hazardous and Solid Waste Amendments are Public Law 98-616, dated Nov. 8, 1984. This law officially amended the Solid Waste Disposal Act, which is commonly referred to by the sweeping amendments passed m 1976: The Resource Conservation and Recovery Act (RCRA). Hereafter, the Hazardous and Solid Waste Amendments will be referred to as the 1094 RCRA Amendments, or the amendments. Waste minimization was only one of many changes ade to RCRA in 1984.

The Statute

Under Section 1003 of RCRA, "Objectives" was retitled "Objectives and National Policy" and a new paragraph stated succinctly:

> The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment.

With this language and the implementation sections that follow, Congress defined a two-tiered national waste minimization policy, First and foremost, the generation of hazardous waste is to be *reduced* or eliminated. Second, the management of waste that is generated should follow practices that minimize risks. Concern about the continuing and long-term risks of hazardous substances formed the basis of this new policy in which three basic facts are recognized: hazardous waste that is not generated poses no risk to human health and the environment; good management practices can lower the risks of hazardous waste that is generated; and land disposal is the least preferred management practice.

These concerns were reiterated in a new paragraph of RCRA where specific methods for achieving the stated national policy are included. This objective states that one of the ways in which the protection of health and the environment is to be promoted is by:

> ... minimizing the generation of hazardous waste and the land disposal of hazardous waste by encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment . . . 23

OTA'S Waste Reduction

The RCRA national policy statement is the basis for this OTA study. The assessment is confined to the first part of that policy: the technical, industrial, and governmental aspects of actions to reduce the generation of hazardous waste. The second part of the national policy statement, hazardous waste management, was assessed in OTA'S 1983 report, *Technologies and Managment Strategies for Hazardous Waste Control .24*

Even though the amendment consistently refers to "hazardous waste, " OTA has included more than RCRA hazardous wastes in this study. Close examination of techniques and practices labeled waste reduction, often reveals that when RCRA wastes are reduced air and/or water pollution can increase. Most of the waste minimization provisions of the 1984 RCRA amendments originated in the U.S. Senate bill, The Solid Waste Disposal Act Amendments of 1983 (S. 757). The Senate Public Works and Environment Committee's report on the waste minimization provisions of this bill voiced concern about " . . . pollutants contained in effluents, emissions, wastes or other pollution streams . . . "2[5]

Thus, in this report OTA has considered the reduction of the generation of all wastes and has defined hazardous wastes as all nonproduct hazardous outputs from an industrial operation into all environmental media, even though they may be within permitted or licensed limits. (See ch. 1 for OTA'S definitions of waste reduction and hazardous waste.)

Waste Minimization Requirements

Three specific activities to implement national policy were mandated by Section 224 of the 1984 RCRA amendments. These requirements apply to generators of RCRA hazardous wasteZB who manage their wastes onsite or to those who ship wastes offsite. In addition, EPA, as the agency delegated to carry out RCRA policies, was told to study the "Minimization of Hazardous Waste" further and report back to Congress.

Specifically, Congress required:

Reporting Procedures:[27] Generators subject to reporting requirements were to include ... efforts undertaken during the year to reduce the volume and toxicity of waste generated; and . . . the changes in volume and toxicity of waste actually achieved during the year in question in comparison with previous years, to the extent such information is available for years prior to [Nov. 8, 1984]. "

Manifest System: 28 A section on waste minimization was added to require a gener-

[23] Solid Waste Disposal Act (SWDA), Section 1003(a)(6)

[24] OTA, op. cit., March 1983

[25] U.S. Congress, Senate Committee on Environment and Public Works, *Solid Waste Disposal Act Amendments of 1983*, Report No. 98-284, Oct. 28, 1983, p. 65.

[26] 40 CFR 260.10 defines generators as "any person, by site, whose act or process produces hazardous waste identified or listed in Part 261 of this chapter or whose act first causes a hazardous waste to become subject to regulation.

[27] SWDA, Section 3002(a)(6), Standards applicable to generators of hazardous waste.

[28] Ibid., paragraph (b)

ator's certification on the manifest for all regulated offsite shipments of hazardous waste, effective September 1, 1985. The certification was to state that, "the generator of the hazardous waste has a program in place to reduce the volume or quantity and toxicity of such waste to the degree determined by the generator to be economically practicable; and . . . the proposed method of treatment, storage, or disposal is that practicable method currently available to the generator which minimizes the present and future threat to human health and the environment. "

- Permits:[29] A section on waste minimization was added saying that, effective September 1, 1985, as a condition of any permit issued for the treatment, storage, or disposal of hazardous waste on the premises where such waste was generated the permittee certify, no less often than annually, that, "the generator of the hazardous waste has a program in place to reduce the volume or quantity and toxicity of such waste to the degree determined by the generator to be economically practicable; and . . . the proposed method of treatment, storage, or disposal is that practicable method currently available to the generator which minimizes the present and future threat to human health and the environment. "
- *EPA Study*[30] Congress required EPA to submit a report to Congress on "the feasibility and desirability of establishing standards of performance or of taking other additional actions under this Act to require the generators of hazardous waste to reduce the volume or quantity and toxicity of the hazardous waste they generate, and of establishing with respect to hazardous wastes required management practices or other requirements to assure such wastes are managed in ways that minimize present and future risks to human health and the environment. Such report shall include any recommendations for legislative changes which the Administrator determines are feasible and desirable to implement the national policy established by section 1003. " The report is due October 1, 1986.

[29] Ibid., Section 3005(h), Permits for treatment, storage, or disposal of hazardous waste,

[30] Ibid., Section 8002(r), Special studies; plans for research, development, and demonstrations.

Two Tiers of Waste Minimization

Each implementation section in the 1984 RCRA amendments is titled *Waste Minimization* and, like the national policy statement, is composed of two parts, The first part is concerned with the reduction of the generation of hazardous waste; the second with proper management of that which is generated. Some of the language in the implementation sections, however, is not as clear as that in the national policy. Phrases such as "reduce the volume or quantity and toxicity of such waste, " and "reduce the volume and toxicity of waste generated" can be interpreted as instructions either to: 1) reduce the generation of hazardous waste, or 2) reduce waste that has been generated. The first phrasing clearly instructs generators to practice pollution *prevention*. The second, however, implies pollution *control*, a management activity that takes place after a pollutant is generated. In requiring EPA to study the "Minimization of Hazardous Waste, " ambiguity appears again in the phrase "to reduce , . . the hazardous waste they generate. " This imprecision can shift or blur the hierarchy of activities based on risk that the national policy seeks (i. e., the primacy of waste reduction).

If the national policy statement is used as a guide to interpretation of the implementation sections, the intent of Congress seems clear. Waste minimization is an overall goal composed of two unequal parts. Within the context of voluntary waste reduction, generators should move as expeditiously as possible to reduce the generation of hazardous waste. This practice requires the alteration of industrial processes and operating procedures—a front-end approach that is pollution prevention. Congress recognized that zero reduction is usually not possible and stated that, for those wastes that are produced, *good* management practices (traditional end-of-pipe control) should be established,

The Regulations

Ten years ago, EPA published a preferred waste management strategy in the *Federal Register* that established waste reduction as the priority option (see figure 5-2). Rules and regulations pertaining to waste minimization were finalized on July 15, 1985.[31] The clear statement giving priority to waste reduction that was provided by the RCRA national policy statement (and EPA's earlier one) is not repeated in the regulations. Instead, the language and positioning of the regulations appear to shift the emphasis of waste minimization from reducing the generation of hazardous waste to reducing land disposal as a hazardous waste management practice.

The language used consistently in the regulations is the ambiguous "to reduce the volume or quantity and toxicity of waste generated. " In the explanatory preamble to the regulations, the terms minimize and *reduce* are used interchangeably, a practice not followed in the amendments. These imprecision in translating statute to regulations have served to guide generators away from reducing the generation of wastes—or even from examining the possibility of reducing the generation of wastes—before turning to waste management alternatives.

RCRA waste minimization regulations include: 1) a waste minimization statement added to the Uniform Hazardous Waste Manifest;[32] 2) two waste minimization information items added to the biennial report required of generators[33] and 3) a provision that each generator holding a treatment, storage, and disposal facility (TSDF) permit record a waste minimization certification in the written operating record kept at the facility .34 EPA made it clear that the last provision applied only to *generators* of hazardous waste, as the language in the amendments stated, This exemption emphasizes the importance of waste reduction over other as-

[31] 50 Federal Register *28702*.

[33] 40 CFR Part 262.41.
[34] 40 CFR Part 264.73(b)(9).

Figure 5-2.—EPA's Statement on Preferred Options

ENVIRONMENTAL PROTECTION AGENCY

EFFECTIVE HAZARDOUS WASTE MANAGEMENT (NON-RADIOACTIVE)

Posltlon Statement

The purpose of this position statement is to describe a preferred waste management strategy or set of priority pathways for hazardous waste control that adequately protects the public health and environment. The priority pathways are equally appropriate for routine (non-hazardous] waste management.

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Although several statements at the December public meetings urged specific definition of hazardous wastes for regulatory purposes, it is the Agency's view that, for purposes of this advisory position statement, a precise definition is not necessary Hazardous wastes are those which may cause or contribute to adverse acute or chronic effects on human health or the environment when such wastes are not properly controlled. These wastes primarily consist of the byproducts of industrial production, conversion, and extraction activities, and may be in the form of solids, sludges, slurries, liquids, or powders. Thev are not otherwise directly regulated under current EPA authority. Thus, hazardous wastemay include residues from pollution control devices (e.g., electrostatic precipitator dusts] as well as production rejects, excess, or obsolete chemicals and substance(e.g , DDT) For purposes of this position statement only, radioactive wastes are excluded.

Wastes containing toxic chemicals, pesticides, acids, caustics, flammables, and explosivesare often classified as hazardous wastes, although their properties may vary widely. Consequently the specific properties of each waste must be considered in determining needed control procedures. Although hospital and veterinary wastes are not the major focus of this pos it ion statement, they may contain pathological wastes which can be considered hazardous, and many of the same principles are applicable and desirable.

***

The Agency believes that reuse, energy recovery and material recover}. as well as treatment are desirable *prior* to u]t1mate disposal, especially land disposal. Thus, the desired waste management options are (in order of priority):

Waste Reduction
Waste Separation and Concentration
Waste Exchange
Energy Material Recovery
Waste Incineration/Treatment
Secure Ultimate Disposal

Waste reduction. Reducing the amount of hazardous waste at the source, through process changes, is desirable. Restriction of hazardous chemicals used in operations, substitution of less hazardous materials, and better quality control to reduceproductionspoilage are all examples of possible actions which reduce the amount of hazardous wasterequiring disposal Also, the less hazardous waste which must he disposed, the less the risk of environmental damage. Materialrecovery, such as solvent reclaiming, is another alternative which reduces waste within the industrialfacility

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Incineration/treatment Incineration even without energy resourcesis desirable, in its proper order of priority, mainly to destroy organic wastes, Other non-burnable wastes should he detoxified and neutralized to the extent possible through physical, chemical, and biological treatment. Careful attention to environmental emissions with control equipment and monitoring devices is still required regardless of th[' process employeed.

SOURCE Federal Register, VOI 41, No 61, Aug 18, 1976

pects of waste minimization. TSDF permit holders who are not generators would not be able to practice waste reduction since it must occur where wastes are produced. They can and should, however, be expected to practice good waste management.

The Manifest Certification

The waste minimization statement is included as a part of the Generator's Certification on the manifest and reads:

> ... Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the [practical][35] method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment,

The Biennial Report

Under RCRA, both generators who ship hazardous wastes offsite and those who generate and/or treat, store, or dispose of hazardous waste onsite must submit a biennial report by March 1 of each even numbered year. Only those generators who ship *offsite* (the same group subject to the manifest certification) are subject to the new waste minimization biennial reporting regulation. They are required by EPA to include in their reports:

> ... a description of the efforts undertaken during the year to reduce the volume and toxicity of waste generated . . . [and] . . . a description of the changes in volume and toxicity of waste actually achieved during the year in comparison to previous years to the extent such information is available for years prior to 1984.

EPA placed these regulations under Part 262.41(a) of the RCRA regulations. Generators who treat, store, or dispose of hazardous waste onsite are subject to biennial reporting requirements under Part 262.41(b) and, thus, do not have to report biennially on waste minimization efforts.[36]

The Permitting Condition

This third provision of the waste minimization regulations requires permitters who treat, store, or dispose of hazardous waste onsite where such wastes are generated to certify:

> ... no less often than annually, that the permittee has a program in place to reduce the volume and toxicity of hazardous waste that he *generates"* to the degree determined by the permittee to be economically practicable; and the proposed methods of treatment, storage or disposal is that practicable method currently available to the permittee which minimizes the present and future threat to human health and the environment.

This certification must be placed in the operating file that is maintained on the site of the TSD permitted facility.

Consequences of the Regulations

As a result of the way in which Congress wrote the legislation and EPA the regulations, generators of hazardous waste have been unevenly hit, no enforcement can reasonably take place, and little evaluation can be made as to whether the goals of waste minimization are being met. The regulatory program will not make possible the determination of whether waste reduction is taking place. Table 1-1 in chapter 1 summarizes how effectiveness has been eroded by the statute, regulations, and their implementation.

while many generators may operate in both modes, those who ship their hazardous wastes offsite are subject to two regulations; those who

[35] The word *practical* which appears in the amendments was omitted from this statement in the regulations.

[36] It can be argued that these on site managed wastes are not as potentially hazardous to the general public as those transported offsite, due to the lesser number of people with which they come in contact. However, many hazardous waste disposal sites that are now being cleaned up under the Federal Superfund program or by private parties are located on the sites where the wastes were generated. The potential damage to the Nation's groundwater is largely unknown.

[37] Italics added for emphasis to indicate another change in phrasing.

operate as a TSDF are subject to one. Small quantity generators (SQGs), on the other hand, are subject to the manifest certification but do not need to comply with the waste minimization portion of the biennial report.[38] Table 5-3 gives a breakdown of the types of generators under RCRA and the waste minimization regulations to which each is subject.

It will be difficult to evaluate how effective y waste minimization is being implemented. Data collected because of the regulations will be sparse and inconclusive, Only the biennial reporting regulation requires an actual description of voluntary efforts and the submission of time series data to show whether wastes have been reduced or not. (Both the manifest and permit certification only require a statement that such a program is in place and that wastes that are generated are being managed properly.) The information provided by the biennial reports will be from a small subset of the Nation's RCRA hazardous waste generators, as the reporting ignores those wastes that are managed on the site of generation.[39] In addition, as discussed in chapter 4 of this report, true waste reduction can be disguised in waste generation trend data by changes in production, changes in the amount of nonhazardous constituents in waste streams, regulatory changes, and cross-media shifts. Despite this complication, the regulations do not provide any guidance to generators on appropriate waste minimization measures.

A potential change in the emphasis of national policy arises out of the way that EPA wrote the regulation regarding TSDFs. Lan*guage appears in this regulation that never appeared in the amendments and does not appear in the other regulations.* A TSDF permittee is told that it is a condition of his permit that he reduce the wastes *that he generates.* This phrasing implies an end-of-pipe approach to waste minimization and is inconsistent with the fact that TSDFs that only manage wastes are not covered by waste minimization regulations. Either EPA has placed a TSDF permittee in a different category with regard to waste minimization or the ambiguous phrases used elsewhere (under manifesting and reporting) can be interpreted in this latter fashion.[40]

From EPA's perspective, enforcement is not an important aspect of these regulations, as is consistent with Congress' objective of encouraging voluntary efforts. In the *Federal Register* notice, EPA cited legislative history[41] as making it clear that the amendments do not authorize EPA to interfere with or to intrude into the production process. Reinforcing the voluntary nature of current waste reduction activities, the "economically practicable" test for the reduction of the generation of hazardous waste and the "practical method" test of hazardous waste management are to be defined individually by each generator.

EPA, however, stated a concern with compliance ''with the certification signatory require-

[38] The 1984 amendments mandated EPA to promulgate standards by Mar. 31, 1986, for Small Quantity Generators who generate between 100 and 1,000 kilograms per month. The statute exempted SQGs from TSDF permitting requirements if they store onsite up to 180 days, rather than 90 days. EPA wrote the SQG regulations such that SQGs are not subject to the waste minimizations biennial reporting requirements. They are, however, subject to the full manifesting provisions of RCRA. Thus, the waste minimization certificate on the manifest form must be signed. [51 Federal Register 10146, Mar, *24, 1986,]*

[39] The State of California has recognized this coverage deficiency of the biennial reports. A law was enacted in September 1985 (Assembly Bill No. 685) that imposes the reporting requirements as a 'TSDF permitting condition for generators who manage wastes on the site of generation. The language adopted was that of the 1984 RCRA Amendments, however, so that while the State will be receiving more information from a larger universe of generators, it will be the same inconclusive information.

Table 5-3.—Waste Minimization Regulations

	Regulations		
Generators	Manifest certification	Biennial report	Permit certification
Off site shipment. . .	X	X	0
Onsite TSDF	0	0	X[a]
Small quantity	X	0	X[a]

X = required, O = not required
[a] Only SQGs holding wastes more than 180 days need to obtain a TDF Permit

SOURCE Off Ice of Technology Assessment

[40] When the biennial reporting regulations were translated into the instructions on the form, the phrase reads: "reduce the volume and toxicity of the hazardous waste *which your business generates."* [U.S. Environmental ['protection Agency, Hazardous Waste Generator Report for 1985, EPA Form 8700-13A (5-80) Revised (11-85).]

[41] Using the Senate Report No. 98-284 on .S,757. See previous citation,

ment" which it identifies as the manifest certification.[42] Manifests are not collected by EPA. They are sequentially routed along with each batch of hazardous waste and end up wherever the material comes to rest. Copies of manifests (with the certification) are not routinely inspected by EPA. Similarly, the waste minimization certifications made by TSDFS are placed onsite. Verification of compliance could only be made by collecting such documents from the 5,000 national TSD permitted facilities. Given the language used in the regulations, however, verification of a signed certification, would not indicate whether a generator has: 1) a program to reduce the generation of hazardous waste, 2) a program to reduce waste that is generated, or 3) a program that combines both. OTA could not find any evidence of any enforcement activity underway.

The EPA Report to Congress

In requiring EPA to study waste minimization, Congress broke the task into the two components of waste minimization. Both parts deal with establishing requirements (i. e., no longer a voluntary program) that generators comply with national policy. In the first part EPA is to advise on possible methods to *require* the reduction of the generation of hazardous waste. In the second, EPA is to advise on *required* good management practices for those wastes that are generated. Because EPA's effort was ongoing during OTA'S study, OTA has not been privy to the content of EPA's forthcoming report to Congress. Sources of information that are available include statements made by EPA officials preparing the report and drafts of contractor background reports.

EPA recognizes that the 1984 RCRA Amendments failed " , , . to give [a] clear and concise definition of the term waste minimization . . . "[43] However, instead of using the national policy statement in the amendments as the basis for its working definition of "waste minimization," EPA has consulted legislative history (Senate Report No. 98-284) and, it says, sought advice from outside organizations such as the Great Lakes Regional Waste Exchange and the National Association of Solvent Recyclers.[44] Its definition of waste minimization becomes :[45]

> Any source reduction or recycling activity undertaken by a generator that results in (1) the reduction of total volume of hazardous waste or (2) the reduction of quantity and toxicity of hazardous waste, that is either generated or subsequently treated, stored, or disposed. Such activities must be consistent with the goals of minimizing present and future threats to human health and the environment.

Source reduction is subsequently defined as:

> Any activity that reduces or eliminates the generation of a hazardous waste in a process.

and a material as being recycled if:

> . . . it is used, reused, or reclaimed.

EPA's *source reduction* is analogous to OTA'S *waste reduction*. But, the emphasis of national policy on waste reduction (i. e., its primacy) is lost in the EPA definition of waste minimization. Source reduction activities are front-end practices which by their nature minimize hazardous substances and therefore lessen public health and environmental risk. But in EPA's definition these practices carry no precedence over recycling. The phrase "that is either generated or subsequently treated, stored, or disposed" implies that waste minimization can take place either before the wastes are generated or after.

[42] 50 Federal Register 28734, July 15, 1985.

[43] James R. Berlow, Treatment Technology Section, U.S. Environmental Protection Agency, speech before the "Hazardous and Solid Waste Minimization" conference of the Government Institutes, Inc., May 8-9, 1986.

[44] Ibid.

[45] Ibid.

EPA'S IMPLEMENTATION OF WASTE MINIMIZATION

The Office of Solid Waste (OSW), one of three major units under EPA's Assistant Administrator for Solid Waste and Emergency Response, is charged with implementing RCRA. OSW is awaiting the findings of its report to Congress to proceed with any waste minimization activities beyond the promulgation of the regulations mandated by the 1984 RCRA Amendments.[46] Meanwhile, little oversight is being conducted of the implementation of those regulations, and no waste minimization organizational entity has been set up within EPA. Waste minimization is not a budget item; the issue is given only passing reference in EPA's fiscal 1987 budget justification document.

With the inclusion of waste minimization in the 1984 RCRA Amendments, Congress gave some attention to the issue of reducing the generation of waste. In regulating and implementing waste minimization, EPA is caught between the statute's call for regulations and congressional intent that they not be intrusive. Should enforcement occur, EPA has no criteria of its own with which to judge compliance. Congress left the choice of exactly how to meet the regulations up to the regulated community by providing that substantive determination of "economically practicable" and "practicable method currently available" be made by the generator. Further, the statute did not explicitly define waste minimization and EPA did not define it in the regulations. As a result, not only the choice of actions but also the determination of what actions constitute waste minimization has been left up to the regulated community.[47]

A Low-Priority Issue

In keeping with Congress' initial low-key approach to waste minimization, OSW has not assumed a leadership role and considers waste minimization a low-priority item on its agenda. If considered at all, waste minimization is something for the future. This lack of priority and of any distinctiveness given to waste minimization by EPA is reflected in many OSW statements, actions, and publications, A draft document, "Hazardous Waste Implementation Strategy, " produced by OSW in March 1986, analyzes ways to incorporate all the 1984 RCRA Amendments into the existing program. It also provides some insight into OSW's thoughts about potential waste minimization options. Within the short-term strategy section, waste minimization receives only scant mention, as a way to shift more responsibility to waste generators. Under the long-term strategy (beyond 4 years), waste minimization becomes "the long-run solution to many of [our] current problems and should be a major component of our long-run strategy.[48] The document then discusses how increasing regulatory burdens will make "this concept . . . feasible. " Options are presented that range from "voluntary implementation and technology transfer to promulgating uniform waste generation limits by industry category. " The latter are presented in terms of waste streams, whether they are untreatable and whether they are low or high risk. Untreatable wastes, for instance, could be subject to minimization levels while minimization of low-risk wastes could be affected by technology transfer and outreach programs. A "marketable permits approach" could be considered for high-risk, untreatable wastes.

[46] Marcia Williams, Director, Office of Solid Waste, U.S. Environmental Protection Agency, statement to OTA, Mar, 13, 1986.

[47] A de facto definition is evolving, however, The principal contractor for EPA's report to Congress on waste minimization has been making speeches at conferences and seminars over the last year using a definition of waste minimization that includes waste reduction, recycling *and* treatment—any activity short of land disposal, Because of the contractor's known connection with EPA, industry has been adopting this definition, despite the fact that EPA's own later working definition for the report does not include treatment.

[48] M[illegible]. S. Environmental Protection Agency, Office of Solid Waste, "Hazardous Waste Implementation Strategy, " undated draft (copy made available to OTA from OSW in April 1986), p. 26. In the April 1986 issue of *EPA Journal*, the director of OSW was quoted as saying that this document, which concentrates on pollution control, was to serve as a catalyst for discussion about what is really important and key in the implementation of RCRA.

A brochure, *Highlights of the Hazardous and Solid Waste Amendments of* 1984: *The New RCRA requirements*[49] is sent in response to all inquiries received about RCRA. A copy of the brochure is presented as figure 5-3. Where is there any mention of waste minimization? Is it one of the "major changes?" Is it among the list of the new law's "significant provisions?"

In the Hazardous Waste section of EPA's *Operating Guidance FY 1987,* waste minimization is not one of eight program priorities. It appears, instead, under a subsection on "new initiatives" within Goal 111: "Anticipate and prevent future environmental problems and maintain high levels of environmental quality. " Other than announcing the anticipated report to Congress, the single paragraph devoted to the subject states that waste minimization "holds promise for helping to abate capacity shortfalls and for assuring the public that effective efforts are being made to manage waste responsibly. " In other words, waste minimization *might* help to control pollution; *no* value is placed on prevention. The only action indicated for 1987 is the vague statement: "secure implementation of appropriate waste reduction/minimization method[50]

The Office of Solid Waste was reorganized in May 1986, but the opportunity was not used to raise the visibility of or bestow any importance on waste minimization or waste reduction. In fact, the opposite appears to have occurred. Previous to OSW's reorganization, the group preparing the waste minimization report to Congress was located in the Treatment, Recycling, and Reduction Program, five levels below the Assistant Administrator, Under the reorganization, this program was renamed the Treatment Technology Section. It remains five levels down and under the Waste Treatment Branch of the Waste Management Division (ex-Waste Management and Economics Division) of OSW. The Waste Treatment Branch is given "primary responsibility for the assessment of technologies and promulgation of regulations, guidelines, and guidances for the storage, treatment, incineration, and recovery of hazardous wastes. " In the reorganization announcement, the only time the words "waste minimization" appear is as the last of the Waste Management Division's 32 assigned functions: "Developing the Report to Congress on Waste Minimization.[51]

Waste Minimization Oversight

It is a reflection of the lack of any focus on waste minimization that responsibility for the current requirements of the 1984 RCRA Amendments is shared by many portions of OSW. As mentioned, the report to Congress is being prepared by the Treatment Technology Section. The manifest certification, biennial reporting, and permitting provisions are assigned to offices normally responsible for such activities. The State Programs Branch has overall responsibility for seeing that the 1984 amendments are implemented at the State level; EPA Regional Offices are responsible for implementation in those States without authorized RCRA programs.[52]

The 1984 amendments provided that all requirements or prohibitions of the act pertaining to the generation, transportation, treatment, storage, or disposal of hazardous waste were to take effect in all authorized and nonauthorized States at the same time. EPA was directed to carry out such requirements and prohibitions directly in a State until the State became authorized to do so. EPA decided that all the RCRA rules promulgated on July 15, 1985, including those regarding waste minimization,

[49]U.S. Environment] Protection Agency, EPA/530-SW-85-008, April 1985.

[50]USEnvironmental Protection Agency, *Operating Guidance FY 1987* (Washington, DC: Office of the Administrator, March 1986), p. 37.

[51]Gary M. Katz, Director, Management and Organization Division, U.S. Environmental Protection Agency, memorandum on "Reorganization of the Office of Solid Waste, " to Howard M. Messner, Assistant Administrator, May 7, 1986.

[52]The number of States with RCRA authorization changes from time to time; as newly authorized States are added, existing authorized States can lose that status by not adhering to the rules, In March 1986, 33 States had received final authorization to operate RCRA programs. No States, at that time, had authorization to implement the 1984 amendments. Federal and State RCRA people often use the terms *pre-HSWA authorization* and *post-HS WA authorization* to distinguish between the latter two possible states of State RCRA authority,

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Highlights of the Hazardous and Solid Waste Amendments of 1984

The New RCRA Requirements

On November 8, 1984, amendments were enacted strengthening the Resource Conservation and Recove~ Act (RCRA), the federaf law protecting human health and the environment from the improper management of hazardous waste. This new legislation—the Hazardous and Soiid Waste Amendments of 1984-makes many changes in the national program that regulates hazardous waste from the time it is generated to its final disposition. The program 1s administered by the U.S. Environmental Protection Agency (EPA) through its Office of Solid Waste.

The new legislation makes major changes in the program to:

. Contro] ***leaking underground*** storage tanks. There may be as many as 10 million tanks used to store fuel, toxic chemicals, and waste in the United States. Leaking tanks are a growing source of ground-water contamination.

● Control hazardous waste generated in quantities between 100 and 1000 kilo~rams per month. The inciusion of these small quantity generators will increase the number of federally regulated generators from about 15,000 to over 150,000.

. Phase out the land disposal of hazardous waste. in the future, waste generators will have to reduce the amounts of hazardous waste generated, recycle their waste, and use other treatment technologies to the maximum extent possible

● Give EPA authority to develop new crl terid for facilities receiving nonhazardous soiid waste (municipal iandfills) to ensure that these facilities adequately protect human }]eaith and the envl rorrmen t from ground-water contamination

The following is a iist of the new I.*w's significant provisions.

. Immediate prohibition against certain land disposal practices, (for exarnpie, placement of liquids in landfilis. salt beci formations, mines, and caves: use of hazardo~ wa~te as a dust suppressant; and certain types of injection of hazardous waste].

. M inirnum technology requirements for hazardous waste Iandfilis, surface tmpoundmen ts, and incinerators (for example, installation of double liners, systems for co]iecting leach~~e, aiid ground-waler monitoring)

. Require[nc[][s ior re[rofi[ting L'eridl Il existing surface impoundments with iiners.

. Expanded requirements for monltorlrrg and cleanup of ground waier al fJcllit Ies holding permits under RCRA.

. Authority to clean u p past reie~ses of hazardous wastes at RCRA-permi tted fac II I[Ies

. Authority [o expedite permits for new and innovative treatment technologies to foster research and developmcni

. Authority, to impose permit conditions beyond the scope of the exis~irlg RCRA regulations 10 prolect human heai[h and the environment

. Require mer; ts to identify addi I lon~l hazardol]s wastes.

● A full assessment of the hazards posed by a waste prior to dells[ing

● Enhanced federal en forcemerr t du t hOritl CS (including Lhe .ibitt ty [o issue 'correct I\e action orders to f~c II I t Ies U'I[h i nterl m 5(.+ [us under RCRA)

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. Specific coii [rols on t])e burn i ng and blc I IJI ng of hazardous wastes as fuels

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Figure 5-3.—EPA Brochure on "The New RCRA Requirements"

met that test and therefore were to "take effect in authorized States and are Federally enforceable. "[53] Thus, until States are authorized under the 1984 amendments, the burden is placed on EPA to implement those amendments.

As of March 1986(8 months after the regulations were promulgated) little oversight was being provided by EPA. OSW was not aware of which States had adopted the new Uniform Manifest, whether the biennial reporting forms in use requested the required waste minimization program information, or whether the waste minimization conditions were being included as a permit condition for TSDFS. OTA conducted a telephone survey during the last 2 weeks in March 1986 to ascertain how much implementation was underway since the information was not available from OSW, In some cases, EPA Regional Offices could supply the information; in others it was necessary to contact State RCRA offices.

One particular comment made repeatedly to OTA by people in EPA Regional Offices and in State RCRA offices was that no guidance was provided by OSW to EPA Regional Offices, States, or generators as to what constitutes "waste minimization" or a waste minimization program. The rationale for this lack of guidance apparently derives from the nonintrusive intent of the statute, which allows actions to be determined by generators, The consequence of this lack of guidance—especially of any attempt to define waste minimization—is confusion among generators and regulatory staff and a lack of any consistency in reporting.

Manifest Certification

The waste minimization certification statement was added to the Uniform Manifest; and the new manifest became effective on September 1, 1985. The results of the telephone survey by OTA showed that, in general, States have adopted the use of the new manifest for offsite shipments.

The position of the waste minimization statement on the manifest form caused some concern among generators, It was added as a second paragraph to an already existing statement certifying that the information on the form was correct. In many firms a shipping supervisor had been responsible for signing that certification. It was not appropriate for that person to certify, as well, that the firm had a waste minimization program in place.

There is no Federal enforcement of manifests; the regulated community is relied on to monitor compliance and report possible violations of the tracking system. Some States do collect manifests, primarily to obtain waste generation data[54],"

Biennial Reporting

Under RCRA regulations, all generators and TSDFS must report the previous year's activities biennially (in even numbered years).[55] This reporting system was first used in 1984 (covering 1983), and the second reporting was done in 1986. In States with RCRA authority, generators and TSDFS report to their State, which in turn must send a summary of the collected information to EPA. In States without RCRA authority, generators and TSDFS report to the EPA region covering their State. The EPA region is then responsible for the summary report to EPA. Generators and TSDFS must report by March 1; States and EPA Regional Offices have until September 30 to submit a summary report to EPA.

The last set of information collected by the biennial report in 1984 was never aggregated to provide data on a national level about the state of waste generation in 1983, A major problem encountered by EPA was the lack of consistency of waste definitions among States. Few, if any, of the problems that prevented aggregation of the 1983 data were corrected prior to the collection of the 1985 data,

Biennial reporting is the only one of the three waste minimization activities in which the statute language specifically requires generators

[53] 50 Federal Register 28729, July 15, 1985.

[54] For instance, New York, New Jersey, California, Michigan, Pennsylvania, and Illinois collect a copy of the manifest and computerize the data.

[55] Some States require annual reporting.

to indicate any changes in volume and toxicity of waste over the previous year. But neither the statute nor the regulations provide a standard and appropriate measurement method. As a result, the data collected will be inconclusive. It will also be sparse, because this reporting is only required of those who ship wastes offsite, a subset of the Nation's generators.

EPA did not forewarn generators about the new waste minimization reporting requirements. The EPA form for 1985 reporting included three-quarters of a page titled ''Section XVI. Waste Minimization (narrative description)." The complete instructions for this section are:

> Describe in the space provided your efforts, undertaken during calendar year 1985, to reduce the volume and toxicity of the hazardous waste *which your business generates.* Also describe changes in waste volume and toxicity actually achieved during 1985 in comparison to previous years, to the extent possible.[5B]

Some States have their own forms; some have used the EPA form. Some, such as Minnesota, used the previous 1983 form as a guide and the result was that they failed to collect the waste minimization information. One State, New Jersey, went beyond the Federal requirement and included with the reporting form a survey for generators to complete on waste minimization activities. This was not done because New Jersey saw a need for a more systematic collection of information. Instead, State officials were afraid that without providing some further explanation of "waste minimization" they would be overloaded with telephone calls from generators wondering what that narrative statement should contain (see ch. 6).

EPA did not provide any supplemental information to generators about the new reporting requirements. One EPA official was advising generators who asked for guidance about their narrative statement to consult the statute (rather than the regulations). They were also informed that simply stating: "I have no waste minimization program" would be acceptable since the statute language did not *require* generators to have such a program. Procedural guidance was given to EPA regions for those required to conduct the biennial reporting for unauthorized States but no guidance was provided to authorized States. EPA considers the burden of reporting to be on generators to follow the statute and regulations, whether or not the State form includes a request for a waste minimization statement.

Despite the lack of EPA oversight, a majority of States appear to have included a waste minimization statement requirement. This information, however, will be kept at the State level as States do not have to include waste minimization information on the summary that they must supply to EPA by the end of September. Because of the lack of guidance given to generators as to what constitutes waste minimization, there will be no consistency in the information that is reported to States or EPA. Given *the EPA language in the instructions that accompany its form, it should be expected that most generators will report on waste management rather than on waste prevention activities.*

Permitting

All TSDFS must obtain an operating permit from EPA (or their State if it has RCRA authority). The permit is issued in two steps: An interim (Part A) followed by a final (Part B) permit. So far, most TSDFS are operating with interim permits and can continue to operate that way until EPA or the State notifies them to apply for a Part B. Until States are authorized to implement the 1984 RCRA Amendments, a joint permitting system exists for new TSDF permits, A State can issue a permit covering the pre-1984 amendments and the EPA region attaches the additional 1984 amendment requirements.

In the case of permitting, EPA did offer guidance to Regional Offices. In a memo on September 1985,[57] it advised them on how to proceed

[56] U.S. Environment] Protection Agency, Hazardous Waste Generator Report for 1985 [Form 8700 -13A (5-80] Revised (1 1-85)]. The section of the regulations covering the reporting requirements is also included as part of the form packet, Italics added for emphasis.

[57] Bruce R. Weddle, Director, Permits and State Programs Division, Office of Solid Waste and Emergency Response, U.S. Environ mental Protection Agency, memo to Hazardous Waste Division Directors, Regions I-X, Sept. 11, 1985.

with the waste minimization permit condition. In addition to providing the appropriate language[58] the memo dealt with the joint permitting system. It suggested that if the waste minimization condition was the only 1984 RCRA Amendment condition of a permit, then a special arrangement could be worked out with the States (prior to authorization) whereby they could incorporate the waste minimization condition themselves when writing an onsite TSDF permit.

[58] It is quite brief. An addition of the phrase ''and (9 [on-site only])" to the Operating Record portion of the permit refers the permittee back to the 40 CFR 264.73 section where the operating record regulations are written. Paragraph [9] of that section contains the annual certification of waste m inimizat ion requirement.

OTA found that the aspect of the waste minimization regulations that deals with permitting conditions was well understood at the region level. Either regions were assuming responsibility (under the joint permitting procedure) or held responsibility for unauthorized States or they had arranged to delegate the responsibility to the States. What was not clear at the regional and State levels was how to explain to generators just what constituted a waste minimization program. In other words, how to write the permit and what to write in the permit had been made clear. But, what generators with permits are expected to write up in their annual waste minimization statement was left unclear,

WASTE MINIMIZATION: A VOLUNTARY ENDEAVOR

From a nonintrusive regulatory statute, a contradictory *voluntary waste minimization program with mandatory reporting requirements* has been created. It is an attention getting approach that can cause those firms subject to the regulations—or, certain people in them—to give more thought to waste minimization. But, in the absence of an official definition for waste minimization, responses should predictably be more of the easy, familiar waste management actions that have been taken in the past. Growing awareness and the threat of a more stringent regulatory program may motivate some firms to do as much as seems feasible. But other firms uncertain about future legislation and/or regulations may do little, holding off on major changes to make sure that they will conform to future legislative and regulatory language. This latter response may be especially true in a regulatory environment with little enforcement.

As discussed above, however, certain legislative and regulatory aspects of the current, voluntary waste minimization program assure that neither a qualitative or quantitative evaluation of its impact can be objectively accomplished. All mandatory reporting is in a narrative form, and there is no recognized definition of waste minimization to at least standardize the reports.

Today there is no way to know with any certaint y whether *waste reduction* has occurre is the principal focus of action or even whether industrial practices are changing and *waste minimization* is underway. Three sources of formation are available and can offer some indication of what is happening: 1) anecdotal evidence from firms in public statements about their waste minimization plans, 2) hundreds of case histories presented in the literature and at conferences, and 3) generator surveys conducted to ascertain attitudes and forecast waste reduction's potential, None of these sources can reliably provide the information being sought. Anecdotal evidence contributes to the body of knowledge but does not provide definitive information, Case histories only report positive experiences. Waste reduction forecasts are flawed because they fail to consider that *waste reduction technology* encompasses the entire arena of industrial production (see ch. 3).

Corporate Plans

While a number of firms have well-publicized waste minimization plans, firms without any plans are silent, Some positive response to the current voluntary program does not necessarily indicate a readiness throughout U.S. industry to embrace waste minimization. Moreover, for

some of the same reasons that compliance does not necessarily follow regulations, plant activities can remain unrelated to corporate plans and statements. Many firms have supplied OTA with copies of their corporate waste minimization plans. The examples presented below, which show commitment by three firms, point out that the definition of waste minimization varies but tends to include waste reduction and waste management and that waste reduction is not given any primacy, In general, firms are reluctant to provide the level of detail that would give convincing proof of waste reduction because of proprietary concerns.

A major U.S. firm has formed a Corporate Hazardous Waste Minimization Committee. It has instructed its plant managers on how to comply with the waste minimization regulations. Information has been requested from plant managers to form the basis of company reporting requirements, Included are: 1) quantities and nature of wastes generated per year, 2) procedures and technologies used in waste disposition, 3) steps taken to reduce the volume and/or toxicity of wastes generated, and 4) changes in volume and/or toxicity achieved. However, nowhere in the corporate documents is the distinction made between the reduction of the generation of wastes (waste reduction) and reduction of wastes that have already been generated (waste management). Also, the company has asked its plants to report volume *and/or* toxicity reduction, whereas the regulations ask for volume *and* toxicity reduction. While manufacturing process change is identified as a way to promote the reduction of wastes, the two research projects funded in 1986 (solidification and incineration) are intended to solve waste management problems not enhance the feasibility y of waste reduction.

Another firm, a medium-sized chemical company, defined waste minimization in an internal notification about the new RCRA regulations, The definition includes generation minimization, recycle/reuse, treatment, and disposal. While the document does not explain the term *generation minimization,* its placement in the list of actions implies reduction of the generation of waste and the document does suggest that selecting production processes that minimize byproduct streams is the most cost-effective and efficient method of dealing with wastes.

Minimization is defined in a major chemical company's corporate plan as any waste reduction or waste management practice short of land disposal. Corporate policy does place waste reduction as the prime consideration, and the company has given detailed information in public forums about its waste reduction projects. Public relations brochures on the environmental policies of two of the company's plants contain graphs showing significant reductions in air releases and water *emissions* of specific hazardous wastes over 10 years despite increased product production at the plants. Left unsaid, however, is how the reductions were accomplished. Waste reduction receives a one-line mention in each brochure while the balance of the *24* pages deals with waste management. This emphasis on waste management leaves the impression that waste reduction was not the prime factor in the reduced levels and that pollution control or waste management may have occurred.

Case Histories

OTA reviewed the literature on waste reduction case histories (see ch. 5). Case studies pertain to both waste management (consistent with waste minimization) and waste reduction. 1n general, OTA found that often the data most critical for analysis were omitted. Hazardous substances were poorly identified, information about the concentrations of chemicals in waste streams was missing, and it was often difficult to ascertain whether the reported waste reduction involved volume or toxicity or both, In addition, because case histories have focused almost exclusively on RCRA wastes, air and water examples were difficult to obtain and often suspected shifts from RCRA to air or water could not be documented.

Surveys

Another way to determine the status of waste reduction is through a survey of generators.

One section of OTA's industry survey (see app. A) was to have been completed only by those firms that have engaged in waste reduction activities. Of the 99 firms that completed the survey, only four skipped that section. This high rate of response seems to imply that most firms have waste reduction activities underway. It could, however, also be a consequence of the fact that the survey respondents were biased toward waste reduction, and this bias should lead to a higher than normal activity level.

Other surveys have been conducted in the last year or so by a consulting firm while analyzing the need for hazardous waste facilities in several States. These surveys asked generators who ship wastes offsite to project their plant's potential for waste reduction, Thus, these firms were to respond about the current feasibility for waste reduction, given the extent of their knowledge, weight of current incentives to reduce wastes, and current disincentives to generate hazardous waste. In an indirect way these results can be seen as indicating the extent to which surveyed generators have considered waste reduction. These estimates of potential should be somewhat higher than activities actually underway. A compilation of the results for five States over a variety of industry categories and waste streams shows that the potential for waste reduction ranges from 4 to 47 percent. (For more information on these surveys, see ch. 3.)

Under the current waste minimization program, little definitive information is voluntarily made available that makes it possible to assess the current state of waste reduction and little is being collected for future analysis because of the waste minimization regulations in effect today. It is possible to say that some work is underway but not to say how much, how widespread it is across the Nation, or how environmentally significant it is.

THE EXISTING MEDIA PROGRAMS: WASTE REDUCTION OPPORTUNITIES AND PROBLEMS

The environmental programs with major nationwide influence on U.S. industry are those based on: the Resource Conservation and Recovery Act, the Clean Water Act, and the Clean Air Act, The impact of TSCA over the last 10 years has been primarily the cost to chemical manufacturers of reporting. The Superfund (CERCLA) program affects the economics of industrial activity directly through its taxing mechanisms and, indirectly, through liability provisions.

The following reviews of these major statutes, regulations, and programs offer some insight into the opportunities and problems associated with operating a waste reduction program within the context of the existing environmental protection system,[59] Table 5-4 contains general information about the programs and includes information on the Federal Insecticide, Fungicide, and Rodenticide (F IFRA) and Safe Drinking Water (SDW) programs, as well. As the table also shows, about $1 billion has been requested for Federal spending on these program for fiscal year 1987. Most of these funds cover pollution control; very little is spent on waste reduction. (See table 5-2 for a comparison on government spending for pollution control vs. waste reduction,)

Throughout the following analysis only the Federal level is considered. Some State environmental programs may effectively compensate for some of the Federal deficiencies. It is, however, beyond the scope of this report to analyze 50 State air, water, and hazardous waste regulatory programs. State waste reduction programs are the subject of chapter 6 in this report.

Resource Conservation and Recovery Act[60]

Since its beginnings, the RCRA program has been a waste management program. Through

[59] In ch. 4 of this report, the relevance to waste reduction of the information and data collection systems of the current environmental programs is separately evaluated.

[60] The waste minimization actions mandated by the 1984 RCRA Amendments are discussed in preceding sections of this chapter. This section covers other aspects of the RCRA program that pertain to waste reduction.

Table 5-4.—Comparison of Environmental Control Media Programs

Program	EPA office	Fiscal year 1987 request (mllllons $)[a]	Pollutants covered	Parties subject to regulation	Type of regulation
R C R A	Office of Solid Was~~ (under Assistant Admlnlstrator for Solid Waste and Emergency Response)	$256.2	Hazardous waste, either Ilsted or by meeting characteristic test	Generators Transporters Treatment, storage, and disposal facllltles (TSDFS)	Management standards, EPA sets by regulation
Clean Alr	Assistant Admln!strator for Alr and Radiation	$2392	Alr (crlterla) pollutants Hazardous	Industnal sources Mobile sources	EPA sets emlsslon l lmlts/standards State or local authorities permit
Clean Water	Assistant Admfnlstrator for Water	$2178	Conventional Toxic priority Nonconventional	Direct dischargers Into U.S waters !ncluding publ!cly owned treatment works (POTWS) Indirect dischargers (into POTWS)	By Industrial category emission guldeltnes set by EPA, allowed discharges set by permit Pretreatment standards set by EPA
T S C A	Office of Toxic Substances (under Assistant Administrator for Pestlclde and Toxic Substances)	$ 893	Potentially any chemical, must be judged “unreasonable risk” Statute excludes some speclflc substances, prohlblts manufacture of PCBS	Manufacturers and Importers of chemicals	Can prohlblt manufacture, require labellng, llmlt production, require record keeping, control disposal methods. require notification to customers
FIFRA	Office of Pestlclde Programs (under Assistant Admlnlstrator for Pestlclde and Toxic Substances)	$ 69.4	Pestlclde	Manufacturers Users	EPA sets regulations on use, registers manufacturers, monitors residues States certify firms that apply pesticides
S D W	Office of Drinking Water (under Assistant Admlnlstrator for Water)	$ 841	Contaminants found In dr!nklng water	Suppliers of drtnklng water Users of underground Inject Ion wells	EPA sets national allowable maximum concentration levels (MCLS) and regulations for users of Inject Ion wells States Implement and enforce

aBudget data are from EPA s Budget Justification Document for fiscal year 1987

SOURCE Office of Technology Assessment

the act or regulations, RCRA defines hazardous wastes; prescribes a manifesting system for all wastes shipped off the site of generation; and sets operating standards for generators of hazardous waste, for facilities that treat, store, or dispose of hazardous wastes, and for transporters of hazardous waste. Permits are required to operate treatment, storage, and/or disposal facilities.

While this management system sounds comprehensive, exclusions and operating inefficiency erode its effectiveness. Congress, in the 1984 RCRA Amendments, tried to fix the deficiencies by setting up a series of land disposal bans based on chemical classes, bringing small quantity generators into the system, requiring the control of underground storage tanks, and requesting studies on such recognized problems as discharges of hazardous wastes to publicly operated treatment works (POTWs) and on mine wastes.

The failure of land disposal to control pollution has become well known, especially under the companion Superfund program. In moving toward land disposal bans, the RCRA program is, however, also moving away from the current method of defining hazardous wastes. This change has implications for waste reduction. Traditionally, once a substance is defined as a hazardous waste, any amount or concentration of that waste is hazardous. There are no limits placed on the amount that can be generated, but once generated it must be managed in a prescribed manner. Waste reduction occurs when less of a hazardous waste is generated. Under initial plans for land disposal bans, EPA has developed a system of permissible water-borne releases, similar to the basic system used in the air and water programs. On a more comprehensive basis, but at a more preliminary stage within the RCRA program, is a plan to redefine the universe of hazardous wastes using a health-based model for setting permissible concentrations." Should such a change eventually be adopted, a hazardous waste could be eliminated—in a regulatory sense—simply by lowering its concentration. If, under a health-based model, hazardous wastes are ranked by degree of hazard, then waste reduction could occur when a less hazardous material is substituted,

The land disposal bans process is also pushing the RCRA program toward "the use of treatment technologies on a large and comprehensive scale," despite the fact that " . . . waste minimization, recycling and reuse [are] the preferred solutions under RCRA. [62] (Preferred solutions, with waste reduction at the top of the list, were first officially articulated by EPA in 1976; see figure 5-2.) While millions of dollars are being spent by the RCRA program on land disposal bans and treatment technology, the expanded use of the stated preferred solutions is left to " . . . the normal operation of the marketplace. [63]

The POTW study[64] was conducted to determine if the Domestic Sewage Exclusion in RCRA should be repealed, This exemption states that domestic sewage and any "mixture of domestic sewage and other wastes that passes through a sewer system to a publicly-owned treatment works for treatment" is not a hazardous waste.[65] The rationale for this exemption under RCRA is that industrial wastes discharged to sewers are regulated by CWA'S pretreatment standards. Among its findings, the study concluded that 95 percent of the metals in such discharges were eliminated due to Clean Water Act regulations. At the same time, the control systems required by these regulations were catching only 50 percent of the

61 *Inside E.P.A. Weekly Report*, vol. 7, No. 23, June 6, 1986.

62 John P. Lehman, "Can Pollution Be Destroyed?" *EPA Journal*, April 1986, p. 10.

63 Ibid. EPA has proposed spending over $75 million in fiscal year 1987 on a Hazardous Waste budget category called Regulations, Guidelines, and Policies, [U.S. Environmental Protection Agency, *justification for Appropriation Estimates for Committee on Appropriations, Fiscal Year 1987, pp. HW-23 and HW-25.] A major component of that category is the development of the land disposal bans. Underway is the identification of best demonstrated available technology (BDAT) for classes of wastes harmed from lane] disposal.*

64 *U.S. Environmental Protection Agency, Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works* (Washington, DC: Office of Water Regulations and Standards, February 1986).

65 40 CFR Part 261.4(a)(ii). The regulation actually states that such mixtures are not *solid wastes*. However, due to RCRA regulations, a substance must first be judged a solid waste before it can be a hazardous waste.

organics discharged to POTWs.[66] EPA recommended that continuation of the CWA programs " . . . can bring about major, additional reduction of organic substances. "[67] In other words, despite past experience, it was concluded that the regulations based on pollution control would eventually work effectively to remove pollutants, There was no consideration given in the study to solving the problem by reducing the generation of hazardous wastes which are now being dumped into the sewage system,

In the EPA report to Congress on mine wastes, waste reduction was considered. The extraction and processing of minerals presents some unique problems for waste reduction. The objective in mineral extraction is to obtain as high as possible a concentration of the desired mineral, leaving behind waste tailings. When chemicals must be used to assist in the separation process, the EPA report points out that: ''some changes in beneficiation processes can lead to changes in the chemical composition of the tailings released into tailings impoundments. [68]

Recycling Regulations

New RCRA regulations on recycled materials, which are often cited as disincentives to waste minimization, became effective in July 1985. '9 As discussed in chapter 1, it is difficult to determine precisely the difference between recycling as waste reduction and recycling as waste management. EPA explicitly excluded from regulation those recycling activities it determined *not* to be waste management practices. TO In general, under the new regulations, recycled (used, reused, or reclaimed) materials are defined as solid wastes. As such, recycJed materials can be subject to hazardous waste regulations under Subtitle C of RCRA. Special exemptions, however, allow waste reduction to occur outside of RCRA. A key exemption is materials " , . . recycled by being returned to the original process from which they are generated, without first being reclaimed, [71] If a material is first reclaimed before being returned to a process, a variance must be obtained to exempt that material from RCRA regulations.

A major benefit of waste reduction is avoiding the regulatory system since that which is not produced is not regulated, The recycling regulations can require a firm to apply for a variance if its waste reducing in-process recycling requires a reclamation step. While the variance procedure provides for regulatory escape, it *can also be a deterrent to waste reduction,* The need for a variance can also prod industry to consider alternate waste reduction approaches (such as changes in process technology and equipment, process inputs, and end products) which have less of an add-on or end-of-pipe character and may be more difficult to achieve technic ally. [72]

New regulations concerning the burning and blending of fuels and use of waste oils are also often cited as disincentives to waste minimization because they regulate practices that can reduce the use of land disposal, Depending on the circumstances, OTA considers the burning and blending of fuels to be, at best, a marginal waste reduction approach. Such regulations

[66] Some of the chemicals released by industries *are* shifted to the air and land during t ransportat ion" to POTWs. At the POTW, the received chemicals (loadings) are either destroyed or discharged to the air, land, and water. Of the substances received by the POTW group included in the study, 14 to 25 percent volatilizes to air, 43 to 62 percent biodegrades, 14 to 16 percent ends up in sludge, and 8 to 18 percent is discharged into surface water. *[Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works, op.* cit., p. *5-8.]*

[67] Lee M. *Thomas, Administrator,* U.S. Environmental protection Agency, POTW study transmittal letter to U.S. Congress, Feb. 7, 1986.

[68] U.S. Environmental Protect ion Agenc]", *Wastes from the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden from ['ranium Mining, and Oil Shale, EPA/530-SW-85-033* (Washington, DC: Office of Solid Waste, December 1985), p. 3-5.

[69] The f i nal rules were published i n 50 Federal Register 614, Jan. 4, 1985. The regulations may be altered somewhat in *1987* by a lawsuit pending in the U.S. Court of Appeals in Washington, DC.

[7050] Federal Register 619, Jan. 4, 1985, Part I(I I 1)(B] Secondary Materials That Are Not Solid Wastes.

[71] 40 CFR Part 261.29(e)(1). Reclamation is defined by RCRA as an activity that: " . involves the regeneration of wastes or the recovery of materials from waste s," [50 Federal Register 618, Jan. 4, 1985,]

72 See ch. 3 of this report for a complete discussion of waste reduction approaches and the tendency of industry to concentrate on in-process recycling.

could indirectly and positively influence waste reduction decisions by increasing the cost of producing these materials.

Small Quantity Generators (SQGs)

The 1984 RCRA Amendments brought into the system those firms generating between 100 and 1,000 kilograms per month of hazardous waste. The SQG regulations, finalized on March 24, 1986,[73] included two on waste minimization: manifest certification and the TSDF permitting condition. SQGs must now complete a portion of the biennial report but not the waste minimization section.

Most of the nonregulatory activities related to SQGs in RCRA have been outreach efforts to assure that such generators become aware of their new responsibilities. One method of doing so has been through the dispersal of RCRA Section 8001 grant funds via EPA Regional Offices to State and local governments and other nonprofit entities.[74] The fiscal year 1985 funds ($4.5 million), were not intended exclusively for SQG-related projects. They were in part to:

> . . . fund the development or implementation of State or local hazardous waste management efforts not directly permit-related but focused on innovative waste management activities, such as waste reduction, waste exchange, siting, use of alternatives to land disposal, shared treatment, and assistance *to small quantity generators,* which will reduce dependency on land disposal . . . [75]

However, the single largest group of projects that resulted and most of the funding went for SQG education and assistance projects. A review of the summaries of 80 such projects reveals that most dealt with compliance needs. Only three projects included waste reduction. The second set of funds (fiscal year 1986, $4.5 million) was awarded by the Regional Offices for projects based on the same guidance information as was provided for the previous year. For this reason, it is unlikely that waste reduction will become a higher priority during the second round of projects. It was expected that a large portion again will be directed at SQGs, as supporters again conducted an organized effort to obtain the funds,[76]

There was at least one possible win and one definite loss for waste reduction in the 1986 Section 8001 grants. Pennsylvania's Department of Environmental Resources was awarded $125,000 by EPA Region 3 to fund "hazardous waste source reduction" demonstration or pilot projects. Despite the fact that Pennsylvania's definition of source reduction is similar to OTA'S waste reduction, the grants will be available for both waste reduction and waste management projects. The loss is a research and technical assessment program begun by Tennessee's Department of Economic and Community Development with fiscal year 1985 Section 8001 funds that will not continue. Tennessee had received $90,000 for Phase I of this program, which was matched by $10,000 in State appropriated funds. The department's request to EPA for 1986 funding for Phase II was denied by Region 4. One goal of the project had been to "reduce hazardous waste generation for 3 to 5 selected industrial categories by 20 to 50 percent." Both State projects are aimed at small and medium-sized business.

Clean Air Act (CAA)[77]

Federal responsibilities concerning industrial sources of air pollution have included the setting of National Ambient Air Quality Standards (NAAQS) for total suspended particulate, sulfur dioxides, carbon monoxide, nitrogen dioxides, ozone, and lead; the setting of National Emission Standards for Hazardous Air Pollutants (N ESHAP); the imposition of new source

[73] 51 Federal Register 10146.

[74] The availability of these funds has been one of the reasons that State waste reduction programs have targeted such generators. See the discussion in ch. 6 of this report.

[75] U.S. Environmental Protection Agency, "Guidance on Use of Additional Appropriation for State and Local Activities," Attachment B to memorandum from Lee Thomas to all Regional Administrators, Dec. 13, 1984.

[76] Marty Madison, Office of Solid Waste, U.S. Environmental Protection Agency, personal communication, May 14, 1986.

[77] Although initial versions of the act date from the early 1960s, the Clean Air Act was passed essentially in its present form in December 1970 (Public Law 91-604) with additional amendments in 1977 (Public Law 95-95). Legislation was pending in the 99th Congress to amend the act.

performance standards (NSPS) on emissions from new stationary sources of pollution; and oversight for State programs which set up permitting systems to control actual emissions .78

The Clean Air Act begins, "Title I—Air Pollution Prevention and Control" and continues with Findings and Purposes, among which are:

> that the *prevention and control* of air pollution at its source is the primary responsibility of States and local governments; and
>
> .,. that Federal financial assistance and leadership is essential for the development of cooperative Federal, State, regional, and local programs to *prevent and control* air pollution.[79]

Title I includes the stationary source provisions of the Clean Air Act, those that affect U.S. industry. [80]The phrase *prevention and control* appears throughout the first sections of the act. The Administrator is to encourage cooperative activities "by the States and local governments for the *prevention and control* of air pollution." A national R&D program is to be established for the *prevention and control* of air pollution,[81]

The Pollution Control Culture Under CAA

Unlike under the Clean Water Act, where pollution control has been the primary tool, both pollution control and prevention have been adopted under CAA. In the 1970s, initial actions by EPA concentrated on setting NAAQS. These environmental quality standards, which serve as the basis for individual plant emission limits determined at the local level, are now well established. Standards for numerous new sources and standards for six hazardous air pollutants have been promulgated. Unlike NAAQS, these latter two categories (NSPS and NESHAP) determine emission limits for individual sources of pollutants and can be industry-specific.

Conventional (Criteria) Pollutants .—The Air Quality Criteria and Control Technologies section[82] of CAA governs conventional pollutants. With the issuance of air quality criteria documents, which give the scientific basis for NAAQS, EPA is obligated to provide information to States and air pollution control agencies on "air pollution control techniques" related to specific air pollutants, However, such information must include data on " . . . available technology and *alternative methods of prevention* and control of air pollution. Such information shall also include data on *alternative fuels, processes, and operating methods which will result in elimination or significant reduction of emissions.* [83] Thus, while the statute requires EPA to disseminate information on pollution control methods to meet the criteria, it is also supposed to accompany that information with alternative methods that include waste reduction approaches, (See ch. 3 for a discussion of waste reduction methods.)

New Source Performance Standards .—Section 111 of CAA requires EPA to set NSPS based on the "application of the best technological system of continuous emission reduction . . . the Administrator determines has been adequately demonstrated . . . " The technological system is defined by the statute in two ways. The first is a "technological process for production or operation by any source which is inherently low-polluting or nonpolluting" (i.e., a waste reduction approach). The second includes a pollution control approach or the pretreatment of fuels,[84]

As discussed in chapter 3, given the variety of industrial processes and operations in use it can be more difficult and expensive to prescribe *the best* (as the statute requires) technological system if it involves waste reduction rather than pollution control. Production processes can be

[78]EPA can also prevent significant deterioration (PSD) in selected regions where NAAQS are higher than ambient conditions and place limits on new emissions in non attainment areas where NAAQS are not being met. Under CAA, EPA also deals with air pollution from mobile sources.

[79]Italics for emphasis, Section 101(3) and (4).

[80]Title II deals with mobile sources.

[81]Clean Air Act, Section 102(a) and 103(a).

[82]Ibid., Section 108.

[83]Ibid., Section 108(b)(1). Italics for emphasis.

[84]Ibid., Section 111(a)(l). Fuel pretreatment includes such techniques as "washing' coal to remove the sulfur prior to combustion. Depending on the fuel, the substance removed may be as hazardous as that which would be emitted after combustion. If so, a potential CAA problem most likely ends up as a RCRA or a CWA problem,

plant-specific, whereas pollution control tends to involve generic systems applicable over a wide range of production processes.

Hazardous Air Pollutants.—In setting hazardous air pollutant standards, EPA is directed to "issue information on pollution *control techniques* . . . [85] The amendments to CAA passed in 1977 allowed EPA to promulgate "a design, equipment, work practice, or operational standard" when it is not "feasible to prescribe or enforce an emission standard. [86] This paragraph gives EPA the authority to set waste reduction standards for hazardous air pollutants. The Administrator can also allow the use of "alternative means of emission limitation" that will achieve a reduction in emissions equivalent to the emissions standard. This appears to give an individual generator the option of applying a waste reduction approach to meet the emission standards. The option could be unattractive to a generator, however, if a lengthy and costly procedure is required to obtain approval from EPA.

The history of hazardous (toxic) air pollutant regulations under CAA highlights many of the problems intrinsic to a pollution control scheme, especially one facing the regulation of potentially hundreds of substances.[87] Regulatory actions concerning hazardous air pollutants are defined and regulated under Section 112. This section is currently one of the most controversial parts of CAA. Of prime concern to many people is the slow way and the methodology by which hazardous air pollutants have been identified and studied and how the decisions regarding whether or not to impose emission standards have been made. Since Section 112 was added to CAA in 1970, 29 substances have received some kind of regulatory attention by EPA; emission standards for specific sources have been set for six of them by mid-1986.

In its 1985, "A Strategy To Reduce Risks to Public Health From Air Toxic [88] EPA outlined plans to move forward in regulating hazardous air pollutants. The major component of the plan, however, was to shift responsibilities to other Federal programs (such as FIFRA and TSCA) and to the State level. Few, if any, new ideas were presented; waste reduction was not considered,

While industry can be subjected to varying regulations by State and regional air control districts, the Federal list of regulated toxic substances under CAA is short, and standards are not comprehensive in terms of industry category or source. Substances that are not regulated can be emitted without limit. Not all emissions of a particular substance are covered; only specific, identified major sources are included. Benzene standards, for instance, apply so far only to fugitive sources (defined as various equipment, such as pumps, compressors, etc., "intended to operate in benzene service"). Any equipment at a site "designed to produce or use less than 1,000 megagrams of benzene per year" is exempt, [89] (One thousand megagrams is equal to 1 million kilograms or *1,000* metric tons.) Coke oven emissions standards (proposed in January 1986) are intended to control a variety of substances but only from wet charging and topside leaks.[90] The cost of setting NESHAP has been high. EPA has been working on the setting of benzene standards since 1977 and has categories other than the above yet to be determined. Expenditures—on this one substance—have totaled over $6 million through fiscal year 1985.[91]

Waste Reduction Under CAA

As the above shows, a legislative framework exists for the reduction—to complement the control—of hazardous air pollutants and also, to a lesser degree, of conventional air pollutants. NSPS explicitly allow waste reduction to be used for standard setting, but the language

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@s Ibid., Section 112(b)(2). Italics for emphasis.

Be Ibid., Section 112(e)(l).

[87] A new study, undertaken by OTA in 1986, will assess the regulation of hazardous air pollutants.

[88] U.S. Environmental Protection Agency, Washington DC, June 1985.

[89] 40 CFR *61* .1 *10* through 61.112, July 1, 1985.

[90] U.S. Environmental Protection Agency, "A Strategy To Reduce Risks to Public Health From Air Toxics, " table I.

[91] U.S. Congress, General Accounting Office, *AIR POLLUTION: EPA Strategy to Control Emissions of Benzene and Gasoline Vapor,* GAO/RCED-86-6 (Gaithersburg, MD: December 1985), p. 66.

requiring a finding of the best technological system places a high burden on its use for that purpose.

The concept of reduction has been used under CAA. For example, sulfur dioxide emissions have been lowered in part by a switch to the use of lower-sulfur content coal. However, the NSPS for sulfur oxides for coal-fired utilities both sets a maximum allowable emissions rate and requires the removal of 70 to 90 percent of potential emissions by technological *means,* Thus, utilities are required to use pollution control scrubbers whether or not waste has been reduced at the source.[92] Under the NAAQS category the use of waste reduction has not been similarly overridden. Emissions of nitrogen oxides from existing combustion processes have been partially controlled by changing process operating conditions, such as combustion temperature.

On the other hand, for many of the industries subjected to CAA regulations, pollution control equipment may be more commonly used. In a document on control techniques for VOCS, EPA reported that there are two methods, end-of-pipe control and "changes in the process or rawt materials, " employed commercially to control VOC emissions.[93] Chapter 3 of the document contains 63 pages of general discussion on pollution control and two pages on waste reduction. Air pollution control devices such as electrostatic precipitators separate out rather than convert or destroy pollutants and baghouses collect particles contained in air streams. The resultant solids and sludges, if hazardous, are then shifted to the RCRA regulatory arena. [94]

The type of emission standard employed by EPA under NESHAP varies by substance and source. Operating standards have been applied (i.e., for asbestos use). For vinyl chloride, emission standards are stated either in concentrations (ppms) permitted to be released, which is conducive to the use of stack scrubbers, or in terms of allowable operating losses per product unit. The latter standard is more liable to promote waste reduction.

Innovation Waivers

Incentives to promote the development of innovative ways to control pollution were introduced into CAA by amendments to the act in 1977,[95] Waivers can be granted to both new and existing sources to delay compliance dates while new systems are being designed, installed, and tested. In both cases there must be a substantial likelihood that the new method will either reduce emissions below the regulatory standard or meet the standard at lower cost. Waste reduction could apply in either case but may have to be explicitly mentioned as a feasible alternative to be considered by regulators and industry.

According to a study conducted by the Department of Commerce in 1980, the waivers have failed to encourage industry to develop innovative technology. [96] The main reasons cited were lack of flexibility, confusion over the eligibility of technology, and inappropriate time limitations, (See also the following discussion of waivers under the Clean Water Act,)

[92] See U. S. Congress, Office of Technology Assessment, *Acid Rain and Transported Air Pollutants: Implications for Public Policy,* OTA-O-204 (Washington, DC: U.S. Government Printing Office, June 1984), p. 141 and app. A to ch. 7.

[93] U.S. Environmental protection Agency, "Control Techniques for Volatile Organic Compound Emissions From Stationary Sources," op. cit., p. *3-1.* The stated purpose of this document is to comply with Section 108(b) of CAA (see above] which requires EPA to provide information on pollution prevention methods.

[94] A typical 1,000-megawatt power plant scrubbing high-sulfur coal produces about 200,000 tons of sludge per year. [*Acid Rain and Transported Air Pollutants: Implications for Public Policy,* op. cit., p. 141.]

[95] The waiver provisions appear in Sections 111(j) and 113(d)(4) of the Clean Air Act.

[96] "Opportunities for Innovation: Administration of Sections 111 (j) and 113(d)(4) of the Clean Air Act and Industry's Development of Innovative Control Technology," as cited by Nicholas A. Ashford, et, al., "Using Regulation To Change the Market for Innovation, " *Harvard Environmental Law Review,* vol. 9, 1985, *pp. 419-466.*

Clean Water Act (CWA)[97]

The Nation's current programs governing discharges to surface waters were set in 1972 by major amendments to the Federal Water Pollution Control Act. Among the policy and goal declarations in the statute are:

> . . . it is the national goal that the discharge of pollutants into the navigable waters be elim*inated* by 1985;
>
> . . . it is the national policy that a major research and demonstration effort be made to develop technology necessary to *eliminate* the discharge of pollutants . . . [98]

It is only physically possible to achieve the goal of elimination of discharges of pollutants by eliminating pollution at the source (i.e., waste reduction). Elimination from the Nation waters can occur by using end-of-pipe treatment that shifts pollutants to another medium. This latter strategy of pollution control has been the guide for over a decade of emphasis on a system of controlled, sanctioned discharges designed to "restore and maintain the . . . integrity of the Nation's waters.[gg] The second, interim goal of the statute has become guiding principle:

> . . . it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983; '00

A basic premise of the Clean Water Act is that the only legal pollutant discharge is a regulated discharge. In all other cases, "the discharge of any pollutant by any person shall be unlawful. [101i] Since *1972,* technology-based regulations have been imposed on industrial plants in over *30* industrial categories and on publicly owned treatment works (POTWs). CWA splits dischargers into two groups: those who emit pollutants directly into surface waters and those who Discharge indirectly through sewers to POTWS. The direct dischargers—both POTWS and industrial plants—are subject to permitting conditions under the National Pollutant Discharging Elimination System (NPDES). For this group, effluent limitations which set the maximum quantity or quality of pollutants that may be discharged are promulgated by EPA and are used to set specific permit conditions for levels of conventional pollutants, toxic pollutants, and nonconventional pollutants,[102] Indirect users of POTWS that have pretreatment programs, are subject to toxic pollutant pretreatment standards. [103] The discharge levels allowed under effluent limitations and by pretreatment standards vary among industrial subcategories and also by whether a discharge is a new or existing source of pollutiono[104]

The Pollution Control Culture Under CWA

While EPA is instructed to " . . . prepare or develop comprehensive programs for *preventing, reducing, or eliminating* the pollution of the navigable waters and ground waters. . . [105]

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[97] Throughout this discussion the terms Clean Water Act and CWA will be used, as is common, when referring to the Federal statute, the Federal Water Pollution Control Act (FWPCA). The latter act was originally passed in 1948 [Public Law 80-845) to which major amendments were made in 1972 by Public Law 92-500. The Clean Water Act is actually the name of the 1977 amendments [Public Law 95-21 7) to the Federal Water Pollution Control Act.

[98] FWPCA, Title 1, Section 101(a)(1) and (6). Italics for emphasis.

[99] Ibid., Section 101(a). In some instances, like for the Paint and Ink Formulating category, the regulations [40 CFR Parts *446* and 447] require that no discharge of process wastewater be made. EPA justified this discharge ban by noting that most plants already comply by using solvent recovery, incineration, and contract solvent recovery *[40* Federal Register 31724, July 28, 1975]. These are waste management approaches that can shift pollutants from navigable waters into other media.

[100] Ibid., Section 101(a)(2).

[101] Ibid., Section 301(a).]

[102] Conventional pollutants are biochemical oxygen demand (BOD), total suspended solids (TSS), pH, fecal coliform, and oil and grease. Toxic pollutants under CWA are more commonly called "priority pollutants. " They are designated by Section 307(a)(1) of the act and listed in 40 CFR Part 401.15 as 65 classes of toxic pollutants which determine 126 specific materials. Most are organic chemicals; 13 are heavy metals.

[103] Indirect dischargers are also subject to General prohibitions [40 CFR Part 403.5(a)] and Specific Prohibitions [40 CFR Part 403.5(b)]. These regulations prohibit pollutants that will "Pass Through or Interfere" with POTW operations and pollutants that will cause hazards (fire and explosions), corrosive damage, etc.

[104] The basic industrial categories (see 40 CFR 403, App. C) are broken down into several hundreds of subcategories. For a more comprehensive review of the CWA program, see U.S. Congress, Office of Technology Assessment, ***Wastes** in Marine Environments*, to be published in early 1987.

[105] FWPCA, Section 102(a). Italics for emphasis. The language, "prevention, reduction, and elimination" is also used in Sec-

(continued on next *page)*

the use of control technology (primarily, wastewater treatment facilities) has primacy under CWA and in the way it has been implemented. An EPA publication, for instance, reports that:

> Categorical pretreatment standards for a given industry are based on the capability of a specific wastewater treatment technology or series of technologies to reduce pollutant discharges to the POTW , . . [106]

The following review of some of the statutory language reveals that EPA does have latitude in setting regulations under CWA. While control technology is stressed and often mentioned first, other options are given that point toward the use of waste reduction.

Effluent Guidelines.—The act set up a schedule so that limitations on direct discharges of pollutants were to be met in stages. The first, to be met by July 1, 1977, was based on "best practicable control technology currently available" (BPT). By July 1, 1984, a standard of the "best available technology economically achievable" (BAT) was to be applied, along with the use of "best conventional pollutant control technology" (BCT), to toxic pollutants in order to move toward the national goal of elimination.[107] In setting the various regulations, EPA must specify the factors taken into account in determining the "control measures and practices" applicable under BPT, BCT, or BAT; and the rigorousness of the application of the control concept varies under each. BPT and BCT factors are similar and include "total cost of application ., . engineering aspects of various types of control techniques, process changes , . . "108

The language defining BATs quite clearly includes waste reduction by calling for the "best control measures and practices achievable" including "treatment techniques, process *and procedure innovations, operating methods, and other alternatives*. Under BATs, EPA is to require the elimination of discharges of pollutants if, "the Administrator finds . . , that such elimination is technologically and economically achievable . . . [109] To meet the first goal of the act, the statute specifies a fourth category of effluent limitations: the use of control measures and practices available to *eliminate* discharges.[110]

Standards.—The language covering pretreatment and performance standards also provides for the use of waste reduction. In the case of pretreatment standards for indirect dischargers, the "best available technology economically achievable" must be used to set effluent standards. A standard may prohibit any discharge. EPA is given the discretion to revise such standards as "control technology, processes, operating methods, or other alternatives change [111] New source performance standards (NSPS) are to be achieved "through application of the best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants. [113] EPA is also required to "issue information on the process, procedures, or operating methods that result in the elimination or reduction of the discharge of pollutants to implement standards of performance . , . [114]

Neither the statute nor the regulations require that industrial facilities install the specific control technology on which limitations and standards are based. They must, however, achieve discharge limits that EPA determines are possible using the model technology, In fact, the

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tion101(b) in reference to congressional policy regarding rights of States in operating water quality programs and regarding support for research.

[106]U.S. Environmental Protection Agency, *Guidance Manual for the Use of Production-Based Pretreatment Standards and the Combined Wastestream Formula* (Washington, DC : Permits Division and Industrial Technology Division, September 1985), p. 1-2.

[107]FWPCA, Sections 301(h)(1)(A), 301(b)(2)(A), and 301(b)(2)(E). The statute imposed deadlines on the dischargers. Therefore, Congress intended EPA to have the regulations in place sufficiently ahead of these dates to allow for compliance.

[108]Ibid., Section 304(b)(1)(B).

[109]Ibid., Section 301(t)(2)(A). Italics for emphasis.

[110]Ibid., Section 304(b)(3).

[111]Ibid., Section 307(b)(2),

[112]Ibid., Sec t ion 306(a)(1).

[113] Ibid., Section 304(c).

[114]U.S. Environmental Protection Agency, *Guidance Manual for the Use of Production-Based Pretreatment Standards and the Combined Wastestream Formula,* op. cit., p. *1-3,*

use of the model technology does not assure that a facility is in compliance with the regulations.[115] However, the technical Development Documents that support each regulation and the preamble to the regulations published in the *Federal Register* identify the technology used to set the limitations or standards. It seems obvious that a firm being subjected to new regulations would opt to use the identified technology rather than spend time and money devising an alternative. Thus, despite flexibility in the statute and the explicit mention of alternatives to pollution control, the system that has evolved under CWA inhibits the adoption of waste reduction by industry.

Innovation Waivers

A section was added to CWA in 1977 to induce industry to adopt innovative measures. An administrative procedure was set whereby facilities subject to NPDES permits (direct dischargers) could apply for an extension of time (up to 3 years; until July 1, 1987) before complying with BAT regulations. This Section 301(k) specifies three categories of acceptable alternative methods for meeting the regulations and gaining the time waiver: 1) replacing existing production capacity with an innovative production process, 2) installing an innovative control technique, or 3) achieving the required reduction with an innovative system to significantly lower costs beyond those determined by EPA to be economically achievable. To qualify, the first two must result in an effluent reduction significantly greater than that required by the regulations and move toward the national goal of elimination. In all cases, the technology must be judged as having the potential for industrywide application, Waste reduction approaches could apply under the first and third categories, but there is no evidence of its use under this section,

Only a handful of applications for the waivers have ever been received by EPA headquarters,[116] Three waivers for better control techniques were granted by EPA Region 5 to steel firms and only one of these was ultimately used, One was unused because the plant was closed, In the second case, the existing treatment process was modified to comply with the BAT regulation making the innovative process unnecessary.[117] In Region 3, two applications were received and one waiver has been granted. As in Region 5, the grantee was a steel firm that proposed an innovative control technology that qualified because of lower cost[118]

Several factors could account for the seeming unattractiveness of this waiver provision to industry. Among them are: 1) a possible lack of knowledge among direct dischargers that the provision exists; 2) a feeling in industry that the uncertainty of outcome is not worth the cost of applying, since either *significant* discharge or cost reductions must be proven; and 3) the value of the reward (a 3-year extension) is low. Because little or no compliance enforcement occurs under the NPDES, a similar "extension" is available to all dischargers whether or not they bother to go through the waiver process.[119] In addition, regulations were not written for all industrial categories by the BAT statutory deadline of July 1, 1984, so many potential applicants are essentially ineligible for the waiver that will expire in 1987.

A Model for Waste Reduction Standards or Guidelines

Examination of the effluent limitation guidelines and the performance and pretreatment standards process that has evolved under the Clean Water Act provides an opportunity to foresee what a prescriptive waste reduction program might be like. The process under the Clean Water Act has been lengthy, contentious,

[115] Marvin Rubin, Industrial Technology Division, U.S. Environmental Protection Agency, personal communication, June 16, 1986.

[116] Marilyn Goode, Permitting, U.S. Environmental Protection Agency, personal communication, June 16, 1986,

[117] Gary Amendola, Eastern District Office, Region 5, U.S. Environmental Protection Agency, personal communication, June 17, 1986.

[118] Terry Oda, Permitting and Enforcement, Region 3, U.S. Environmental Protection Agency, personal communication, June 18, 1986.

[119] U.S. Congress, General Accounting Office, *Wastewater Dischargers Are Not Complying With EPA Pollution Control Permits, GAO/* RCED-84-53 (Gaithersburg, MD: Dec. 2, 1983), p. 42. Also see OTA'S *Wastes in Marine Environments*, op. cit.

and expensive. The following discussion shows that setting waste reduction standards could be more complex, take more time, and be more costly. If resources were sufficient and industry, government, and environmental organizations worked cooperatively, these complications of setting waste reduction standards might be dealt with effectively over time.

The setting of regulatory standards under the Clean Water Act began in 1973 and is still in process, By March 1979, EPA had not even proposed BAT guidelines for any industrial categories [120] although the 1972 act required dischargers to comply by July 1, 1983. While many of the BAT regulations for direct dischargers have now been promulgated, some of these are still not in effect because of lawsuits that have not been concluded. After numerous delays, the regulations for the organic chemicals and plastic manufacturing industry category—originally proposed in 1983—are under court order to be finalized by December 1986. Some of the pretreatment standards, although promulgated, are still not in effect; some (notably for the organic chemical industry) are not yet set (see table 5-5). The annual budget for the Effluent Standards and Guidelines program at EPA that sets the regulations peaked at $28.2 million for fiscal year 1981 and totaled $144 million from fiscal year 1979 through 1986. The requested budget for fiscal year 1987 is $6.2 million. As the cost of research is not included in these figures, the true cost to the Federal Government of setting regulations under the Clean Water Act is considerably greater. When government costs peaked in 1981, U.S. industry spent $14 billion on water pollution abatement and control. [121]

As mentioned above, the regulations differ by industrial categories and subcategories because of the many differences in processes, waste streams, and economics that must be taken into account. [122] These differences made it necessary for EPA to gather industry-specific data on raw materials, final products, manufacturing processes and operating costs, equipment, age and size of plants, water usage, wastewater discharge, treated effluent characteristics, the sources and volume of water used, the sources of pollutants and wastewaters, the amount of raw waste, the constituents of wastewaters, and maintenance operations and costs. The analysis of each industry category based on the collected information and data is published in Development Documents, which serve as the support for the proposed regulations.

Table 5-5.—Status of Clean Water Pretreatment Standards by Industrial Category

Industry category	Final regulations	
	Promulgation date	Compliance date
Aluminum forming	10/24/83	10/24/86
Battery manufacturing	03/09/84	03/09/87
Coil coating	12/01/82	12/01 /85
Coil coating (can)	11/1 7/83	11/1 7/86
Copper forming	08/15/83	08/1 5/86
Electrical components I	04/08/83	11 /08/85
Electrical components II	12/1 4/83	07/14/86
Electroplating	01/28/81	06/30/84
	07/1 5/83	07/15/86
Inorganic chemicals I	06/29/82	08/1 2/85
Inorganic chemicals II	08/22/84	06/29/85
		08/22/87
Iron and steel	05/27/82	07/1 0/85
Leather tanning	11 /23/82	11 /25/85
Metal finishing	07/15/83	06/30/84
		07/1 0/85
		02/1 5/86
Metal molding and casting	*10/08/85*	10/31/88
Nonferrous metal forming	*08/23/85*	08/23/88
Nonferrous metal manufacturing I	*03/08/84*	03/09/87
Nonferrous metal manufacturing II	*09/20/85*	09/20/88
Pesticides	*10/04/85*	1 0/1 ***8188***
Petroleum refining	10/1 8/82	12/01/85
Pharmaceuticals	10/27/83	10/27/86
Plastics molding and forming	12/1 7/84	None
Porcelain enameling	11 /24/82	11/25/85
Pulp, paper, paperboard	11/1 8/82	07/01/84
Steam electric	11/1 9/82	07/01 /84
Textile mills	09/02/82	None
Timber products	01/26/81	01 /26/84
Organic chemicals	[a]	None
Plastics/synthetics	[a]	None

[a]Under court order to promulgate standards by December 1986

SOURCE: U S Environmental Protect Ion Agency, Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works (Washington DC: Off Ice of Water Regulations and Standards February 1986) pp 6-59

[120] U.S. Congress, General Accounting Office, *Wastewater Dischargers Are Not Complying With EPA Pollution Control Permits*, op. c it., p. 38.

[121] U.S Department of Commerce, "Pollution Abatement and Control Expenditures," *Survey of Current Business*, March 1985.

[122] See Margherita Pryor, "Fighting Water Toxics With Effluent Guidelines," *EPA Journal*, September 1985, pp. 8-10.

The final result of these efforts is a complex array of regulations. Three different limitations can be set—based on BPT, BAT, and BCT—for all regulated direct discharging industries, performance standards have been adopted for some new sources, and two sets of standards—one for existing and one for new sources—are being set for the regulated indirect dischargers. The existing regulations cover 1,102 pages in the *Code of Federal Regulations.*[123]

The CWA regulatory structure and the procedure that produces it is simple, however, compared to the effort that would be required to regulate waste reduction. Under CWA, once processes producing polluting streams were analyzed, a discrete set of feasible end-of-pipe technologies could be identified and tested against the economic criteria set forth in the statute. Next, one model technology was chosen to provide the basis for the limitations or standards.

It is not possible to determine one model technology for waste reduction. OTA has defined five categories of possible waste reduction approaches (which are discussed fully in ch. 3). For each process or operation identified as a producer of hazardous waste, therefore, one or all five categories could be applicable and within each category a very large number of approaches might also be possible. While the actual approach to be adopted could be left up to a specific plant to determine, government would need to analyze the possible approaches in order to determine an equitable level of reduction that could then be required and enforced for specific processes or operation within a specific industry.[124] Moreover, it is not clear that generic waste reduction approaches can be applied across plants within specific industries. In other words, many processes and operations can be plant-specific. In addition to the problems of matching production processes to reduction approaches, an effective waste reduction program needs a multimedia approach. Standard setting under such a program would require the consideration of all hazardous waste generating processes as well as potential shifts across media.

As discussed in chapter 4, the data and information that EPA has collected under the water program is out of date and is, therefore, not relevant for setting future standards for waste reduction, Comparable information has not been collected for air emissions nor for RCRA discharging industries and processes. Thus, the first stage of a prescriptive waste reduction program would be a lengthy and expensive process of collecting information and data.

Toxic Substances and Control Act (TSCA)[125]

Through TSCA, EPA has the authority to deal with many aspects of a chemical's lifecycle. The statute covers a broad category of chemical substances and mixtures[126] and is one of two environmental statutes that deals with the production of chemicals as well as the effects of their use.[127] Of major relevance to waste reduction is the prevention concept embodied in TSCA.

In enacting TSCA, Congress was concerned that:

> . . . among the many chemical substances and mixtures which are constantly being developed and produced, there are some whose manufacture, processing, distribution in commerce, use, or disposal may present an unreasonable risk of injury to health or the environment . . , [128]

[123] 40 CFR, July 1, 1985.

[124] Under the Metal Finishing Category in the water program EPA identified 46 unit operations. The first six were called core operations and a facility has to perform at least one of them in order to be subject to pretreatment standards for metal finishers. Many of the 46 might offer a potential for hazardous waste reduction. [U.S. Environmental Protection Agency, *Guidance Manual for Electroplating and Metal Finishing Pretreatment Standards* [Washington, DC: Effluent Guidelines Division and Permit Division, February 1984), p. 3-2.]

[125] lzspublic Law 94-469 enacted on Oct. 11, 1976.

[126] TSCA, Section 3(2)(A), defines chemical substances as "any organic or inorganic substance of a particular molecular identity." Exempted from coverage under TSCA are pesticides, tobacco or tobacco products, materials covered by the Atomic Energy Act of 1954, and "any food, food additive, drug, cosmetic, or device . . . "

[127] The other statute is FI FRA which regulates the production and use of pesticides.

[128] TSCA, Section 2(a)(2).

The statute provides the government with the authority to require manufacturers to develop and submit data on the chemical substances they produce or intend to produce. During its 10 years, the Office of Toxic Substances (OTS) has generated an inventory of over 62,000 chemicals produced or imported as of 1977. This list provides the basis for the Pre Manufacturing Notice (P MN) system whereby manufacturers must notify EPA at least 90 days in advance of their intent to produce a new chemical substance,lzg In fiscal year 1984, 1,192 PMNs were received. After review, OTS gave permission for 1,036 (86 percent) of these chemicals to be produced. OTS took some action (regulation or further review) on 116 (10 percent). The balance were withdrawn.[130]

EPA can regulate chemicals under TSCA in a variety of ways. It can prohibit or limit the "manufacture, processing, distribution in commerce, use, or disposal" of a chemical judged to present "an unreasonable risk of injury to health or the environment. " It can also alert users to potential risk by requiring that "any article containing such substance or mixture be marked with or accompanied by clear and adequate warnings and instructions [131]

OTS can refer chemicals to other agencies for action, removing them from regulation under TSCA. For instance, after concluding that 1,3-butadiene was a probable human carcinogen, a referral was made to OSHA in 1985 for consideration of 'engineering controls or personal protective equipment" to reduce the cancer risk to which thousands of workers are exposed.[132]

The potential for regulating chemicals under TSCA is greater than its implementation so far. In its first 7 years, EPA issued regulations on four existing chemicals: 1) the manufacture, processing, and distribution in commerce of polychlorinated biphenyls (PCBS) was prohibited, as had been required by the statute; 2) nonessential uses of chlorofluorocarbons were banned; 3) the disposal of dioxin was controlled; and 4) the inspection of schools for asbestos was required. As of early 1986, regulations were under consideration for a number of existing chemicals.

While the TSCA program has subjected industry to extensive reporting and recordkeeping procedures on specific chemical substances, most of the information collected has been labeled as confidential business information by the manufacturers, Chapter 4 in this report discusses the information collected under TSCA and concludes that, because of the number of limitations placed on what information can be collected as well as the confidential nature of much of this information, this function of TSCA would be of marginal use for a Federal waste reduction program and perhaps of even less value if such a waste reduction program were delegated largely to the States.

Some proponents of waste reduction point to TSCA as the appropriate environmental statute under which to operate a waste reduction program. The slow pace of activity under both TSCA and FIFRA, however, points out a difficulty of relying on regulating chemicals at the raw material stage. 'llhe sheer numbers of chemicals and the changes in chemicals produced for raw material use can easily overwhelm any government attempt to thoroughly, equitably review and assess chemicals prior to their use, The General Accounting Office has estimated that it will take the FIFRA program the next 20 years to complete its reregistration of existing pesticides.[133]

[129] *New* being defined as either not he ing on the existing inventory list or a "significant new use" of a chemical on the list.

[130] Council on Environmental Quality, EJI *vironmental Quality 1984, 15th Annual Report* (Washington DC: U.S. Government Printing offic, 1984), p. 194.

[131] TSCA, Section 6(a) and 6(a)(3). A judgment of "unreasonable risk is a ha la nc i ng p recess between health and environmental effects, exposures, and economic value of a chemic al, according to EPA, [Don R, Clay, "Issues in Toxics Control'" *EPA Journal*, June 1985, p. 4,]

[132] *Hazardous Materials intelligence Report* (Cambridge, MA: World Information Systems, Jan, 10, 1986), p. 4.

[133] U, S, Congress, Genera] Accounting Office, *PESTICIDES: EPA Formidable Task To Assess and Regulate Their Risks*, (lAO/RCE 1)-86-1 25 (Gaithersburg, MD: April 1986), p. 20.

Superfund [134]

Superfund has been a major influence in convincing industry to change traditional waste management practices. The act is also cited as an inducement to firms to undertake waste reduction because of its taxing and liability provisions, In combination with RCRA, liabilities assessed to generators who can be named as parties responsible for creating Superfund sites can be high. This potential cost of doing business is now becoming a part of investment calculations in major corporations.

In addition to having these indirect impacts, provisions calling for citizens right to know and the establishment of a national chemical inventory in the U.S. House of Representatives and Senate Superfund reauthorization bills are relevant to waste reduction.[135] Implementation of the right-to-know provision would increase the awareness of people working in a plant about hazardous substances in the plant and, thus, act as an incentive for waste reduction practices. Information about the presence of substances within a community can also increase public pressure on industries to consider waste reduction as an alternative to waste management.

A national chemical inventory could directly benefit a Federal waste reduction program, primarily as a tool to identify priorities. The current legislation suggests a plant-level inventory in which chemical input and outputs are identified. As discussed more fully in chapter 4, aggregated plant-level information leaves many questions unanswered about whether waste reduction is actually occurring. It can, however, provide information essential for setting directions and priorities for waste reduction program components such as information and technology transfer, education, and generic R&D.

[134] Superfund is the common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 98-510, December 1980. Reauthorization Of Superfund may occur in 1986 in the 99th Congress.

[135] As this report was going to press, Congress had finished its conference committee deliberations on new Superfund legislation. Details of the final bill, however, were not available in time to include them here.

RESEARCH AND DEVELOPMENT, INFORMATION AND TECHNOLOGY TRANSFER

A number of existing agencies of the Federal Government could provide substantial support to U.S. industry in its efforts to prevent environmental pollution. Government actions could include evaluating generic process operations, engaging in industrial process R&D, and information and technology transfer. But, little such support is offered today that is relevant to waste reduction. EPA—the obvious lead agency—spends less than 1 percent of its R&D budget on waste minimization. Research organizations desiring to work on waste reduction find it difficult, if not impossible, to obtain funding because of the lack of importance given waste reduction by government and industry.

Most of the work that is conducted by the Federal Government is primarily directed at the internal needs of agencies. Most work labeled waste minimization has a minor waste reduction component. EPA has a small technology evaluation contract underway, makes some grant funds available to small firms and academia, and has helped to fund some State research grant programs. The Department of Energy is informally incorporating waste reduction into its waste management program at one major facility. The Department of Defense has developed a formal waste minimization program to help control its extensive waste generation problems. The Tennessee Valley Authority

offers some regional technical and information support. Information programs on hazardous materials are managed by the Occupational Safety and Health Administration in the Department of Labor. There is no coordination of these activities other than that which occurs within EPA between its Office of Solid Waste and Office of Research & Development.

May opportunities exist, howevrer, within the existing mandates of these and other agencies and programs to increase support for waste reduction. Federal agencies, such as the Bureau of Mines, the National Bureau of Standards, and the National Science Foundation, could lend additional support to U.S. industry. Doing so, which would avoid the cost of setting up new programs, would not be productive, however, without the establishment of a modest Federal waaste reduction program to provide policy drive, guidance, and coordination .

Research and Development at EPA

Waste minimization research and development is a low-priorit~' item within EPA. It received about $1.2 mill ion—half of 1 percent of EPA's fiscal 1986 estimated $213.8 budget for all R&D, The waste minimization estimate of $1.2 million is derived from portions of the expenditures of EPA's Hazardous Waste Engineering Research Laboratory, EPA funds budgeted for the Center for Environmental Management at Tufts University in Massachusetts, and EPA funds granted to the Industrial Waste Elimination Research Center in Illinois.[136]~ (In ch. 6 of this reort, table 6-2 identifies State waste reduction programs that have received additional EPA funds,)

OTA estimates that much less than *50* percent of E PA's funding for waste minimization R&D applies to waste reduction, even though the agency has identified waste reduction as one of two categories of waste minimization. For EPA's report to Congress, $500,000 was spent for contract reports that reviewed the state of existing technology for waste reduction and recycling. Current work within EPA continues in the same vein, assessing and collecting information; no technology R&D is being conducted, (Waste reduction R&D options are presented by OTA in ch. 2 and technology is discussed in ch. 3.]

As has happened elsewhere within EPA, waste reduction has become a minor tool in the agency's search for alternatives to land disposal. In the April 1986 issue of *EPA Journal* in an article about research at EPA that seeks to "break the land disposal habit, " waste reduction is mentioned as one of four "major alternatives, " along with materials recovery, energy recovery, and waste treatment. Over two-thirds of the article is devoted to waste treatment activities at EPA; in the section on waste reduction there is a brief mention of the fact that some private sector initiatives exist and that as economic conditions change more waste reduction will take place.[137]

Proposals for future R&D efforts do not indicate a change in emphasis. Waste treatment continues to receive high priority. In drafting up its justification for a $36 million request for hazardous waste R&D for fiscal year 1987, the closest EPA came to mentioning waste m i n imization was in plans to centinue to evaluate "both new and existing alternative treatment processes for wastes likely to be banned from land disposal. [138] Such alternative treatment processes could include recycling, but will not reduce the generation of hazardous waste at the source.

Internal and Contract Research .—TheHazardous Waste Engineering Research Laboratory}" (HWERL) is one of three research laboratories in the Office of Environmental Engineering & Technology.[139] Despite claims that HWE RL "is working to foster increased use of . . . waste reducti On . . . ,"[140] OTA could find little work specifically directed toward this objective. The

[136]EPA R&D budget numbers are taken from its *Justification for Appropriation Estimates for Committee on Appropriations, Fiscal Year 1987.*

[137]John H. Skinner, "Research to Break the Land Disposal Habit," *EPA Journal*, vol. 12, No. 3, April 1986, pp. 12-14.

[138]EPA Budget Justification Document, op. cit., p. HW-18.

[139]The laboratories are set up by media; the other two are the Air & Energy Engineering Research Laboratory and the Water Engineering Research Laboratory.

[140]Skinner, op. cit., p. 12.

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Alternative Technologies Division of the laboratory has responsibility for waste minimization research. A series of case histories on recycling opportunities has been completed and will be published in 1986, Funding for waste minimization for fiscal year 1986 is $235,000 (2 percent of the division's total budget) and is being used for one contract.

The aim of this single waste minimization project is to develop a standard waste audit procedure that could be used throughout industry to identify waste minimization opportunities. The current project will test the applicability of a waste audit procedure developed by the contractor to five different facilities that generate large amounts of RCRA wastes that are slated to be banned from land disposal. Problems will be identified and improvements proposed (recycling or waste reduction) at each facility. A followup project is under consideration to determine whether the proposals are actually adopted and whether they are successful.

Waste audits, in various forms, are used by industry today and have become one of the services offered by engineering consultants (see ch. 3). EPA's funding to test the applicability of a model waste audit appears to be primarily internally directed. For instance, a model procedure has potential as a regulatory tool (for the analysis of waste minimization plans). Or, if EPA decides to institute a waste minimization grants program, a standardized waste audit could serve as a required feasibility step to aid in the analysis of proposals.[141] EPA is not conducting, and has no plans to conduct, technology R&D related to either recycling or waste reduction. Such research—generic or specific—is viewed as being more appropriate for industry itself to conduct, especially given the small amount of government budgets available for waste minimization.[142]

Future spending on waste minimization by EPA is only due to increase slightly and will continue to be used for technical analyses with potential for information transfer. In an overall planning document outlining the fiscal year 1988 R&D budget for RCRA hazardous waste, waste minimization is not identified by EPA officials as a "hazardous waste strategic issue area" for which a budget is recommended.[143] Neither waste minimization nor waste reduction is included among the issue areas identified. In a research plan document reviewing the Alternative Technology Division's future budget needs, waste minimization is included as one of five major research objectives.[144] The budget plan for waste minimization for fiscal year 1989 calls for an increase from the present 2 percent to 4 percent of the division's total budget. It is apparent that future budgets, like current budgets, will continue to concentrate on waste treatment. One discussion point in the research plan suggests supplemental funding to support a program on potential waste minimization reuse and recycle regulations. The amount suggested for this project would grow from $400,000 in fiscal year 1987 to $500,000 in 1990 and amounts to a tripling of the division's current waste minimization budget. No supplements are suggested for waste reduction research.

The Alternative Technology Division's research plan was reviewed by the EPA Science Advisory Board, The board recommended that waste minimization research be "significantly strengthened. " Methods suggested by the board included increasing the proportion of the division's research funds dedicated to waste minimization, placing more emphasis on waste reduction (as opposed to the division's concentration on recovery and reuse of waste materials), and establishing a formal network between

[141] Harry Freeman, Research Program Manager, Alternative Technologies Division, Hazardous Waste Engineering Research Laboratory, U.S. Environmental Protection Agency, personal communication, July 8, 1986.

[142] Ibid.

[143] U.S. Environmental Protection Agency, Office of Research and Development, memorandum from the Hazardous Waste/ Superfund Research Committee (Meg Kelly and John Skinner] to Donald J. Ehreth (Acting Assistant Administrator for Research and Development) and J. Winston Porter (Assistant Administrator for Solid Waste and Emergency Response), Apr. 23, 1986.

[144] U.S. Environmental Protection Agency, Office of Research and Development, memorandum "Alternative Technology Review (Step 2), " from Alfred W. Lindsey (Acting Deputy Director, Office of Environmental Engineering & Technology), to the Hazardous Waste Research Subcommittee, June 16, 1986.

industry, academia, and government to improve the transfer of information,[145]

Research by Grants Funding .—There are three programs within the Office of Exploratory Research that handle EPA's unsolicited grants and university research: the Research Centers Program, the Research Grants Staff, and the Small Business Innovation Research (SBIR) Program. Since the research centers' work is determined by EPA needs, little attention has been given to waste reduction or even waste minimization. A small percentage of the research funded by grants and the SBIR program has dealt with waste reduction in the past. If the issue of waste reduction increases in visibility, these two programs as now constituted have the potential of providing more funding—for research by nonprofit entities and small businesses. Waste reduction, however, will need to be placed explicitly on suggested proposals lists and given prominence during award procedures. Accordingly, the persons involved both in determining the lists and judging the proposals submitted will need to be cognizant of waste reduction. Neither of these programs offers funding assistance to the bulk of industry, which maybe the most relevant place for development of waste reduction techniques.

The Research Centers Program oversees activities at the eight EPA Centers of Excellence set up in 1979 to provide EPA with an improved basic research capability. Each center-located at a university—receives $540,000 per year from EPA's R&D budget and is expetcted to supplement its income from other public and private sector sources. The centers do not focus exclusively on hazardous waste.

The Industrial Waste Elimination Research Center, established in 1980 as a joint project of the Illinois Institute of Techrmlogy and the University of Notre Dame, is the EPA center where work is most directly related to waste reduction. Its annual budget is based on the EPA grant and is supplemented occasionally by funds given by public or private interests for specific projects. The center's mission is to pursue basic research applicable to environmental problems that have been identified by EPA. Specific projects have focused on the chemistry of metal recovery and adsorption of organics from liquids and vapors. Both of these recovery techniques could have applicability to waste reduction if they are incorporated into manufacturing processes. The center would like to pursue waste reduction more directly but does not do so because the subject lacks priority at EPA. It also finds there to be little industrial support for waste reduction research because neither environmental regulations nor eccnomic factors are sufficiently compelling to force an interest.[146]

Within the 1986 Superfund legislation is an authorization for the establishment of 5 to 10 regional University Hazardous Substance Research Centers at an annual cost of $5 million. These centers—which could replace the Centers for Excellence—are to conduct "research and training" relating to the "manufacture, use, transportation, disposal, and management" of hazardous substances.[147] Such a legislative mandate is broad and could be interpreted to include research relating to waste reduction, However, without a specific mention of waste reduction or waste minimization in the legislation, the likelihood that such research will occur is poor, given the inclination of EPA to place such items low on its agenda.

Through the Research Grants Office, annual funding is awarded to nonprofit institutions and State and local governments primarily for basic research. The total research grants budget for fiscal year 1986 is $10.8 million. (This

[145] U.S. Environmental Protection Agency, "Review of the Alternative Technologies Research Program, report of the Environmental Engineering Subcommittee of the Science Advisory Board, July 1986.

[146] Charles Haas, Industrial Waste Elimination Research Center, personal communication, May 23, 1986.

[147] The language quoted comes from Research and Development paragraphs in an undated Superfund conference draft. As this report was going to press, Congress had finished its Superfund conference committee deliberations but details of the final bill were not available in time to include them here. Hazardous substances are defined under Superfund (CERCLA) and include RCRA hazardous wastes, hazardous air pollutants listed under Section 112 of Clean Air Act, toxic pollutants regulated under Section 307(a) of Clean Water Act, and imminently hazardous chemical substances under Section 7 of TSCA.

amount will decrease to about $7 million in the budget requested by EPA for fiscal year 1987)[148]

Proposals for projects are submitted based on a list of four program areas of interest to EPA: environmental biology, health, engineering, and air/water chemistry and physics. For the 1986 award cycle, waste reduction projects were explicitly mentioned as an area of interest under wastewater treatment and pollution control within the environmental engineering program area. They are defined as: "In-plant unit process operations minimizing or eliminating toxics generation and release to the environment. [149] Similar solicitation was not suggested under the air pollution control category; there is no comparable category for RCRA hazardous wastes,

No projects that could be considered relevant to industrial waste reduction were awarded research grants in 1985; however, two dealt with reducing the use of chlorine in and the formation of toxic byproducts from the disinfection of drinking water.

The SBIR program is mandated by the Small Business Innovative Development Act of 1982[150] and, under that act, is entitled to at least 1 percent of EPA's R&D outside contract funds. In fiscal year 1986 the program's funds amounted to about $2.6 million,[151] Contracts are awarded in two stages. Phase I funding is used to show the scientific and technical merit and the feasibility of a proposal. Phase 11 funding is intended to move the Phase I innovation toward commercialization n.

As in the procedure under the grants programs, prospective SBIR bidders receive a list of broad topics of interest to EPA. For the 1986 cycle of awards, the topics are: drinking water treatment, municipal and industrial wastewater treatment and pollution control, biological sludge treatment for improved handling and disposal, solid and hazardous waste disposal and pollution control, mitigation of environmental pollution problems, air pollution control, and environmental monitoring instrumentation. While neither waste minimization nor waste reduction appears as a topic area, the concept of waste reduction appears as a suggested "area of interest" under the wastewater treatment and pollution control topic and under solid and hazardous waste disposal and pollution control.

Fifty-one Phase I and II projects were funded by EPA between 1983 and 1985. A review reveals that five waste reduction projects were included in 40 Phase I awards over that time; one of these waste reduction projects advanced to Phase II,

Small business firms may also be able to obtain assistance directly from the Small Business Administration for waste reduction projects (see box 5-A),

Other Environmental R&D Organizations

A number of States or universities have established hazardous waste research facilities. Some receive financiaI assistance from EPA or other government agencies; some do contract work for EPA. Overall, they now conduct relatively little waste reduction research, but they would do more if the need were recognized and funding made available. Four such existing organizations are highlighted in table 5-6 and discussed briefly below. A Research and Development Center for Hazardous Waste Management has been proposed for the State of New York,

The Industry/University Cooperative Research Center for Hazardous and Toxic Waste at the New Jersey Institute of Technology takes a multimedia approach in its research but concentrates on end-of-pipe solutions. According to the director, the center's mission to conduct research in treatment technologies at the

[148] Clarice Gaylord, Program Manager, Research Grants Office, U.S. Environmental Protection Agency, personal communication, May 23, 1986.

[149] U.S Environmental Protection Agency, *Solicitation for R(?search Grant Proprosals*, EPA/600/8-85/021 [Washington DC: September 1985), p. 9.

[150] Public Law 97-219. *T'111* slegislation includes a S11 nset provision that comes due Oct. 1, 1988, The House of Representatives passed a bill—H.R. 4260, Small Business Innovation Research Program—on Aug. 12, 1986, to extend the program through 1993. Upt. that time, the Senate had not acted on S1 B R reauthorization.

[151] Walter H. Preston, Progra 111 Manager, Small Business Innovation Program, U. S. Environmental Protection Agency, personal communication, May 23, I 986.

Box 5-A.—Small Business Waste Reduction Funding Assistance

The Small Business Administration (SBA) offers a wide range of loan programs to small business firms. In the environmental area the prime SBA loan vehicle is a Pollution Control Financing Guarantee (PCFG) authorized under the Small Business Investment Act.[1] So far, no applications have been received by SBA for any waste reduction projects. Consistent with what OTA has repeatedly found elsewhere, the PCFG program has been viewed by those outside and within SBA as a way to support traditional pollution control activities. The Small Business Ombudsman at EPA, however, has recognized its potential to assist its constituency by advancing waste minimization projects and has been trying to work with SBA to expand the program.[2]

PCFGs should be applicable to waste reduction projects. A small business firm can apply to SBA for this loan guarantee if private financing is denied or if it is granted, but at a rate not comparable to those granted to other business concerns, "with respect to the planning, design, or installation of pollution control Facilities . . ."[3] The statutory definition of a facility has been interpreted as one that is likely to:

> . . . prevent, reduce, abate, or control noise, air or water pollution; or eliminate contamination by removing, altering, disposing, or storing pollutants, contaminants, waste, or heat; or provide for the collection, storage, processing, treatment/utilization, or final disposal of solid or liquid waste, including any related resource recovery property.[4]

Other general SBA loan programs could also apply to waste reduction projects. These alternative programs, however, are less favorable. They do not carry a fixed interest rate, are for a shorter term than PCFGs (maximum 7 years rather than 15), are only 75 percent (vs. 100 percent) guaranteed by SBA, and are applicable only when financing has been denied in the private market.

Loan programs that emphasize the need for capital costs can promote the application of more costly waste reduction approaches. As discussed in chapter 3, waste reduction can often be achieved by simple, relatively inexpensive methods such as changing operating procedures of existing facilities or instituting better housekeeping methods around a facility. Since waste reduction approaches improve the overall operation of industrial processes, it can be difficult to draw a line between a change for waste reduction and a change for process efficiency. Given the huge number of small business firms in the Nation, this lack of distinction and the promotion of government loans for waste reduction could initiate an ultimately costly, unbounded industrial loan program. (See the discussion of this problem under Policy Option III in ch. 2 of this report.)

[1]Section 404, which authorizes PCFGs, was added to the act by Public Law 94-3o5 in 1976.

[2]Karen Brown, Small Business Ombudsman, U.S. Environmental Protection Agency, personal communication, May 29, 1986. See the Ombudsman's office report, "Evaluating the Need for an SBA Pollution Control Financing Program," May 16, 1986.

313 CFR Part 111.

[4]Small Business Ombudsman, U.S. Environmentaf Protection Agency, "Assistance Programs for Pollution Control Financing," March 1986, A possible complication may arise over a statement that appeared about PCFGs in the ***Federal Register*** on June 4, 1986 (vol. 51, p. 20247): "PCFG assistance . . . is intended for small concerns to comply with ecological standards by installing *non-productive pollution abatement equipment, purchased incident to their other profit-oriented activities.*"

present time and later, recycling. When research has thoroughly explored these means to manage wastes, then the center may consider waste reduction. The center is increasingly dependent on industry funding. It has not noted any current interest on the part of industry in gaining outside assistance in the development of waste reduction techniques because "... such activity is handled internally and always coupled with production cost and improved competitiveness needs. 52

At the (university of Alabama in Birmingham, a Hazardous Materials Management and Resource R~[;~very Pro~r~m (HAM N1 ~ R R] m' as

[52]John Liscowitz, Executive Director, Institute for Hazardous and Toxic Waste Management, personal communication, May 27, 1986.

Table 5-6.—State Level Environmental R&D Centers

Organization and location	Funding source(s)		Annual budget[a]	Waste management v. waste reduction [WR] activities
Center for Environmental Management at Tufts University	EPA	100 "/0	$2.0 million	Little waste reduction. Two waste minimization projects completed. A technical waste treatment study planned.
Industry/University Research Center for Hazardous and Toxic Waste at New Jersey Institute of Technology.	NSF	3 %	$3.0 million	Concentrates on waste treatment methods; no WR research planned.
	State of New Jersey	66%		
	Private sector	16%		
Hazardous Materials Management Resource Recovery Program at University of Alabama	State of Alabama	660/0	$0.2 million	Aim to eventually focus on WR, but initial projects are on recycling, treatment, and regulatory compliance.
	University	33 "/0		
Illinois Hazardous Waste Research and Information Center	State of Illinois	100"/0	$1.3 million	"Prevention and Source Reduction" is one of 4 research areas. WR is now 10 percent of technical assistance work. No WR research yet.

[a]Estimated operat!ng and research

SOURCE: Office of Technology Assessment, 1986

established in late 1985. The prime goal of the facility is to support research "aimed at ultimately eliminating by-product wastes from manufacturing processes. ''153 So far, funding support for this waste reduction research has proven difficult to acquire from either government agencies or the private sector. Initial projects—funded primarily by the Alabama Development Office—have included establishment of a regulation information newsletter, development of a waste exchange information service and a training assistance program for RCRA generators, and waste incineration research. The organization hopes to have one or two waste reduction engineering research projects funded within a year.[154]

The Center for Environmental Management at Tufts University is funded principally by EPA at a cost of $2 million per year. The center's mission is "to develop an effective approach to environmental management through innovative research, policy analysis, education, and information exchange programs .''[155] Waste Reduction and Treatment is one of four "clusters of concentration. " Two projects have been completed: a study of foreign government waste minimization practices and the organization of a conference. A technical project on onsite treatment is being planned.

Illinois' Governor and Legislature created a Hazardous Waste Research and Information Center in 1984. One of five objectives of the center is: "Reducing the volume of hazardous wastes generated and the threat they pose to human health and the environment. ''[156] Prevention and Source Reduction Studies is one of four research areas, and projects in this area that "will support industries' efforts to minimize or prevent hazardous wastes from being produced or to detoxify those wastes'' 157 (i.e., waste reduction *and* waste treatment). Actual work in waste reduction has, so far, only been incorporated into the activities of the center's technical assistance project (see ch. *6),*[158]

153University of Alabama, "Hazardous Materials Research Center Will Aid Industry, " *Capstone Engineering*, vol. 2, No. 1, Winter 1986,

154 George Whittle, Coordinator, Hazardous Materials Management and Resource Recovery Program, University of Alabama, personal communication, July 10, 1986.

155The Center for Environmental Management, Tufts University, promotional brochure, undated.

156Hazardous Waste Research and Information Center, *Annual Report (May 1, 1985 - April 30, 1986),* p. iv.

157 bid., p. viii.

158David L. Thomas, Director, Hazardous Waste Research and Information Center, personal communication, May 1986.

Other Federal Agencies: R&D and Information Transfer

There are a variety of ways in which existing Federal agencies could promote waste reduction. The Department of Defense and a major Department of Energy facility have newly initiated internal waste minimization programs to help ameliorate their own hazardous waste problems. This work may have limited value outside of the agencies in terms of technology transfer. More important to this discussion on waste reduction may be the incentives each agency has instituted to reduce the generation of hazardous wastes. The Tennessee Valley Authority has been instrumental in assisting States in its region to promote waste minimization. The Occupational Safety and Health Administration indirectly promotes waste reduction through its regulation of hazardous materials in the workplace.

As discussed in chapter 3 of this report, waste reduction technology is a misleading phrase. It implies that there are distinct technologies that lead to the reduction of waste. But waste reduction is, instead, a criterion by which to assess almost any industrial production technology. By the same token, R&D in waste reduction encompasses many aspects of industrial production. Thus any Federal agency already offering support to U.S. industry could also assist its waste reduction efforts.

The Department of Defense

DOD generates over 500,000 tons of RCRA hazardous waste annually[159] and has identified several hundreds of sites that will require cleanup at an estimated cost of $10 billion.[160] Logistics operations (procurement, maintenance, and transportation of materiel and facilities) are the major sources of new waste. The need to minimize the generation of this waste has been recognized in the Office of the Secretary of Defense (OSD) and in each of the military services.

A DOD policy on hazardous waste was established in 1980 which cited as the first step a determination to "limit the generation of hazardous waste through alternative procurement practices and operational procedures.[161] Waste minimization within the Navy, Army, and Air Force has preceded—and been the impetus for —the development of an official DOD waste minimization plan. These individual efforts are outlined in table 5-7. Throughout DOD, waste minimization has been defined broadly to include reduction, recycling, reuse, and treatment. Waste reduction, therefore, constitutes an unknown part of DOD waste minimization activities, most of which are focused on RCRA hazardous wastes.

The Joint Logistics Commanders' Hazardous Waste Minimization Ad Hoc Working Group (JLC Working Group[162] submitted a report to OSD in December 1985 which recommended the elements for a DOD waste minimization program (see details below). As of mid-1986, OSD was formulating a directive that would require all parts of DOD to develop waste minimization plans. Funding of $30 million for fiscal year 1987 has been requested. For fiscal year 1986, $47 million had been approved for the existing individual programs but was eliminated because of overall Federal Government Gramm-Rudman-Hollings budget constraints. Services were, however, subsequently authorized to spend approximately $5 million for waste minimization out of a $50 million supplemental appropriation for DOD's cleanup program.

A number of procedures within DOD that have counterparts in the private sector have been identified as key elements in causing excessive hazardous waste generation. A major disincentive to waste reduction within DOD is

[159] U.S. Congress, General Accounting Office, *HAZARDOUS WASTE: DOD Efforts to Improve Management Of Generation, Storage and Disposal,* GAO/NSIAD-86-60 (Gaithersburg, MD: May 1986), p. 10.

[160] U.S. Congress, General Accounting office, *HAZARDOUS WASTE: Federal Civil Agencies Slow to Comply with Regulatory Requirements,* GAO/RCED-86-76 (Gaithersburg, MD: May 1986), p. 9.

[161] U.S. Department of Defense, DEQPPM 80-8, Oct. 21, 1980.

[162] Members include representatives from the Defense Logisticsties Agency, Naval Materiel Command, the Army Materiel Command, the Air Force Logistics Command, and the Air Force Systems Command. Groups such as the Strategic Air Command and the Tactical Air Command are not represented.

Table 5-7.—Waste Minimization (WM) at the Department of Defense

Office of the Secretary:

Defense Environmental Leadership Project (see text).

Defense Logistics Agency (D LA) provides material support (procurement, quality control, storage, distribution, maintenance), Has instituted some informal changes i n materiel ordering to reduce wastes created by shelf-1 ife regulations.

Navy:

All Commands required to report by April 1986 on WM measures taken. Object IS to raise awareness of issue and accumulate information for transfer across Commands,

Naval Civil Engineering Lab is investigating private industry initiatives for transferability to Naval operations,

Army:

Army Materiel Command (AMC) has developed a Hazardous Waste Minimization (Hazmin) Plan. All AMC installations must implement wide range of activities including reduction goals (15 to 60 percent by 1992) for major wastes streams (metal working, electroplating, painting, electrical maintenance, and waste treatment sludges). Also disposal of untreated wastes in landfills to be eliminated by 1992,

Air Force:

Office of Secretary of Air Force has several studies underway on decision making and costing practices that affect waste generation,

Air Force Systems Command (AFSC) requested $13 million from Defense Environmental Restoration Account for WM in 1986. Has completed assessment of WM opportunities in 8 major facilities (U.S. Air Force, Aeronautical Systems Division, *Waste Minirnization at Air Force P/ants,* by the Earth Technology Corporation, 1986)

Air Force Logistics Command (AFLC) "Pacer Reduce" WM plan in place since end 1985. Set overall goal of over 50 percent reduction by 1992. Has taken complete waste stream inventory by process, Studying technologies in private sector for transfer to AF operations. Some R&D conducted at Tindle AFB,

SOURCE Off Ice of Technology Assessment, 1986

that the Defense Property Disposal Office removes hazardous waste from facilities without charge. Thus, DOD's production and storage facilities need not consider the cost of hazardous waste management in their operations. In addition, because DOD tends to order materials in excess of needs, many materials outlive their shelf-life and end up as hazardous waste. According to a 1986 DOD report, because of the many components of DOD, even within military departments, and because there has been a lack of official oversight, it is difficult to disseminate waste reduction processes and innovative ideas throughout the agency.

DOD is not necessarily a source of technology transfer to the private sector. R&D in DOD often occurs in areas where the applicability is unique to DOD or where DOD constitutes a large part of the industry (e. g., aircraft manufacturing). The agency considers that the private sector—because of its costs incentives-is more likely to generate more and better waste reduction techniques.[163] Most DOD waste minimization programs include scouting the private sector for technology,

DOD Goals .–DOD may establish a policy that is transferable to the private sector and other government agencies-the setting of nonbinding reduction goals which are to be incorporated with increased stringency. Such goals, to be met by 1992, have already been established with in some military departments, based on waste streams or processes. For instance, the Army has reduction goals in place that are to be met by 1992. They include reductions of 60 percent for electrical maintenance and waste treatment sludges, 50 percent for electroplating and painting wastes, and 15 percent for metal working wastes. In the Air Force an overall goal of 50 percent reduction by 1992 has been set, DOD already has established a goal to eliminate the disposal of untreated hazardous waste by 1992 through waste reduction, recycling, and treatment.

JLC Working Group.—The JLC Working Group was created in September 1985 because of concern about "the serious liabilities associated with the generation and subsequent handling

[163] Captain Jay Green, United States Navy, Chairman, Joint Logistics Commanders' Hazardous Waste Minimization Ad Hoc Working Group, personal communication, Apr. 3, 1986.

and disposal of hazardous wastes. [164] The Group's Hazardous Waste Minimization Program, which was submitted to OSD in December 1985, includes a number of elements for each DOD department to implement. They include: accurate annual waste reporting, material control programs, reviews of existing technology and activities, coordination between services, implementation of "economically practicable hazardous waste minimization technology" and the initiation of R&D, consideration of waste minimization in all acquisition programs, and the development of reduction goals and monitoring of progress within each command. The group identified hazardous material control, delisting, material substitution, process change, and recycling as "means of hazardous waste minimization. [165]

The program requires that R&D be coordinated among depart ments to avoid duplication. Necessary spending levels were estimated at $10 million per year for each of the military departments, with funds for development of these programs to be taken from the Defense Environmental Restoration Account.[166]

Office of the Secretary of Defense.—Currently, two different groups within OSD have worked on waste minimization: The Defense Logistics Agency (see table 5-7) and the Defense Environmental Leadership Project (D ELP).

DELP was founded in January *1984* by the Director of Environmental Policy at the Pentagon. It was originally funded for a 2-year trial period but has since been extended indefinitely. DELP's stated mission is to find innovative solutions to long-term environmental problems that have cost and policy implications and to improve DOD's national leadership position in environmental protection. The program has focused its activities on improving DOD compliance with environmental regulations and minimizing waste,

DELP is searching out and publicizing waste reduction success stories within DOD to encourage development and implementation of industrial process modifications that will reduce the amount of hazardous waste generated at DOD facilities.[167] The first phase of this project evaluated *40* case studies of industrial process modifications and recommended 18 of these for further study in phase two oft he project. From these 18 case studies, three were selected as "Projects of Excellence. " The third phase includes training sessions at a number of DOD installations on applying the tcchniques developed in the three selected projects.[168] The final three projects were: a paint-stripping process using plastic pelIet blasting, modifications to metal plating, and reducing solvent and oil pollution from vehicle washing and maintenance. The 2-year project cost approximately $300,000, primarily for contractor support. It has been completed and no other major tiaste reduction efforts are pending in DELP.

Department of Energy

DOE faces estimated costs of *$750* million for environmental cleanup at three of its facilities. Among Federal agencies, this cost is second only to DOD's. [169] Eighty-s ix percent will be spent at the Oak Ridge, Tennessee, facility DOE has not yet began a formal waste minimization program but has had an informal program at its Oak Ridge National Laboratory since mid-1985.[170]

Two important changes have been made to create incentives for both DOE contractors and individual researchers to consider waste reduction. First, the reduction of hazardous

[164]Joint Logistics Commanders, Hazardous Waste Minimization Program, memorandum to William H. Taft, IV, Deputy Secretary of Defense, Dec. 12, 1985.

[165]Ibid.

[166]Captain Jay Green, op. cit.

[167]Such facilities include many that are often confused with the private sector. Manufacturing plants are often government-owned, contractor-operated (GOCO) facilities. Repair and reconditioning facilities, on the other hand, are typically government-owned and government-operated (GOGO).

[168]DOD Environmental Leadership Project, *Industrial Processes To Reduce Generation of Hazardous Waste at DOD Facilities*, Phase 2 Report: Evaluation of 18 Case Studies, prepared by CH2MHill (T.E. Higgins), July 1985, p. 2.

[169]U.S. Congress, General Accounting Office, *HAZARDOUS WASTE: Federal Civil Agencies Slow to Comply with Regulatory Requirements*, op. cit.

[170]Bob Sleeman, Waste Management Division, Oak Ridge, Department of Energy, personal communication, June 30, 1986.

wastes has been added as a fee criterion to contracts. Thus, those contractors who can show a reduction in wastes can qualify for increased payments. Secondly, DOE's Waste Management Division no longer assumes the costs for the management of wastes generated at Oak Ridge. Instead, such costs revert back to each generator.

DOE is unique in that its facilities generate radioactive wastes that must be handled quite differently from RCRA hazardous wastes and from water and air pollutants that are also produced. Radioactive wastes cannot be destroyed; they must be stored, usually after being encapsulated. The waste minimization program at Oak Ridge began because the facility was facing storage constraints for radioactive wastes that were contaminated with liquid RCRA hazardous wastes. The success of efforts to prevent the contamination of radioactive wastes and thus significantly reduce the volume of radioactive wastes needing storage led the Waste Management Division to apply waste minimization to its RCRA waste problems. A secondary reason for this action was the subsequent waste minimization requirements imposed by the 1984 RCRA Amendments.

The facility's waste minimization efforts are now being geared primarily toward reducing RCRA hazardous waste generation at the source. During the investigation of processes that generate RCRA hazardous wastes, however, possibilities for air and water pollution reductions have been discovered. One project, for instance, resulted in the substitution of a water-based for a solvent-based coolant, The solvent coolant had to be managed as a RCRA hazardous waste and was the source of air emissions as well. Waste reduction efforts are still a minor but increasing component of the Waste Management Division's activities. There is no separate budget item for waste minimization.

Tennessee Valley Authority

TVA is a regional development agency that seeks to attract and keep industries in the valley while at the same time protecting and conserving the resources of the valley, Helping local industries comply with hazardous waste regulations and manage their wastes in an environmentally responsible way is one way of meeting these goals,

TVA has therefore developed a Waste Management Program that offers technical assistance and information to waste generators and the public on ways to manage and minimize their hazardous wastes. The annual budget for this program totals $2 million.[171] TVA defines waste minimization to include many facets of waste management as well as waste reduction. To date, its activities have been strongly focused on promoting recycling and reuse and good management practices—and there have been some encouraging results,l [172] While there is some recognition of its value at TVA, little waste reduction work has yet been done so far.

States in the TVA region have received support from TVA for their activities in promoting *pollution prevention pays* through State conferences. Such conferences bring the concept of waste reduction and proper waste management to State generators and disposal operators, government officials, and educators. They do not concentrate on waste reduction or present waste reduction as the preferred choice, They do tend to provide the initial consensus gathering which can serve as the base for an official State program. TVA participates in these conferences and functions as a cosponsor. An estimated $35,000 of its Waste Management Program budget is used for this purpose. So far, conferences have been held in Alabama (October 1985) and Tennessee (March 1986). A third conference is scheduled for Kentucky in late 1986.

Occupational Safety and Health Administration

OSHA, in the Department of Labor, regulates hazardous materials in the workplace and through some of these actions has influenced industrial management of hazardous materials. The Hazardous Communication Standard,

[171] Dr. Philip J. Mummert, Projects Manager, Waste Management Program, Tennessee Valley Authority, personal communication, July 23, 1986.

[172] Doye Cox, Program Manager, Solid and Hazardous Waste Management, Tennessee Valley Authority, personal communication, Mar. 28, 1986.

which went into effect in November 1985, requires that manufacturers and distributors of chemicals provide their customers and workers with Materials Safety and Data Sheets (MSDS) and that they label hazardous products, Users of chemicals, such as the auto and steel industries, have until May 1986 to develop such data for the chemicals they mix for their own operations. Intensive safety training programs for workers must also be in place at that time for both chemical and nonchemical industry employers. Currently these measures apply only to manufacturing industries, however OSHA has proposed broadening application of the standard to cover service industries as well.

In addition to alerting employers and workers to workplace hazards, these worker right-to-know measures, by publicizing the hazardous constituents of materials, have served as catalysts for waste reduction, [173] Substitution of nonhazardous materials into processes may result from worker pressure or from the fact that implementing worker safety measures could be more expensive than substituting nonhazardous materials. Improved segregation and recycling (as well as improved management] may result as businesses learn more about hazardous constituents in manufacturing inputs. The information provided by MSDS may be particularly useful to smaller businesses, which may not have the facilities to test all their raw materials for hazardous constituents and which, therefore, may not have known what was in *their* waste streams. The regulations governing MSDS, however, allow for certain proprietary exemptions which can mask the contents of a product.

All of these possible effects on waste reduction are indirect. Waste reduction—in the form of materials substitution—has been part of OSHA'S traditional method of protecting workers. Its regulations require that engineering and work practice controls be used to comply with standards unless they are not feasible—in which case, personal protective equipment may be used. Health and safety professionals use a hierarchy of engineering controls: substitution, enclosure, isolation, and ventilation .17A How prevalent substitution is as a method of regulatory compliance is not known. One OSHA publication about protecting workers from exposures to methylene chloride suggested that: "The best method for controlling exposure to any extremely toxic material is to use a less toxic material where possible. [175] The bulk of the document, however, presented end-of-pipe solutions to industry-specific problems,

OSHA has done little research and taken no specific action to push reduction, In fact, OSHA's powers to advocate waste reduction are very limited, OSHA itself has no jurisdiction over hazardous *wastes,* which are regulated under EPA statutes, In addition, while it can require publication of known health risk data about hazardous chemicals, the Agency cannot require the generation of any new health studies or data; that power is given to EPA under TSCA.[176]

Potential Sources of Waste Reduction R&D

There are a number of agencies within the Federal Government that conduct industrial R&D and that, therefore, could be sources of waste reduction technical assistance and information transfer, Two prominent examples are the Bureau of Mines and the National Bureau of Standards. In addition, the National Science Foundation, which has traditionally been a funding source for basic research in universities, has now established Engineering Research Centers that could conduct industrial applied research relevant to waste reduction.

The National Bureau of Standards in the Department of Commerce provides a variety of

[173] *Business Week* reported that "several newspapers now are ordering different—albeit more expensive—inks that do not carry the jarring label." The magazine was referring to notification of newspaper publishers by ink manufacturers that "one widely used printer's ink would have to be labeled a possible carcinogen . . . " [Dec. 9, 1985, p. 86H].

[174] U.S. Congress, Office of Technology Assessment, *Preventing Injury and Illness in the Workplace,* OTA-H-256 (Washington, DC: U.S. Government Printing Office, April 1985), p. 175.

[175] Occupational Safety and Health Administration, Office of Science and Technology Assessment, "Guideline for Controling Exposure to Methylene Chloride," OSHA Instruction PUB 8-1.2, Mar. 10, 1986.

[176] Jennifer Silk, OSHA, personal communication, Apr. 15, 1986.

scientific and technological services to industry and government. Three of its four divisions —the National Engineering Laboratory, the Center for Chemical Engineering, and the Center for Materials Science—conduct basic and applied research that can lead to improved processing of chemicals and materials. Waste reduction is a form of improved processing.

The Bureau of Mines is the Federal agency that those in the mining and mineral processing industries look to for technical assistance and process information. One of its goals is to "ameliorate conflicts between environmental goals and mining operations and mineral processing and utilization plants. ''177 The Bureau has an ongoing program in reuse and recycling R&D, and $25.3 million have been requested for R&D in extractive metallurgy and recycling technologies for fiscal year 1987. Waste reduction has not yet been added to its research efforts.

177U.S. Congress, House of Representatives, Hearings before a Subcommittee of the Committee on Appropriations, *Department of the Interior and Related Agencies Appropriations for 1987,* Part 2 (Washington, DC: U.S. Government Printing Office, 1986], p. 5.