COMPARATIVE ANALYSIS

An examination of the OTA and EPA reports shows that there are areas of agreement and disagreement on waste reduction. Both OTA and EPA agree on a number of technical issues and that traditional mandatory regulations to force waste reduction are not now appropriate. OTA and EPA do not agree on terms and definitions (and thus, the focus of potential Federal efforts), on the hazardous wastes that should be considered for reduction, or on how waste reduction is affected by various incentives and obstacles. OTA's analysis of EPA's report relies principally on its summary volume. However, there are discrepancies between the summary and subsequent volumes of the EPA report. EPA did not use some results of its own analyses that are in more agreement with the findings of OTA and others than EPA's highlighted findings and conclusions would indicate. Box D gives several examples of such unused EPA results.

Areas of Agreement

Technical

Despite the different waste universes studied by EPA and OTA (as discussed later), both reports attest to the availability of technology to reduce waste generation, the basic economic benefits of waste reduction, and the ability of industry (and government) to reduce waste generation. Both reports, moreover, give considerable attention to the lack of substantive information on waste generation *and* reduction: on what has occurred, is now occurring, or may occur in the future. The correct way to measure waste reduction, according to EPA and OTA, is to put changes in waste generation on a product output basis so that other contributions to changing waste generation levels (e.g., production rates) are eliminated. But only a few companies can supply data of this nature, and government has not yet clearly stated that there is a correct way to measure waste reduction that everyone ought to use.

Optimism about future potential does not mean that every waste generator can immediately reduce its waste generation. In some cases, R&D may first be necessary in order for economic benefits to be attained at specific plants. Some industries have less potential for waste reduction than others, either because of the age or type of their production processes, because of past reduction efforts, or because of variable capacity to innovate related to corporate styles, cultures, and strategies. Generally, EPA and OTA conclude that there are a number of problems, disincentives, and obstacles concerning institutions, organizational characteristics, information, and human attitudes and behavior that limit the use of technically feasible waste reduction options.

Within the agreements between the EPA and OTA reports, however, there is a point of disagreement that can have important policy implications. Years of unreliable waste generation data makes accurate accounting for waste reduction difficult, if not impossible, with current information collection systems. This is important for policy development; the greater the potential for future waste reduction the greater is the justification for a major Federal initiative aimed at helping industry reduce waste generation as soon as possible.

EPA and OTA answered the question of how much waste reduction has taken place in different ways. OTA discussed waste reduction extensively with industry people and concluded that while some waste reduction has occurred and more is occurring today, the bulk of feasible waste reduction (where waste is defined very broadly) lies ahead. OTA has not even tried to make exact calculations of past or future waste reduction, because the data are insufficient for that purpose. EPA calculated numbers that show relatively high reduction in the past with a methodology that probably overestimates waste reduction. EPA's calculations were based necessarily on critical subjective judgments, rather than actual data, which do not exist. Other factors (some of which lead to systematically overestimating the waste reduction that has occurred) cast great uncertainty on the EPA conclusion that most waste reduc-

Box D.—Unused Results in EPA's Report Appendices Agree With OTA's Findings

- **Policy should address obstacles to waste reduction rather than rely on the marketplace to provide indirect incentives**
  "Many of the hazardous waste generators subject to these pressures face obstacles to implementing waste minimizing processes or practices, because they lack awareness of the technical alternatives available, have inadequate capital to make the necessary investments, lack engineering expertise to redesign processes, or fail to understand the importance of considering compliance or disposal costs in time/cash flow calculations. " [p. **A-92]**
- **Current EPA efforts are limited; better organization and a comprehensive grants program are needed to support State programs**
  "EPA's current technical assistance effort is restricted, Few States receive direct support and the support that is available is limited. Research programs are selected and funded without any systematic determination as to whether their research might duplicate efforts of other States. " [p. A-108]
- **All sizes of firms face obstacles to waste reduction**
  "Direct financial assistance would presumably focus on small and medium-sized companies, not the largest generators, since the large firms tend to have greatest access to information and capital to support waste minimization programs. A sustained and well-publicized program would, however, help change the general climate within which firms make waste management decisions, exploiting peer pressure and creating a milieu in which firms can demonstrate technological leadership and innovation in a field where public anxieties are great." [p, **A-98]**
- **Waste reduction is a multimedia environmental protection strategy**
  "[Technical assistance programs] could encourage thinking about environmental problems on a cross media basis, Waste audits and technical assistance provided to companies generally focus on the entire pollution generation profile of a company—not just RCRA wastes. " [p. A-99]
- **Substantial unused waste reduction opportunities still exist**
  "It will be difficult to predict or to measure the impact of technical programs on waste generation rates, but the Agency believes it is potentially substantial . . . Technical assistance could potentially have a significant beneficial effect on the toxicity of wastes produced by large numbers of firms, " [P. A-98]

tion that can happen has happened. Those factors include:

1. extrapolation from approximately 20 production processes to the literally hundreds of thousands of processes in all of U.S. industry;
2. the picture of U.S. industry used in the estimate was static;*
3. the assumption of maximum use of best waste reduction technology is unrealistic because waste disposal costs were very low during most of the years used for the estimate and there was little incentive for firms to look beyond waste disposal to waste reduction or to concentrate process modification work on waste reduction rather than on product improvement; and
4. even today a waste stream can be counted as totally reduced when it moves from one regulatory system to another (e.g., instead of going to a RCRA facility it goes to a public wastewater treatment plant) or when it is only partially recycled.

The EPA report on waste minimization estimates that an additional 15 to 30 percent reduction in waste generation is possible in the next 25 years, over the 60 percent estimated for the past, In the OTA report, available company data on hazardous waste reduction was

*During the years covered by the estimate, new processes and new products were introduced in great number, some of which must have caused more waste to be generated than the processes and products they replaced. This phenomenon was not factored into the estimates.

used to support an average 10 percent year-to-year level of waste reduction for the next 5 years as a feasible goal, although individual companies and plants might accomplish less or more. In other words, the EPA report concludes that most waste reduction has already occurred; the OTA report, on the other hand, supported a greater potential for waste reduction in the near-term future.

An optimistic view of future waste reduction potential is supported by the following. First, the acknowledged leader in waste reduction, 3M, has reduced its hazardous waste generation by about 50 percent over the past 10 years and has said that it hopes to reduce by about another 30 percent over the next 5 years. It seems implausible to suggest, as EPA's report does, that all of American industry has been able to achieve what this large research-oriented company has done. Companies, such as 3M and Dow Chemical, that have given a lot of attention to waste reduction publicize the results of their efforts. These companies are few in number, suggesting that few have equaled 3M's performance, much less have reached EPA's 60 percent level.

Second, the OTA report's survey of people in 99 companies showed that about 50 percent believed technology available to them in 1985 could reduce their waste generation (all, not just RCRA wastes) by more than 25 percent. This indicates that much more waste generation could be reduced over a longer period with more extensive information dissemination, technology transfer, and government support.

Third, a recent OECD report concludes that penetration of clean technologies (processes that reduce the generation of wastes) into production has been small in the United States and elsewhere.[16] It found that 80 percent of U.S. spending on air and water pollution from 1973 to 1980 was on end-of-pipe pollution control measures. More detailed data from France, where the national government has promoted waste reduction, show that major waste generating industries have introduced clean technologies into only 1 to 3 percent of their plants (major exceptions were gas and electric plants at 72.7 percent and wood at 36 percent). In Denmark, which is very progressive in the environmental area, about one-third of firms adopted new production processes with environmental benefits between 1975 and 1980.

Still other recent information is consistent with OTA's conclusion that much more reduction in waste generation (broadly defined) is possible. New Jersey has perhaps the best State data on waste generation, and new data indicate an *increase* in waste generation of 50 percent over the past 3 years (when the effect of a major plant having closed down some operations is taken into account). Increases in production were not likely to have been the cause, because of a slow economy, but better information reporting could account for it.

New York officials have reported that out of some 2,000 biennial waste generator reports submitted in 1986 only 50 provided any information on waste minimization required by Congress in the 1984 amendments to RCRA. A reasonable interpretation of these numbers is that most generators did not reduce waste generation, since they could benefit from public acknowledgment of such efforts. The report format was not an obstacle because they could report their efforts in any narrative form they chose. According to Illinois officials, annual reports indicate that 50 percent of large quantity generators and an even greater fraction of small quantity generators have made no serious progress in waste reduction.

In California, the Metropolitan Water District of Southern California and the Environmental Defense Fund have embarked on an innovative program (supported by $300,000 from each for the initial program) to assist industry to reduce the generation of chlorinated solvents by up to 75 percent. This high goal indicates this industry has not pursued much waste reduction in the past.

Lastly, if EPA was correct about so much past waste reduction, then there should have been some observable effects on aggregate waste generation. Unfortunately data for RCRA waste

[16] Organization for Economic Cooperation and Development, *Environmental Policy and Technical Change,* op. cit.

have been undergoing change and remain suspect. Nevertheless, it is important to consider aggregate waste generation data because from a waste reduction perspective all generated wastes establish the potential for waste reduction. There is very little data from EPA's air and water regulatory programs on how much waste is generated. In the initial years of the RCRA program, EPA said that about 40 million metric tons of hazardous waste were generated annually. Then in the early 1980s, beginning with OTA, the Congressional Budget Office and an EPA contractor study raised the estimated level to some 250 million metric tons annually. However, a survey of 1984 practices taken by the Chemical Manufacturers Association (C MA) of its members suggested that total RCRA waste generation for the Nation might be as high as 1 billion tons annually .17

Now, a new EPA contractor survey has, for the first time, counted RCRA waste that is exempt from being managed in RCRA regulated facilities. All RCRA wastes, regardless of how they are managed, define targets for waste reduction. Preliminary data reported in December 1986 show that a total of 569 million metric tons of RCRA wastes were generated in 1985. While this survey covered more RCRA wastes (but only currently regulated RCRA wastes) than those in the past, it did not account for nonRCRA wastes that are handled exclusively by nonRCRA facilities (e. g, a wastewater treatment plant not requiring a RCRA permit). It should be noted that numbers for total amounts of waste generation are influenced by several factors, such as plant closings, changing production levels, or regulatory delistings, that can mask or distort changes due to waste reduction.

Data on the generation of hazardous waste (only RCRA wastes) by the chemical industry have been presented to show that waste reduction is occurring. 17 The reductions in the amounts generated over time for 301 plants have been correlated with changes in the industry production index published by the Federal Reserve Board. However, this approach does not necessarily provide an accurate measure of waste reduction. First, the problem is that the production index is for the entire chemicals industry. This is not the same as relating the changes in waste generation, on a one-to-one basis, to the actual production changes from those plants. There is considerable diversity in the chemicals industry for different industry segments (e.g., organic, inorganic, specialty) and for different companies within those segments. Second, the procedure hides changes other than production levels that can affect waste generation data.

In conclusion, OTA finds pent-up opportunities throughout industry for waste reduction; they await the removal of obstacles, the provision of information and technical means, and clear benefits to be provided by general regulatory and economic conditions. A slow, incremental approach to waste reduction unnecessarily prolongs avoidable environmental costs in industry and delays environmental benefits to the Nation.

Use of Regulations

Both reports recognize that a traditional regulatory approach to, in some way, prescribe industrial waste reduction is not now practical or feasible. Both reports also note the apparent effectiveness of State and foreign government waste reduction programs that have not been based on a regulatory approach. However that effectiveness is limited in scope, especially in the context of affecting national waste generation and management. That is, the nonregulatory approach to waste reduction has been found effective when used, but has not yet received broad and serious public and private support anywhere.

Both reports hold up the prospect of regulations in the future if better information demonstrates need and justifies the high implementation costs. This could happen if the nonregulatory approach is never fully supported or if it is and is found to be ineffective. EPA plans to con-

[17] Chemical Manufacturers Association, "Results of the 1984 CMA Hazardous Waste Survey," January 1986. The sample of companies represented one-half of the chemical industry and the chemical industry generates about half of the total for the Nation. The CMA total of about 247 million tons can, therefore, be roughly extrapolated to about 1 billion tons nationally.

[18] Chemical Manufacturers Association, " 1985C MA Hazardous Waste Survey, " April 1987.

tinue to examine mandatory controls in order to reach a final decision in 1990. However, it does not appear that there is any information now being collected at the Federal level on industrial practices that could justify, much less be the basis for, a major new regulatory program. By carefully designing new information collection within existing regulatory programs, it might take 5 to 10 years to get reliable systematic data on waste reduction nationwide. It is not so much that it could not be done faster but that organizational and administrative factors associated with using *existing regulatory programs* would slow down the process. As discussed later, a separate, new waste reduction office in EPA could perform the job more efficiently.

Areas of Disagreement

The differences between OTA and EPA regarding the use and definition of terms and whether waste reduction is best applied within a multimedia context are outlined in tables 1 and 2.

Operative Term and Definition

There is no standard term for actions that reduce the generation of waste and none of the terms in use cover a standard set of similarly defined activities. The term waste reduction, however, has roots in government activities and policy statements going back many years and has always referred to cutting down the generation of waste at its source. Therefore, it is consistent with the broad concept of pollution prevention as distinct from pollution control which deals with wastes and pollutants *after they are generated* and leave a production process.

OTA has placed utmost importance on this distinction because the historical record indicates clearly that there is a tendency in government and industry to opt for post-generation pollution control solutions instead of prevention. If one accepts the long-standing proposition that waste reduction is without doubt the option of choice, it is necessary to unambiguously distinguish it from pollution control and waste management options. Public policy that does not clearly identify and single out waste reduction and define it unambiguously is likely to lead to programs that underemphasize and undermine waste reduction relative to pollution control.

Waste minimization is the term used in the EPA report because the report was mandated under the *waste minimization* section in the 1984 RCRA Amendments. In the statute a clear distinction is repeatedly made between waste reduction, the uncontested option of choice, and better waste management "of wastes nevertheless generated" as an alternative to land disposal. EPA's report divides waste minimization into three categories: source reduction, recycling, and waste treatment. Source reduction, if it is equivalent to OTA's waste reduction, is consistent with the first part of the national policy statement (see box C), while recycling and treatment processes manage waste that is generated. The EPA report says that "Source reduction measures can include some types of treatment processes . . . "[19] The inclusion of treatment is difficult to interpret. For example, if EPA considers in-plant incineration of waste as source reduction, then there is even greater disagreement between OTA's and EPA's definition. Thus, putting the term waste minimization aside, EPA's definition of source reduction alone could encourage waste treatment by industry instead of waste reduction.

However, for purposes of the waste minimization report to Congress, only source reduction and recycling are included because:

> . . . this report focuses on source reduction and recycling, the two aspects of waste minimization where basic options still remain open. [20]

Basic options here apparently refer to policy options since Congress has already directed EPA to consider treatment technology capacity but not waste reduction or recycling capability when implementing the RCRA land disposal bans. Later the report states:

[19] U. S. Environmental Protection Agency, *Report to Congress: Minimization of Hazardous Waste,* op. cit., p. ii.
[20] Ibid., p. iv.

Table 1.—Definitions Used in the Reports

EPA (for the report)	SPA (Interpreting HSWA)	OTA
waste minimization: "Waste minimization means the reduction, *to* the extent *feasible,* of hazardous waste that is generated or subsequently treated, stored, or disposed of. It includes any source reduction or recycling activity undertaken by a generator *that results in* either: 1) the reduction of total volume or quantity of hazardous waste; or 2) the reduction of toxicity of hazardous *Waste,* or both, so long as such reduction is consistent with the goal of minimizing present and future threats to human health and the environment." [p. 11 and p.	"In the broadest sense, the HSWA defines waste minimization as any action taken to reduce the volume or [sic] toxicity of wastes. That definition includes the concepts of waste treatment, which encompasses such technologies as incineration, chemical detoxification, biological treatments, and others." [p. ii] "In the broad context, HSWA recognizes three options for minizing wastes—treatment, source reduction, and recycling. Whichever method is used, the end result must be a reduction in the volume, quantity or [sic] toxicity of wastes generated and sent to land disposal." [p. 13]	Based its report on the statutory definition as provided by the national policy statement in HSWA. First, reduce the generation of waste (waste reduction); then, apply best waste management practices to wastes that are generated.
"This report focuses on source reduction and recycling, the two aspects of waste minimization where basic options still remain open." [p. iv] "Waste minimization, as defined in this report, includes the first four categories of this hierarchy . . ." [The four categories referred to above are: waste reduction, waste separation and concentration, waste exchange, and energy/material recovery.] [P. 6] "The two ma@ categories of waste minimization activities considered in this report are source reduction and recycling." [p. 43]		
Source reduction: "Any activity that reduces or eliminates the generation of a hazardous waste within a process." [p. 8] "Source reduction refers to the reduction or elimination of waste generation at the source, usually within a process. This is the type of waste minimization that moat closely corresponds to the concept of waste avoidance. Source reduction measures can include some types of treatment include procut they also process substitutions, feedstock or improvements in feedstock purity, various housekeeping and management practices, increases in the efficiency of machinery, and even recycling within a process. As used here, source reduction implies any action that reduces tha amount of waste exiting from a process." [p. 6. also p. H but sentence #2]		Term not used or defined by OTA but accepts EPA's definition as equivalent to OTA's waste reduction, if waste treatment is excluded.
Waste reduction: Not defined, but used intermittently throughout the report. Use varies and *doee* not necessarily urea with OTA's definition.		"in-plant practices that reduce, avoid, or eliminate the generation of hazardous waste so as to reduce risks to health and [the] environment." [p. 3]
Recycling: "A material is 'recycled' if it to used, reused, 0? reclaimed (40 CFR 261.1 (b) (7)." [p. 8] "Recycling refers to the use or reuse of a waste as an effective substitute for a commercial product, or as an ingredient or feedstock in an industrial process. It also refers to the reclamation of useful constituent factions within a waste material or removal of contaminants from a waste to allow it to be reused. As used here, recyclingnplies use, reuse, or reclamation of waste after it is generated by a particular process. It, too, can involve various types of treatment to facilitate the recycling process." (p, 7; also p. ii but Without the final sentence]		"When recycling is environmentally acceptable and is an integral part of the waste generating industrial process or operation OTA considers it waste reduction . . . But recycling is *not* considered waste reduction if waste exits a process, exists as a separate entity, undergoes significant handling, and is transported from the waste generating location to another production site (perhaps a part of a large plant) for reuse, or to an offsite commercial recycling facility or waste exchange." [p. 10]

SOURCES: Complied by OTA, 1987. For columns 1 and 2, U.S Environmental Protection Agency, *Report to Congress: Minimization of* Hazardous *Waste*, EPA/530 +3 W-86-033 (Washington, DC: EPA, Office of Solid Waste and Emergency Response, October 1986), pages as noted For column 3, U.S. Congress, Office of Technology Assessment, *Serious Reduction of Hazardous Waste*, *OTA.ITE.317* (Washington, DC U S. Government Printing Off Ice, September 1986), pages as noted,

Table 2.–Wastes Covered by Reports and HSWA

EPA	OTA	HSWA on waste minimization
Hazardous Waste:		
EPA does not explicitly say which wastes are covered by its use of the term "hazardous wastes." An assumption can be made that since the report deals within the context of RCRA and **was** mandated under RCRA that EPA considers waste minimization to cover only those solid wastes regulated as hazardous wastes under R6RA.	"All nonproduct hazardous outputs from an industrial operation into all environmental media, even though they may be within permitted or licensed limits. This is much broader than the legal definition of hazardous solid waste in the Resource Conservation and Recovery Act, its amendments, and subsequent regulations. Hazardous refers to harm to human health or the environment and is broader than the term 'toxicity.' For example, wastes that are hazardous because of their corrosive, flammability, explosiveness, or infectiousness are not normally considered toxic. " [p. 31]	The phrase used in HSWA was "hazardous wastes. " The assumption can be made, therefore, that the waste minimization regulations required by HSWA were intended to cover only those solid wastes regulated as hazardous wastes under RCRA. Some ambiguit exists, however, due to the legislative history. Senate Report No. 98-284 on waste minimization provisions in S. 757, voiced concerns about ". pollutants contained in effluents, emissions, wastes or other pollution streams. "
Differing views of a multimedia approach: Waste minimization is RCRA:		
Ail incentives/disincentives (barriers) are framed within the RCRA context. The one exception is: "Commercial recycling facilities that wish to increase their operations might be reluctant to do so if the expansion were to require a revision of their NPDES water pollution permit to authorize a change in the composition of their discharges or allow for larger flows." [p. 29] Almost all information/data reviewed for report and assessment of needs for future concerns RCRA hazardous waste generation and management.		
Waste minimization is multimedia:	*Waste reduction is multimedia:*	
EPA lists protecting human health and the environment as a key role for waste minimization because ". . none of EPA's environmental control programs can fully eliminate all the risks that they attempt to control." [p. 9] "To achieve its purpose, waste minimization like other pollution control measures, must look comprehensively across all environmental media; reductions in hazardous waste must not be made at the expense of increases in air or water pollution . . . Waste minimization programs must therefore be carefully designed to avoid cross-media transfers and to protect human health and the environment in a comphrensive sense. The need to design a waste minimization program that addresses both of these goals provides a framework for integrating the objectives of all environmental programs." [p. 10] "EPA believes that waste minimization must be implemented **as a** general policy throughout the hazardous waste management system and, ultimately, more broadly throughout all of EPA's pollution control programs." [p. 121]	"Reduction-applied to a broad universe of emissions, discharges, and wastes—is the best means of achieving pollution prevention." [p. 7] "OTA has concluded that a comprehensive multimedia (air, water, land) definition for hazardous waste is necessary . . . 1) to avoid creating opportunities for shifting waste from one environmental medium to another possibly unregulated or less regulated medium . . . and 2) to include wastes that are not currently regulated, such as most toxic air emissions. If the term hazardous waste is defined or applied narrowly, waste reduction measures can be ineffective. " [p. 11]	

SOURCES: Complied by OTA, 1987. For column 1, U.S. Environmental Protection Agency, *Report to Congress: Minimization of Hazardous Waste*, EPA/530-SW-86-033 (Washington, DC: EPA, Office of Solid Waste and Emergency Response, October 19S8), pages as noted. For column 2, U.S. Congress, Office of Technology Assessment, *Serious Reduction of Hazardous* **Waste,** OTA-ITE-317 (Washington, DC: U.S. Government Printing Office, September 1988), pages as noted.

> Waste minimization, as defined in this report, includes the first four categories of this hierarchy . . . [21]

The four categories referred to are those in EPA's 1976 hierarchy statement and include waste reduction, separation and concentration, waste exchange, and energy/materials recovery but exclude waste treatment and land disposal.

The EPA report can give the impression that waste treatment is not part of waste minimization. But there is a clear statement in the report by EPA that waste minimization includes waste treatment:

> That [HSWA] definition includes the concept of waste treatment, which encompasses such technologies as incineration, chemical detoxification, biological treatments, and others. [22]

Moreover, subsequent to the EPA report, a letter on April 24,1987, from a senior EPA official to the EPA Science Advisory Board says that waste minimization is "generally defined as any reduction of wastes going to disposal whether through source reduction, through on-site or off-site recycling or even **through treatment of wastes to reduce volume, mass or toxicity."** [emphasis added]

By defining waste minimization in two ways, confusion results: 1) Does *every* waste minimization statement in the report exclude waste treatment? and 2) Does *any* waste minimization activity by EPA and its commitments to future activities, outside of the boundaries of the report, exclude waste treatment? This fundamental uncertainty is highlighted by the EPA report's statement of intent to issue "informal guidance to generators concerning what constitutes waste minimization under the reporting and certification requirements of RCRA. "[23] The importance and consequences of defining waste minimization are critical, and EPA should quickly and definitively tell industry what the government means (see box E).

The term *waste reduction,* which is not defined by the EPA report, is widely and unevenly used in that report. At various times it appears to be equivalent to: 1) EPA's source reduction or OTA's waste reduction, or 2) waste minimization, sometimes with and sometimes without treatment. For example:

> Though some of these treatments, such as incineration, are very effective at solvent waste reduction, the costs have been prohibitive.[24]

In this EPA statement, waste treatment is clearly considered part of waste reduction, but the use of the term waste reduction is only sensible in this context if it is equivalent to waste minimization.

The aforementioned letter to the EPA Science Advisory Board says that waste reduction is "defined generally as waste elimination through in-process changes. "

To recap, EPA has two definitions for waste minimization and has not defined but uses the term waste reduction in a variety of ways. This confusing pattern of language creates considerable uncertainty for Congress and industry about EPA's future policies or programs. EPA initiatives to expand waste minimization may not necessarily focus on what OTA calls waste reduction if waste minimization includes any type of recycling and waste treatment. Moreover, when EPA says:

> . . . mandatory standards of performance and required management practices are not feasible or desirable at this time.[25]

does this refer to all three components of waste minimization? Clearly, waste treatment is already regulated, Recycling of generated waste that is not a part of an industrial process is and should be regulated. The OTA report's statement on the infeasibility of traditional command-and-control regulations clearly refers only to waste reduction.

In summary, OTA's waste reduction includes a host of actions taken by waste generators

[21] Ibid., p. 6.
[22] Ibid., p. ii.
[23] Ibid., p. 129.
[24] Ibid., p. 17.
[25] Ibid., unnumbered first summary page.

Box E.—Recent Examples of Obstacles in the Private Sector to Waste Reduction

Current, traditional attitudes in industry keep attention and resources away from waste reduction even when the primacy of waste reduction is explicitly recognized.

A major industrial trade association says". . . while the semiconductor industry recognizes waste reduction at the source (i.e., source reduction) to be the ultimate goal, current practice still emphasizes end-of-pipe management of hazardous waste. " Despite this recognition, a definition of waste minimization that includes waste treatment is used "since it is more reflective of current conditions in industry. "

—Steve Pedersen and Mary Ann Keen, "Waste Reduction in the Semiconductor Industry," *Proceedings of Conference on Hazardous Wastes and Hazardous Materials* (Silver Spring, MD: Hazardous Materials Control Research Institute, March 1987).

Waste reduction is not undertaken because the generally accepted broad definition of waste minimization and the way it is promoted encourage generators to satisfy waste minimization reporting regulations with traditional methods of waste management.

A major consulting firm to industry and government acknowledges the unique, critical benefit of waste reduction—reducing the generation of waste—but attributes lower generation of wastes to waste *minimization,* which is defined, "in order of preference [as] (1) source reduction, (z) recycling, and (3) treatment. " But the firm says that waste minimization reduces the "volume and/or toxicity of hazardous waste. " With this interpretation, waste treatment that simply concentrates a wastestream's hazardous components counts as waste minimization, without lowering risks to public health and the environment.

—Stephen W. Kahane, "Waste Minimization Audits," *Proceedings of California Solvent Waste Reduction Alternatives Symposia* (Sacramento, CA: Department of Health Services, October 1986).

Analyses, even those now being developed for waste minimization purposes, can be biased against waste reduction. In addition, such systems are viewed as a less complicated company policy than direct policies to remove recognized, but diverse, obstacles to waste reduction.

One of the country's leading, large, diversified manufacturers says ". . . waste reduction is the best situation of all; no waste, no liability!" Its "approach has been to develop a financial analysis workbook and companion computer software program which will allow plant personnel to determine total waste management costs including future liability considerations." But it is not clear that waste reduction would be explicitly examined at all. Although the methodology raises the costs of land disposal techniques to better reflect their total long-term costs, it assumes virtually no liability for incineration and, thereby, places incineration on a par with waste reduction. Thus, even though the direct costs of incineration maybe high, they maybe low relative to total land disposal costs which is the base case and not waste reduction. This might be the case especially if onsite incineration or existing industrial furnaces or boilers are chosen (see box F). Plant management can use this dollar savings to support incineration and other similarly evaluated treatment technologies instead of waste reduction because there is a focus on reducing liabilities: "Those programs that reduce all liabilities and are the best accordin$_g$ to established financial proceedings are to be implemented. "

The company financial analysis "method offers several advantages over company policies such as an end-tax on waste or a five-year waste reduction plan. " The company believes that such direct "policy approaches are difficult to administer" for large, highly decentralized and diversified firms. Why? Because of differences between corporate divisions, differences among treatment options and wastes, allocation of resources to other shorter term needs, and a lack of technical expertise at some plants. Clearly, these conditions exist for many companies and constitute obstacles that must be directly addressed if waste reduction is to be systematically chosen instead of traditional waste management.

—Richard W, MacLean, "Financial Analysis of Waste Management Alternatives, " *Proceedings of Conference on Hazardous Wastes and Hazardous Materials* (Silver Spring, MD: Hazardous Materials Control Research Institute, March 1987).

within the confines of their production operations to cut the generation of waste, This language is consistent with the concept of pollution prevention. **Any activity by which hazardous waste is handled, managed, or transported poses risks and costs, requires complicated regulation, offers less certain environmental protection than waste reduction, and contributes to industrial inefficiency and heightened public concern about the environment.** EPA has defined waste minimization to refer to all options other than land disposal, consistent with statute, but has excluded waste treatment in its report on waste minimization, EPA has not clearly stated that certain actions should be shown infeasible before a generator steps down the hierarchy. Recycling and treatment, instead of waste reduction, may be emphasized in future waste minimization activities by EPA. Based on EPA's report, it is impossible to predict to what extent future EPA waste minimization actions will focus on waste reduction.

Appropriate Wastes To Cover

In OTA's report waste reduction applies to all hazardous wastes and environmental pollutants whether they are regulated under the air, water, or RCRA programs or not. (The term multimedia is often used to describe this broad coverage,) The alternative, waste reduction applied to any particular category of waste, might lead to: 1) less waste reduction than is feasible, and 2) abuse because some actions might do little more than transfer waste among environmental media or from one regulatory class to another.

Since all of EPA's waste minimization activities stem from the 1984 RCRA Amendments, the EPA report is concerned with hazardous wastes defined as such under RCRA. There are two important limitations to this definition. First, it is not clear that any EPA waste minimization effort would apply, for example, to discharges to waterways covered by the Clean Water Act or air emissions covered by the Clean Air Act, The strongest statement in the EPA report in this regard is:

> EPA believes that waste minimization must be implemented as a general policy throughout the hazardous waste management system and, ultimately, more broadly throughout all of EPA's pollution control programs. [26]

But this statement is not reflected in EPA's long-term policy option.

Second, it is highly likely that EPA has not yet officially recognized large amounts of industrial wastes as hazardous. GAO has recently studied this problem and its findings are consistent with those of other studies, including OTA's 1983 report on hazardous waste. In its report GAO said:

> EPA does not know if it has identified 90 percent of the potentially hazardous wastes or only 10 percent, according to the division director responsible for hazardous waste identification . . . Ten years after the Congress mandated the identification and control of hazardous wastes, EPA cannot say what portion of the universe of hazardous wastes it has identified and brought under regulation, or even if it is regulating the worst wastes in terms of potential impact on human health and the environment.[27]

This should be borne in mind when figures on the amount of RCRA generated waste are considered by policy makers, such as the new number of 569 million metric tons annually. All such figures refer to only those wastes EPA has already officially designated as hazardous and therefore, underestimate the universe of hazardous waste that pose risks to health and environment. **Thus, OTA has found it important to say explicitly that waste reduction must apply to all hazardous wastes, whether regulated by EPA under RCRA or not. Otherwise, a Federal nonregulatory waste reduction program will inherit the limitations of the RCRA regulatory program.**

Even if a multimedia perspective were eventually adopted by EPA, delay could cause significant environmental and economic costs. While there might be bureaucratic reasons not to consider multimedia waste reduction now,

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[26] Ibid., p. 121.

[27] U.S. Congress, General Accounting Office, *Hazardous Waste: EPA Has Made Limited Progress in Determining the Wastes To Be Regulated,* op. cit., pp. 19 and 23.

there is no reason to assume that it would be harder for industrial production people to apply waste reduction to all of their wastes and pollutants than only to those regulated under RCRA. Indeed, some companies already do so. But systematic adoption of multimedia waste reduction in industry will require overt government policy support.

The merits of multimedia coverage and the long time the RCRA program is taking to determine all the wastes that should be regulated as hazardous support the option of new legislation by Congress rather than a continuation of waste reduction being confined to RCRA.

Incentives and Disincentives v. Enhancements and Obstacles

The EPA report devotes considerable attention to market incentives that can drive industry toward waste minimization. However, **general conditions that can lead to a range of responses are not necessarily an effective incentive for any particular response.** Intentional and purposeful design are crucial for developing effective waste reduction incentives and disincentives and in developing public policy options.

An effective incentive is a specific action or condition that is likely to elicit a specific desired response. A disincentive causes parties to purposefully avoid a specific response. A general condition that elicits a range of positive responses, including the desired response, can be called an enhancement to the desired response. One that leads people away from the desired response or makes the desired response less attractive can be called an obstacle. For development of policy options it is necessary to focus on obstacles and problems relative to a desired outcome, such as waste reduction. Government is not needed if things are going well.

In the EPA report the terms incentive and disincentive are used in confusing ways. The Federal RCRA regulatory program was emphasized and conclusions drawn about its impacts on waste minimization instead of examining the benefits which might accrue from proceeding with waste reduction as a program itself. This perspective systematically biases decisions against major new Federal efforts aimed directly at promoting systematic waste reduction. For example, EPA and others consider rising waste management costs and liabilities, difficulties in siting waste management facilities, and regulatory burdens as incentives for waste minimization.[28] But none of these conditions were purposefully designed to elicit a waste reduction response nor is there any evidence that they have done so systematically, and it is misleading to call them incentives for waste reduction. **Since current regulatory programs are not purposeful incentives, policymakers should be cautious about their value to increase waste reduction.** Increasing regulations and improving their enforcement have their own merits, but they are unlikely to offer as effective and efficient a way to increase waste reduction as do policies designed to promote waste reduction. It is a mistake to believe that nothing other than attempts to fix the current regulatory system has to be done to spark a major movement by industry to comprehensively reduce waste generation. Existing regulatory conditions provide motivation and potential benefits for waste reduction but not necessarily the means to reduce waste generation and reduce the obstacles in the way.

There is also another fundamental problem. **General regulatory conditions are not necessarily effective incentives or enhancements for waste reduction because many other more familiar, intended, and unwanted responses (e.g., waste treatment, regulatory compliance, and illegal disposal, respectively) can displace or limit waste reduction.** Environmental costs may rise faster than generators can reduce waste generation. Responses other than waste reduction by all sizes and types of companies include:

[28] An example of this perspective in the private sector is: "Once a manufacturer is forced to confront the realities of proper hazardous waste management, and in turn the higher cost associated with that treatment, management, then you will force an assessment of the production practices and waste reduction. " [Richard C. Fortuna, Executive Director, Hazardous Waste Treatment Council, testimony before the House of Representatives, Energy, Environment, and Natural Resources subcommittee, Sept. 24, 1986].

- regulatory compliance that maintains an end-of-pipe approach for regulated wastes;
- payment of higher waste management costs to continue use of commercially available pollution control technologies;
- plant closings or relocation to foreign sites;
- changing waste management technology because of regulations or to reduce liabilities (see box F);
- internalizing waste management to reduce liabilities and costs by reducing the use of offsite facilities;
- finding regulatory, legal, and political opportunities to avoid or delay compliance; and
- noncompliance, illegal disposal, or acceptance of fines and penalties as a cost of doing business.

Moreover, the regulatory system: 1) does not apply to all hazardous wastes and environmental pollutants, 2) is unevenly enforced, and 3) often undergoes changes that send contradictory messages to generators that foster a wait-and-see attitude,

General regulatory conditions, therefore, may have positive or negative consequences with regard to waste reduction and, depending on specific company circumstances, may be enhancements for or obstacles to achievable waste reduction. Clearly, some generators will always be positively affected by regulatory conditions. However, the regulatory system, by itself, has and will not motivate *widespread* waste reduction unless one or more of the following are found to be valid:

- Generators facing rising environmental costs and liabilities do not at the same time face significant obstacles to waste reduction.
- The current regulatory system is comprehensive and effective.
- The merits of waste reduction can be used to expeditiously expand and fix the regulatory system so that environmental costs for generators increase and cause them to reduce waste generation.

Some recent research has verified that concerns about liabilities stimulate responses other than waste reduction.zg The mere expression of concern about liabilities does not mean that it will affect decisions. While 10 of 13 waste managers interviewed said that their firms were "very concerned" about hazardous waste liability, only three said that it was a significant waste reduction factor. In speaking to a large number of people in industry, including people in large companies who work at the plant level, OTA has found this situation to be very prevalent. Decisionmakers seek optimal choices within the limits of their knowledge and analytical resources.

The EPA report does not include a discussion about the dual nature of general regulatory conditions (of their role as obstacles as well as enhancements) but concludes that regulations are more effective as enhancements than as obstacles. While the EPA report appendices give some attention to industry, there is no discussion in the summary volume of how widely differing factors (e.g., management style, process type, and age) can affect the way companies adopt waste reduction.

OTA conducted a survey of industry to gain insight into the duality of general regulatory conditions. The results served as the basis for a discussion in the OTA report of why the current regulatory program is likely to act as an obstacle to waste reduction. Briefly, some of the key reasons why responses other than waste reduction are likely are:

- greater familiarity with waste management and pollution control by workers, managers, and advocates in companies and trade associations;
- a belief (which is, in fact, incorrect) that waste recycling and treatment technologies are, or can be made, safe enough to minimize liabilities as much as waste reduction can;

'Robert E. Deyle, "Source Reduction by Hazardous Waste Generating Firms in New York State, " Syracuse University Technology and Information Policy Program Working Paper No. 85-010, as cited in Robert Deyle and Rosemary O'Leary, "Small Quantity Generator Liability and Regulatory Compliance," *Proceedings of the National Conference on Hazardous Wastes and Hazardous Materials* (Silver Spring, MD: Hazardous Materials Control Research Institute, March 1987).

Box F.—Burning Waste in Industrial Furnaces and Boilers Can Reduce Interest in Waste Reduction

Premise

Land disposal restrictions in RCRA and limited availability of high-cost commercial incinerators increase interest in using onsite or offsite furnaces and boilers. Interest is especially strong for liquid organic hazardous waste such as spent solvents. The waste serves as a substitute for fuel.

Level of Interest

Industry .—Waste generators want to use either their own furnaces or commercial cement kilns, lime kilns, and iron-making blast furnaces. For the latter costs are said to be one-quarter to one-third of prices charged for hazardous waste incinerators.[1]

Government.—EPA and State regulatory officials, for the most part, support and encourage use of industrial furnaces and boilers. It is seen as a way to allow implementation of land disposal bans and still allow industry to generate waste.

Regulations

EPA is establishing regulations for burning hazardous waste in industrial furnaces and boilers which thus far have escaped regulation because they have been considered as recycling or recovery operations. EPA's proposed regulations, however, will not pose serious problems. For example, no test burn may be necessary, no routine measurement of discharged solids for hazardous metals with regard to leachability, nor testing for specific toxic air emissions will be imposed. Moreover, for small quantity wastes there will be a regulatory exemption and for many cases the solids discharged will not be considered hazardous until shown otherwise, as is now the case for incinerators. The net effect of all this will be to speed up permitting of facilities and to give them a competitive advantage over conventional incinerators whose only function is to burn hazardous waste. z

Issues and Concerns

- Government regulation may be ineffective. For example, solid products produced by furnaces that may contain hazardous substances, such as lead, may pose risks when in use.
- Generators may have more liability than proponents suggest due to handling and storage of waste, residual waste in product, and toxic air emissions.
- There is a strong economic motivation for furnace operators to use far more waste than is necessary for fuel purposes. This could reduce furnace reliability and effectiveness, result in contaminated products, and cause unsafe storage and handling which has often occurred in the past at "sham" recycling facilities. More money can sometimes be made from burning waste than from making product. And wastes with no fuel value are also being talked about for burning in industrial furnaces.[3]

Impact on Waste Reduction

The promotion of industrial furnaces and boilers as an environmentally acceptable, low cost, and convenient alternative to land disposal is an obstacle to waste reduction. Compared to land disposal, generators with insufficient interest in or knowledge of waste reduction see an economically attractive, government-sanctioned option for their waste management. Ironically, many of the wastes targeted for industrial furnaces are the easiest to reduce the generation of by in-process recycling and raw material changes. Moreover, the risk of sham recycling or ineffective burning makes this waste management option a particularly poor alternative compared to the benefits of waste reduction.

I Michael Benoit, "The Use of Industrial Furnaces for the Destruction of Organic Hazardous Wastes, " proceedings of conference on *Minimizing Liability for Hazardous Waste Management* (Philadelphia, PA: American Law Institute and American Bar Association, April 1987).

[2]Lisa Friedman, oral comments at conference on *Minimizing Liability for Hazardous Waste Management,* Apr. 3, 1987.

[3]Benoit, op. cit.

- inability of companies to simultaneously devote resources to legally demanded regulatory compliance and to voluntary waste reduction;
- lack of a technical support structure and rewards for production people who must implement waste reduction and lack of time to do it;
- a mistaken belief that no waste reduction opportunities remain;
- lack of technical information to pursue waste reduction, including the exact linkage between waste generation and specific industrial operations; and
- lack of accounting systems that allocate environmental costs to specific production operations, where waste reduction must occur, in order to provide the economic motivation to assess waste reduction.

These reasons (see box E for recent examples) for nonwaste reduction responses to general regulatory conditions are obstacles and can be addressed by public policies and corporate actions, Even though they result in less waste reduction, they are not disincentives since they do not purposefully move decisions away from waste reduction. This may explain why these obstacles are often ignored or discounted. Moreover, it is not possible to generalize as to their presence and effect with regard to company size or type of industry or product. Nor is OTA suggesting that the above reasons are caused by the regulatory system. For example, EPA and others point out that a lack of capital in smaller companies is a reason why they do not practice waste reduction. **But many companies, both small and large, with capital to invest are more likely to allocate it to product development, plant expansion, or diversification rather than waste reduction. Moreover, although waste reduction projects may offer attractive paybacks (in the majority of cases in less than one year), they may still be less than some product-related projects.**

An important new piece of information supports the view that government intervention must overcome existing obstacles to waste reduction and provide direct assistance to generators. Ventura County in California has just completed a 2-year innovative program in waste reduction, It has obtained evidence of substantial waste reduction as a result of a proactive program that sends county inspectors into plants to conduct waste reduction audits and make recommendations to generators. so What is important for national policy development is what the Ventura County has concluded:

> The government, so far, intends no further public intervention and assumes that companies have the motivation, finances and informational resources that are necessary to develop and implement their own hazardous waste reduction program. The Ventura County Program results, however, reveal that this assumption is not the case and that generators are not fully aware of all waste reduction methods and opportunities.
>
> Local programs, through established relationships with hazardous waste generators and involvement in land use processes, can provide incentives, information and other assistance that is necessary to achieve significant hazardous waste reduction in their communities.[31]

Ventura County also conducted a survey of the 75 companies it worked with and found that:

> A large component of corporate resistance to volume reduction comes from the managerial level. Attitudes toward changing existing "habits" affect the implementation of strategies to reduce waste generation. Management, it appears, will often select "proven methods" of waste disposal rather than trying to innovate new methods to reduce volume of waste generated. Companies, we

[30] Although OTA finds that the definition of waste reduction used by Ventura County, like the term waste minimization, poses problems because it includes recycling and treatment and that the data reported does not measure waste reduction correctly, there is little doubt that the program has resulted in significant waste reduction. However, the figure generally quoted of 70 percent waste reduction over the 2-year program may overstate or understate waste reduction as defined by OTA. It was based on aggregate generation data of wastes shipped offsite and not waste reduction data from specific companies on a production output basis.

[31] Ventura County Environmental Health Department, "Hazardous Waste Reduction Guidelines for Environmental Health Programs," draft, prepared for the California Department of Health Services, March 1987.

found, were reluctant to take risks with unproven technologies or recyclers, were not aware of alternatives and in several cases were not interested in changing habits.[32]

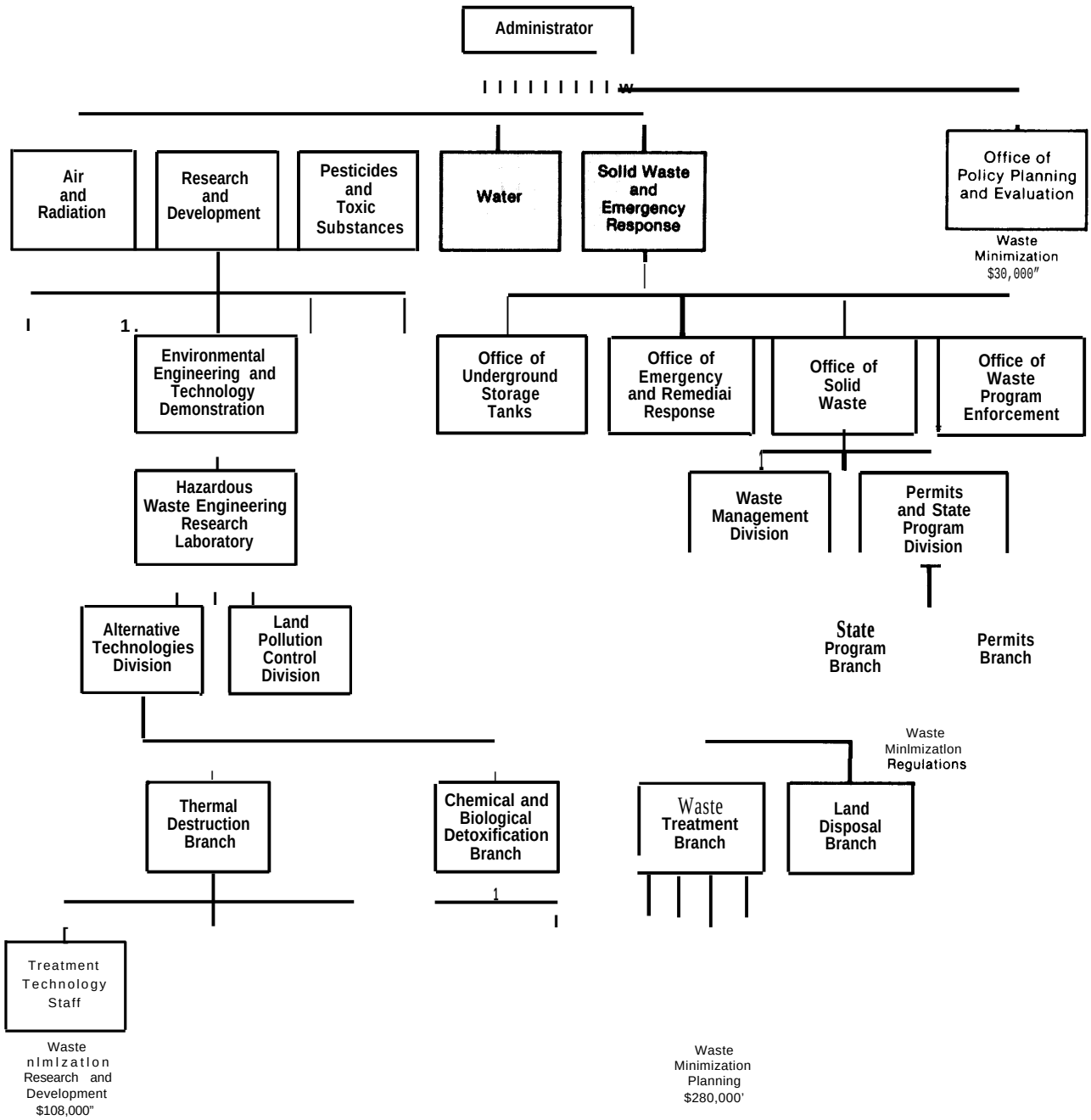
In Summary

Recent information and the OTA analysis provides strong support for a Federal waste reduction initiative designed to address multiple obstacles through a nonregulatory program. The Federal Government has done very little intentionally aimed at promoting waste reduction. This includes the RCRA waste minimization certification and reporting requirements because their intent is not to *encourage* waste reduction but to *discourage* land disposal practices. Existing EPA programs are chiefly concerned with compliance with end-of-pipe regulations. These regulations have incidental and unintended secondary impacts on waste reduction, which have probably not been sufficiently positive to justify concluding that nothing more has to be done by government. Only those companies and individuals with desire, necessary information, and means can translate potential benefits created by the regulatory system into specific waste reduction actions.

Moreover, EPA's definitions and scope for a future waste minimization program, as well as its current regulatory programs, often channel private sector efforts away from waste reduction to traditional pollution control activities. The EPA report assumes effective positive influences on waste reduction from existing regulatory programs and has embedded waste reduction activities within a regulatory framework that has historically given no priority or serious support to waste reduction. (See figure 1 on EPA organization and waste minimization.)

[32] Ventura County Environmental Health Department, *Progress Report on Ventura County Hazardous Waste Volume Reduction and Alternative Technology Program,* April 1986, p. 26.

Figure 1 .—EPA Organization and Funding for Waste Minimization



" FY88 budget request

SOURCE" Office of Technology Assessment