

Chapter 1

Overview of RCRA and General "Solid" Waste Issues

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Overview of RCRA and General “Solid” Waste Issues

INTRODUCTION

The Resource Conservation and Recovery Act (RCRA), the major Federal statute on solid waste, was passed in 1976.¹ RCRA broadly defines ‘solid’ waste—which actually can have any physical forms, for example, garbage, refuse, sludge from treatment processes and other pollution controls, and discarded material from industrial, commercial, mining, and agricultural operations (see “The Resource Conservation and Recovery Act” below for additional details).² Today, efforts continue to refine the Federal system for regulating solid wastes and to fully achieve RCRA’s goals of protecting human health and the environment and conserving valuable material and energy resources.

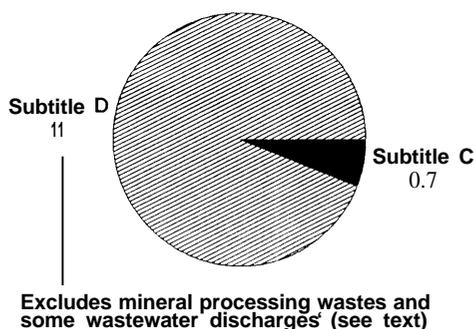
Federal efforts to date have focused primarily on controlling the management and disposal of certain wastes defined as “hazardous.” Yet such wastes, which are regulated under Subtitle C of RCRA, make up only a small portion of the wastes that Congress intended RCRA to address. The remaining solid wastestream, which statutorily is addressed by Subtitle D of RCRA, includes any ‘solid’ waste not currently regulated as hazardous under RCRA (e.g., medical, municipal, agricultural, construction and demolition, oil and gas exploration and production, mining extraction and beneficiation, mineral processing, coal combustion, and industrial manufacturing wastes; municipal combustion ash; cement kiln dust; pollution control sludges; and conditionally exempt hazardous wastes from small quantity generators). In 1980, Congress also exempted certain “special wastes”—from mining, fossil fuel combustion, cement kilns, and oil and gas production—from regulation under Subtitle C, pending further study and regulatory determinations by the U.S. Environmental Protection Agency (EPA).

By weight, this highly diverse universe of Subtitle D waste dwarfs that of Subtitle C (“hazardous”) waste. According to the best available EPA data, about 11 to 12 billion tons of Subtitle D waste is generated annually in the United States; this esti-

mate is an approximation only, because it is based on data whose quality varies greatly among waste types. In comparison, approximately 0.7 billion ton of hazardous waste is generated annually (figure 1-1). The new Toxicity Characteristic (see below and ch. 5) might double the amount of manufacturing waste that would be identified as hazardous but which is managed in units that are exempt from Subtitle C regulation.

Management of Subtitle D wastes is highly variable, depending on waste type and characteristics, location, costs, and other factors. However, much of this “solid” wastestream—perhaps 70 percent—is wastewater that is at least temporarily

Figure 1-1—The Universe of RCRA Wastes
(billions of tons)



SOURCES: Based on U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Report to Congress: Wastes From the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden From Uranium Mining and Oil Shale*, EPA/530-SW-85-033 (Washington, DC: December 1985); *Report to Congress: Management of Wastes From the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy*, EPA/530-SW-68-003 (December 1987); *Report to Congress: Wastes From the Combustion of Coal by Electric Utility Power Plants*, EPA/530-SW-88-002 (February 1988); *Report to Congress: Solid Waste Disposal in the United States*, vols. 1-2, EPA/530-SW-88-01 1 (October 1988); *Report to Congress on Special Wastes from Mineral Processing*, EPA/530-SW-90-070C (July 1990); 1987 *National Biennial RCRA Hazardous Waste Report*, EPA/530-SW-91-061 (July 1991); *National Survey of Hazardous Waste Generators and Treatment, Storage, Disposal, and Recycling Facilities in 1986*, *Hazardous Waste Management in RCRA TSDR Units*, EPA/530-SW-91-060 (July 1991).

¹Acronyms used in this paper are listed in app. A; Public Law numbers for cited statutes are listed in app. B.

²Congress first established a Federal role in solid waste issues in the Solid Waste Disposal Act of 1965, as amended by the Resource Recovery Act of 1970.

managed, and sometimes disposed of, at on-site surface impoundments. The current, nationwide extent of pollution controls and monitoring at surface impoundments is unknown; as of 1985, however, many impoundments lacked sufficient design controls to prevent or detect contamination of the surrounding environment. Some wastewater is also injected underground, recycled, treated, stored in tanks, or discharged into surface waters and sewers. Other, more solid material is managed in landfills or waste piles, is spread on land, or is recycled.

Many public and private industry officials and public interest groups consider the management and regulation of these Subtitle D wastes to be the next item on the Nation's solid waste agenda. In general, EPA, some State officials, and environmental groups are concerned about the potential for leachate or other releases from surface impoundments and other management methods to contaminate groundwater and to cause health risks and various environmental impacts; for manufacturing wastes, though, EPA believes that it needs to collect additional information and evaluate relative risks before making any regulatory decisions. Many State officials, the Department of the Interior, and industry groups disagree about the significance of contamination from properly managed Subtitle D units and the need for additional Federal regulation.

At the Federal level, regulatory programs under other statutes cover certain wastes generated by the mining, manufacturing, electric power generation, and oil and gas industries. For example, wastewater discharges are regulated by the Clean Water Act, underground injection by the Safe Drinking Water Act, and air emissions by the Clean Air Act. In general, States have primary responsibility for implementing these programs. Under RCRA, EPA has developed an extensive regulatory program (i.e., Subtitle C) for hazardous wastes, issued criteria for municipal solid waste landfills, and made regulatory determinations about other, Subtitle D wastes generated by the mining and oil and gas industries. EPA is attempting to develop a Subtitle D program for active mining waste sites, but it has not yet proposed actual Subtitle D regulations for mining or any other industry. Thus, States currently are responsible for

developing and implementing their own programs for Subtitle D wastes. Many States have improved various aspects of their programs in the past few years and now regulate many portions of the Subtitle D waste universe. However, the programs still vary in scope, stringency, and need for upgrading.

As part of the process to reauthorize RCRA, legislation introduced in both the 101st and the 102d Congresses included provisions on Subtitle D wastes. In this background paper, the Office of Technology Assessment (OTA) examines available information on the amounts, management, risks, and statutory and regulatory frameworks for wastes generated by the mining, coal utility, oil and **gas, and** manufacturing industries.³

To understand issues that are specific to these industries and cut across all industries, it first is essential to understand RCRA. This chapter outlines RCRA's general structure; discusses how wastes are identified and classified as hazardous under Subtitle C; discusses the general nature of Subtitle D; and briefly summarizes data on the amounts, management, risks, and regulatory status of Subtitle D wastes.⁴ It then discusses a number of crosscutting RCRA issues, including whether separate regulatory tracks are required for different wastes; the relationships among various Federal and State agencies; efforts to promote pollution prevention and recycling; and alternative approaches to the current Subtitle C/Subtitle D system. Chapters 2 through 5 present more detailed information on mining, coal combustion, oil and gas, and manufacturing wastes, respectively; each chapter ends with a discussion of issues specific to that waste category.

THE RESOURCE CONSERVATION AND RECOVERY ACT

The definition and classification of hazardous and other "solid" wastes under RCRA directly affect the way in which different wastes are regulated and managed. Solid waste is defined broadly under RCRA (Sec. 1004(27)) as:

... any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, **including** solid, liquid, semisolid, or con-

³OTA addressed aspects of municipal solid waste, medical waste, hazardous waste, and mixed nuclear/hazardous waste in several earlier reports (88, 89, 90, 91, 94, 95, 96, 97).

⁴OTA did not attempt to gather or synthesize information on the costs of various methods of managing Subtitle D solid wastes.

tained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 1342 of Title 33, or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923) [emphasis added].

Hazardous waste is defined under RCRA (Sec. 1004(5)) as:

... a solid waste, or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may [a] cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating 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.

The term “solid” thus does not necessarily refer to a waste’s physical form but rather is a general, encompassing term that refers to all RCRA wastes except those excluded in the definition.

The Solid Waste Disposal Act (the precursor to RCRA) and initial drafts of RCRA itself focused on “non-hazardous” wastes, particularly on eliminating open dumps, improving materials management, and promoting resource conservation. However, Congress was also concerned that other Federal environmental protection statutes passed in the early 1970s were having unintended results. In some cases, implementation of the statutes resulted in greater amounts of hazardous and other solid wastes requiring land disposal and, subsequently, resulted in groundwater contamination through **leaching**; surface water contamination through runoff; and air pollution through open burning and evaporation (46, 48).

As a result, by the time RCRA was signed into law in 1976, an integral part was a national hazardous waste program-codified in Subtitle C of the statute--with extensive Federal involvement (47). Subtitle C granted EPA broad authority to develop a comprehensive, “cradle-to-grave” program to

regulate the generation, transportation, treatment, storage, and disposal of hazardous wastes. EPA was also authorized to set minimum standards that States must adopt in order to run their own EPA-approved hazardous waste regulatory programs. Subtitle C tends to be highly prescriptive, with little flexibility to change various requirements. However, States can establish, and some have, broader or more stringent Subtitle C programs than required by EPA; for example, Wisconsin’s regulations apply to very small quantity generators. Other States may feel that the scope of EPA’s program is appropriate or that it is too expensive and time-consuming to regulate additional wastes as hazardous.

Subtitle D of RCRA dealt with wastes not identified as hazardous. State and local governments retained primacy in regulating these wastes. EPA’s role was limited to establishing voluntary guidelines for State solid waste management plans and developing minimum standards necessary to protect human health and the environment from improper management of the wastes. The Federal Government was to provide incentives, in the form of financial and technical assistance, for States and localities to develop management plans.⁵ EPA issued specific criteria and guidelines in 1979; while broadly applicable, these were aimed primarily at municipal landfill facilities.

In the Solid Waste Disposal Act Amendments of 1980, Congress designated certain ‘special wastes’ as exempt from Subtitle C regulation, until EPA studied their environmental and health effects and separately determined for each type whether or not Subtitle C should be applied. The Beville amendment, Section 3001(b)(3), exempted high-volume/low-toxicity mining wastes, fossil fuel combustion wastes, and cement kiln dust. The Bentsen amendments, Sections 3001(b)(2) and 8002(m), provided a similar exemption to oil, gas, and geothermal production wastes. The exemptions were enacted because Congress was concerned, after the oil crises of the 1970s, about creating regulatory disincentives that would impede development of the Nation’s energy resources.⁶ Congress was also concerned about overregulating wastes as hazardous and believed that existing State and Federal regulations would provide sufficient protection while EPA

⁵OTA (95) discusses the Subtitle D program with respect to municipal solid waste.

⁶54 *Federal Register* 15319, Apr. 17, 1989. The Bentsen amendments also specified that EPA could not regulate oil, gas, and geothermal wastes under Subtitle C without a subsequent act of Congress allowing such regulation.

conducted its studies and made regulatory determinations.⁷

A decade later, EPA had issued some of the required reports to Congress and made some regulatory determinations. As of 1991, EPA had submitted reports on mining extraction and beneficiation (111), mineral processing (127), oil and gas exploration and production (117), and coal combustion wastes (118). Their current regulatory status is discussed below (see “The Subtitle D Universe”).

The last major revision of RCRA was the Hazardous and Solid Waste Amendments (HSWA) of 1984, which made major midcourse corrections to the hazardous waste program.⁸ HSWA also directed EPA to study Subtitle D waste management and disposal facilities and evaluate whether current guidelines and standards are adequate to protect human health and the environment; to review the domestic sewage exemption and determine whether existing regulations are adequate; and to revise the existing Subtitle D landfill criteria for those facilities that accept household hazardous waste or small quantity generator waste.⁹ The implications of EPA’s resulting regulatory actions are discussed throughout this report.

A major continuing tension in RCRA’S waste classification system (explained in “The Subtitle C Universe” below) is that management under Subtitle C is stringent and expensive, whereas management under Subtitle D is relatively less stringent and less costly. This does not mean that State regulations

for Subtitle D wastes are necessarily less protective; that would depend on the characteristics of the waste; the geographic site and management facility; and the design and enforcement of State regulations.

The Subtitle C Universe

The “Listing” and “Characteristic” Approaches

EPA uses two approaches— ‘listing’ and ‘characteristic’ —to identify wastes to be regulated as hazardous under Subtitle C. As discussed later in this section, the Environmental Defense Fund has sued EPA over several important aspects of the Agency’s efforts to carry out congressional mandates regarding these approaches.

In the “listing” approach, individual wastestreams or sets of wastestreams are specifically listed as hazardous (40 CFR 261, Subpart D). To date, EPA has listed 33 wastestreams from nonspecific sources (known as the F List);¹⁰ more than 100 wastestreams from specific sources (the K List); and 315 discarded commercial chemical products, off-specification species, container residues, and spill residues (the P and U lists for acutely hazardous and toxic commercial chemical products, respectively).¹¹

In the “characteristic” approach, solid wastes from individual facilities are classified as hazardous if they exhibit one of four hazardous characteristics—corrosivity, ignitability, toxicity, or reactivity (40 CFR 261.21-24)—provided they are not listed and

⁷Congress specified certain factors that EPA was to include in its studies of different special wastes. Sees. 8002(f) and 8002(p) addressed mining wastes, Sec. 8002(m) addressed oil and gas wastes, Sec. 8002(n) addressed coal combustion wastes, and Sec. 8002(o) addressed cement kiln dust. In general, EPA was to address the following factors: sources and volumes of discarded material; present disposal and utilization practices; potential danger to human health and the environment from such materials; documented cases in which danger to human health or the environment has been proved; types and costs of alternatives to current disposal methods; and impacts of alternatives on the given industry’s materials use and commodity production activities.

⁸Subtitle C provisions included, for e-pie, requirements that EPA make “listing” decisions for 22 wastestreams, establish restrictions on land disposal of hazardous wastes, and implement deadlines on permitting of interim status units. RCRA also was amended by the Medical Waste Tracking Act of 1988 (see ref. 97).

⁹This latter requirement is the reason EPA focused its revision on municipal landfills, because they generally accept at least some household hazardous waste.

¹⁰Including five recent listings: F037 and F038, wastes generated from separation of oil, water, and solids from petroleum refinery process wastewaters and oil cooling wastewaters (55 *Federal Register* 46354, Nov. 2, 1990, and 55 *Federal Register* 51707, Dec. 17, 1990); and F032, F034, and F035, wood preserving and surface protection wastes (55 *Federal Register* 50450, Dec. 6, 1990).

¹¹40 CFR 261.31, 261.32, and 261.33, respectively. Chemical products on the P and U lists are not considered hazardous when used for their intended purpose (e.g., pesticides); however, they are considered hazardous when, for example, they are discarded, mixed with waste oil and applied to land for dust suppression otherwise applied to land in lieu of their original intended use, or burned as fuel. Wastestreams containing these chemicals are not considered listed hazardous wastes unless the streams themselves are on the F or K lists or exhibit a hazardous characteristic, but they still are subject to other EPA regulations.

are not otherwise excluded from Subtitle C regulation.¹² Except for reactivity, which is defined in descriptive terms, characteristics generally are based on quantitative threshold levels. For the toxicity characteristic, for example, a waste is considered hazardous when the concentrations of certain toxic constituents in the waste exceed specified levels in laboratory leaching tests. The substances to be tested, threshold levels, and test procedures continue to be sources of controversy, as discussed below.

Two other rules and a procedure known as “delisting” also determine whether a wastestream is considered hazardous.¹³ Under the “derived from” rule (40 CFR 261.3), any waste derived from the treatment, storage, or disposal of a listed hazardous waste is itself considered hazardous—regardless of whether the original listed waste is undetectable after the treatment or the final waste passes characteristic tests. Under the “mixture” rule (40 CFR 261.3), a mixture of a solid waste and a listed hazardous waste also is considered hazardous.¹⁴ Delisting is the procedure by which EPA excludes or removes an individual facility’s particular listed hazardous waste from designation as hazardous (40 CFR 260.22); this might be done, for example, for low hazard or very dilute wastes that are considered hazardous under the derived-from rule. The derived-from and mixture rules are often cited by industry as examples of Subtitle C’s cumbersome nature (11, 13); this is one reason the Chemical Manufacturers Association petitioned EPA to establish *de minimis*

regulatory levels for hazardous constituents in listed hazardous wastes (see “From C and D Toward a New System?” below).

The Federal Government thus regulates as hazardous only those solid wastes that are specifically listed, that fail a hazardous characteristic, or that fall under the derived-from or mixture rules.¹⁵ EPA estimated that listed and characteristic hazardous wastes totaled about 0.7 billion ton in 1986-87; some of these, however, were managed in units exempt from Subtitle C regulation.¹⁶ The new Toxicity Characteristic (TC) might double the amount of wastes characterized as hazardous (see below and ch. 5); however, many of these additional wastes are managed in RCRA-exempt units and thus would not be subject to Subtitle C regulation.

Nevertheless, many States regulate more substances in their own hazardous waste programs and set more stringent regulations (31). Usually this means designating specific wastes, such as polychlorinated biphenyls (PCBs) or waste oil, as hazardous. A few States (e.g., California, Oregon, Rhode Island, Washington, Wisconsin) also include characteristics such as carcinogenicity and acute toxicity. California and Washington estimate that their definitions double their regulated hazardous waste universe.¹⁷

EPA’s relative reliance on the listing and characteristic approaches has shifted several times. In its

¹²Some wastes are excluded by statute or rule from classification as hazardous. These include, for example, the “special” wastes, Conditionally Exempt Small Quantity Generator hazardous waste (which refers to facilities producing less than 100 kilograms of hazardous waste per month), industrial wastewater discharges mixed with domestic sewage (which are regulated under the Clean Water Act), household hazardous wastes, and other industry-specific wastes. Some exclusions, however, were based on assumptions that may no longer be valid. For example, specific chromium wastes from the tanning and finishing industry were excluded in 1980 based in part on the alleged inability of trivalent chromium to oxidize to hexavalent chromium under most plausible types of improper waste management. As a result of more recent evidence, however, EPA is now considering proposing the deletion of this exclusion for chromium wastes that contain virtually no hexavalent chromium (55 *Federal Register* 11812, Mar. 29, 1990).

¹³In December 1991, however, a Federal court of appeals ruled that EPA had not properly sought public comment when it promulgated the “derived-from” and “mixture” rules; the court allowed EPA to maintain the rules temporarily if it chose to do so, while the Agency opened a new public comment period (*Shell Oil Co. v. U.S. EPA*, U.S. Court of Appeals, D.C. Circuit, 80-1532).

¹⁴This rule was developed in part to discourage dilution as a management option; outright dilution is permissible only when expressly allowed by a waste’s treatment standards (40 CFR 268.3). The exception to the rule is a mixture of a solid waste and a waste that is listed as hazardous solely because it exhibits a hazardous characteristic; such a mixture is not defined as hazardous if the mixture itself does not exhibit the characteristic.

¹⁵Note, also, that the definition and identification of “-dous” wastes under RCRA are narrower than the public’s perception of what the term means.

¹⁶EPA’s National Biennial Waste Report (132) estimated that 238 million tons of hazardous waste was managed in RCRA-regulated units in 1987; it did not estimate how much was managed in RCRA-exempt units. EPA’s National Survey of hazardous waste generators and management facilities (133) estimated that 457 million tons of hazardous waste was managed in RCRA-exempt units, including discharges into publicly owned treatment plants for municipal sewage, which are regulated under the Clean Water Act. The survey also estimated that 290 million tons was managed in RCRA-regulated units, but EPA considers the National Biennial Waste Report estimate for these units to be more accurate (U.S. EPA, review comments, Aug. 22, 1991).

¹⁷V. Meinz, Washington Department of Ecology, personal communication, January 1991; C. Markson, California Department of Health Services, personal communication Sept. 13, 1991. Even after accounting for the new TC, the amount of waste regulated as hazardous in California remains about twice the amount that would be regulated as hazardous under RCRA, because the bulk of California hazardous waste is used oil.

first notice of proposed rules in 1978,¹⁸ EPA stated its intent to use characteristics such as radioactivity, mutagenicity, toxicity to aquatic organisms and plants, bioaccumulation, toxicity to humans from chronic exposure to organic chemicals, and infectiousness. The final rule in 1980¹⁹ reduced the scope, however, partly because test methods or laboratories to carry out testing were not available for many of these characteristics. EPA instead determined to use four characteristics: ignitability, corrosivity, reactivity, and toxicity. EPA selected a leaching test, the Extraction Procedure (EP) toxicity test, to evaluate toxicity, because of concerns about the potential contamination of groundwater by leachate from hazardous wastes in landfills. The test covers 14 chemicals (8 metals, 6 pesticides) for which drinking water standards have been promulgated under the Safe Drinking Water Act.

EPA recently replaced the EP with the new TC. In 1984, as part of HSWA, Congress required EPA to promulgate more characteristics by November 1986 and to add organic chemicals to the EP (Sec. 3001(h)). In 1990, EPA responded by issuing the TC.²⁰ The TC uses a slightly different leaching procedure than the EP, retains the municipal landfill model, and covers 39 constituents—including 25 organic chemicals not covered under the EP. Regulatory threshold levels reflect health-based standards, with the same dilution attenuation factor for each constituent, based on an environmental fate and transport model.²¹

EPA also continued evaluating wastes to determine whether they should be listed as hazardous. In the 1980 rulemaking, based on data from production processes, EPA promulgated a long list of wastes,

based on data from production processes, that were considered 'hazardous' by some criterion; much of the data came from work by the EPA Office of Water on effluent guidelines. In the early 1980s, EPA decided to develop additional listings to supplement the universe of regulated wastes, based on the sampling of wastestreams to determine whether they should be regulated as hazardous. In 1984, Congress set specific deadlines in HSWA (Sec. 3001(e)) requiring EPA to list or make listing determinations for 19 waste categories.²²

Both the listing and the characteristic approaches have been criticized. Some people (e.g., 50,51, 141) believe that the four current characteristics are insufficient and some Subtitle D wastes that perhaps should be characterized as hazardous are not. For example, wastes with constituents that may exhibit non-RCRA characteristics such as carcinogenicity or mutagenicity are not subject to designation as RCRA hazardous wastes (5 1), although they may be regulated under other statutes. With respect to toxicity, environmental groups believe that the EP and TC underestimate potential risks, whereas industry representatives believe that they overestimate risks.²³ Industry generally considers the listing process to be time-consuming, burdensome, and often inappropriate for a given wastestream. Environmental groups believe that some solid wastes would likely meet listing criteria but are either exempt (e.g., certain industrial wastewaters discharged into sewer systems, where they mix with domestic sewage, are regulated under the Clean Water Act), improperly classified, or not yet studied and listed by EPA.

¹⁸43 Federal Register 58949, Dec. 18, 1978.

¹⁹45 Federal Register 33107, May 19, 1980.

²⁰55 Federal Register 11804, Mar. 29, 1990.

²¹A different leaching test (the oily waste extraction procedure, or OWEP) is used for delisting oily wastes, because the EP and TC tests may underestimate the leaching potential of oily wastes (see ch. 5). However, the OWEP is not used to characterize or list oily wastes. In its Report to Congress on oil and gas wastes, EPA used the TC to evaluate the toxicity associated with these wastes, despite acknowledging the inappropriateness of doing so (I 17).

²²These included listing chlorinated dioxins and dibenzofurans by May 1985, halogenated dioxins and dibenzofurans by November 1985, and making determinations for 17 other waste categories by February 1986.

²³For example, environmental groups criticized the EP because: 1) it only covers a few toxic constituents (in contrast, EPA can use almost 400 toxic constituents (40 CFR 261, App. VIII) as one means of determining whether to list wastestreams as hazardous on the basis of toxicity); and 2) its threshold levels are based on a dilution factor 100 times greater than the drinking water standards, rather than 10 times greater as first proposed, which means that fewer wastes are identified as having the toxicity characteristic. They criticize both EP and TC for not including other exposure pathways that might be associated with waste management sites—e.g., consumption of surface waters contaminated by runoff, consumption of fish taken from such waters, or air inhalation (29, 76). Many industry groups, however, contend that the EP and TC do not simulate true conditions at most disposal sites, because they are based on models that mimic codisposal in a municipal landfill, and thus do not accurately predict chemical behavior in the field. They also note that some other exposure pathways are regulated under the Clean Water Act, Clean Air Act, and Safe Drinking Water Act.

The Environmental Defense Fund (EDF) sued EPA in March 1989 for, among other things, failure to meet the deadlines for listing determinations and failure to fully meet the Sec. 3001(h) mandate to promulgate more hazardous characteristics.²⁴ The two parties proposed a consent decree in June 1991 that outlined a schedule for EPA to make listing determinations for 13 waste categories. However, EDF's claim regarding characteristics has not been decided, although a decision is pending.²⁵ EPA believes that the listing schedule will need substantial revision if the Agency is required to promulgate new characteristics beyond the TC; an industry group also contends that this would divert EPA resources from other Subtitle D efforts.²⁶

Finally, HSWA also directed EPA to promulgate treatment standards for hazardous wastes destined for land disposal. The regulations prohibit placing hazardous waste residues in land-based units unless they meet treatment standards based on the most stringent controls that can be provided by the best demonstrated available treatment technology (BDAT). However, Subtitle D manufacturing wastes are not subject to the promulgated treatment standards, although they can sometimes contain levels of constituents that are higher than the standards (123). As a result, hazardous wastes that meet the treatment standards are managed in Subtitle C land-based units, whereas untreated Subtitle D wastes—which may contain higher levels of constituents—can be disposed of in surface impoundments and landfills with few or no environmental controls, depending on applicable State regulations. Because the BDAT standards are not health-based, some industry representatives argue that they may overregulate certain Subtitle C wastes rather than underregulate Subtitle D wastes.²⁷

The Subtitle D Universe

Subtitle D generally covers solid wastes not regulated under Subtitle C. These include many diverse waste categories: "special" exempt wastes (certain mining, oil and gas, cement kiln dust, and fossil fuel combustion wastes); industrial manufacturing wastes; agricultural wastes; municipal solid and medical wastes; construction and demolition debris; Conditionally Exempt Small Quantity Generator (CESQG) and household hazardous wastes; municipal combustion ash; and pollution control residuals (e.g., wastewater treatment sludge). These wastestreams vary greatly in chemical composition and physical form. In the manufacturing sector, for example, wastes originate from industries as diverse as pulp and paper, transportation equipment, and organic chemical manufacturing, and they can be in the form of solids, sludges, wastewaters, or even contained gases. Some of these wastestreams are regulated by statutes other than RCRA.

The following sections briefly describe estimated amounts, current management practices, general risks, and regulatory status of Subtitle D wastes. More detailed information on these topics is presented by waste category in chapters 2 through 5.

Overall Waste Generation

Based on data obtained by EPA from industries and the States, it appears that more than 11 billion tons of Subtitle D waste was generated annually in the United States as of the mid- 1980s (figure 1-2).²⁸ This is a crude estimate, because the data are relatively poor and not necessarily comparable. The largest portion, about 6.5 billion tons, consists of manufacturing wastes not regulated as hazardous.²⁹ However, this does not include wastes that were recycled on-site or off-site or disposed of off-site (wastes for which EPA has no estimates), or other wastestreams such as tires and soil cleanup wastes.

²⁴*Environmental Defense Fund v. U.S. EPA et al.*, U.S. District Court for the District of Columbia, Civ. No. 89-0598.

²⁵K. Florini, EDF, personal communication, Oct. 1, 1991.

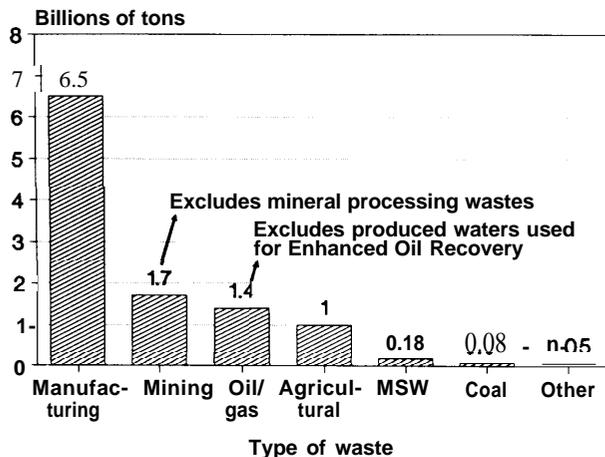
²⁶A. O'Hare, American Petroleum Institute, review comments, July 26, 1991.

²⁷E. Males, Chemical Manufacturers Association, review comments, Aug. 7, 1991; J. Murphy, Amoco, review comments, July 26, 1991.

²⁸This excludes mineral processing wastes, whose amount cannot be estimated from the information available (see ch. 2). In addition, solid wastes mixed with domestic sewage are exempt from regulation under RCRA, although sludges from wastewater treatment are not.

²⁹Based on discussions with EPA and the coal combustion utility industry, OTA assumed that the 1 billion ton of electric utility wastes included in EPA's industrial survey (116) consisted primarily of coal combustion utility wastes. Hence, OTA reduced the estimate of manufacturing wastes by 1 billion tons to avoid double counting. However, OTA also decided to use EPA's estimate (in EPA's 1988 Report to Congress; ref. 118) that coal combustion utility wastes amount to 85 million tons annually. The difference in the two estimates probably results from the inclusion of wastewater in the former (also see ch. 3). Water is added, after wastes are generated, to facilitate transport and management; generally the water is not disposed of in landfills or surface impoundments, but rather is discharged to surface water or recycled in electric power generating operations.

Figure 1-2—Estimated Quantities of Subtitle D Wastes, 1985



SOURCES: OTA, based on various review comments (see text in chs. 2 to 5) and on U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Report to Congress: Wastes From the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden From Uranium Mining and Oil Shale*, EPA/530-SW-85-033 (Washington, DC: December 1985); *Report to Congress: Management of Wastes From the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy*, EPA/530-SW-88-003 (December 1987); *Report to Congress: Wastes From the Combustion of Coal by Electric Utility Power Plants*, EPA/530-SW-88-002 (February 1988); *Report to Congress: Solid Waste Disposal in the United States*, vols. 1-2, EPA/530-SW-88-01 1 (October 1988); *Report to Congress on Special Wastes From Mineral Processing*, EPA/530-SW-90-070C (July 1990). For agricultural wastes, The Conservation Foundation, *State of the Environment: A View Toward the Nineties* (Washington, DC: 1987).

Perhaps as much as 1.4 billion tons consists of oil and gas exploration and production wastes.³⁰ OTA estimates that the mining industry generated about 1.7 billion tons of extraction and beneficiation wastes in 1987 but cannot provide a comparable estimate for mineral processing wastes.³¹ Coal

combustion utility wastes amount to about 85 million tons.

These estimates are difficult to compare with each other. Enormous portions of manufacturing and oil and gas wastes, along with the unknown amount of mineral processing wastes, are in the form of wastewater. In contrast, most mining extraction and beneficiation wastes, sludges, and coal combustion utility wastes generally are solid rather than liquid.

Municipal solid waste (MSW), which OTA assessed elsewhere (95), totaled 180 million tons in 1988 (126). Estimated amounts of other Subtitle D wastes are much lower (119): perhaps 32 million tons annually of demolition and construction wastes; 12 million tons of municipal drinking water and municipal wastewater treatment sludges;³² 4.5 million tons of municipal solid waste combustion ash;³³ 2 million tons of infectious medical wastes from hospitals; and less than 0.2 million ton of CESQG hazardous waste.³⁴

The amount of agricultural wastes that would fall under Subtitle D has not been estimated by EPA, although the Conservation Foundation (15) suggests that more than 1 billion tons may be produced yearly, much of which is crop residue left on the field or animal manure used as fertilizer.

Current Management Practices

EPA examined Subtitle D waste management units that were active in the mid- 1980s (119); these were usually surface impoundments, landfills, waste piles, or land application units.³⁵ According to EPA data, almost 85 percent of all active Subtitle D units were surface impoundments (figure 1-3). Furthermore, although amounts and management tech-

³⁰EPA estimated that about 3.8 billion tons of such waste, almost 98 percent of which represented "produced waters," was generated in 1985. However, produced waters reused in underground injection for enhanced oil recovery (EOR) are regulated (at least from the wellhead down) under the Safe Drinking Water Act rather than RCRA. Because about 62 percent of produced waters are reinjected for EOR (6), this would leave about 1.4 billion tons of produced waters to be managed as RCRA wastes. Industry analysts, however, estimate that about 2.8 billion tons of produced waters was generated in 1985, of which 2.5 billion tons was used for EOR operations (ch. 4).

³¹EPA estimated that 2.0 billion tons of mineral processing wastewater was generated annually, with 90 percent being phosphoric acid process wastewater (127). However, this represents the total amount of wastewater that cycles through various operations; much of this is process water that is used several times, making it difficult to estimate the amount of new water that is actually used initially (ch. 2). EPA included recycled process water in its total estimate, but the Department of the Interior believes that such water should not be characterized as wastewater.

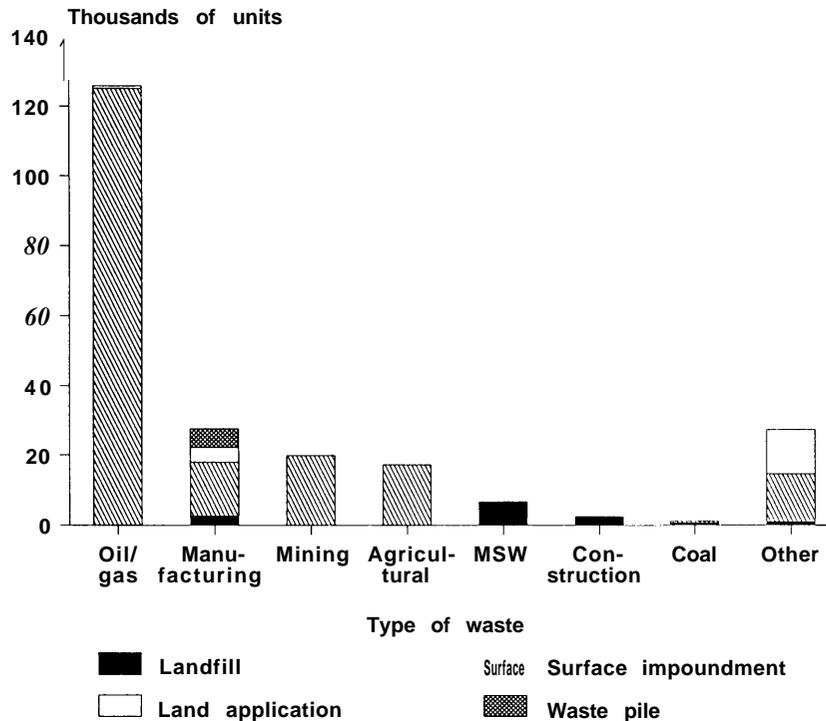
³²54 Federal Register, Feb. 6, 1989.

³³EPA estimated that about 8.25 million tons of ash is produced annually, about half of which is water (S. Levy, U.S. EPA, *Municipal Waste Combustion Inventory*, Sept. 4, 1991). This is based on the design capacity for operating municipal combustion facilities and on the assumptions that 25 percent of municipal solid waste by weight is ash and the moisture content is 50 percent.

³⁴Hazardous waste regulations in some States (e.g., Wisconsin) are more stringent than Federal regulations and apply to CESQGs.

³⁵A surface impoundment is a depression in the earth or a diked area that contains liquid wastes for treatment, storage, or disposal. A landfill is an excavated area in the earth where wastes are permanently disposed. A waste pile is an amass of waste generally placed on the ground for storage or treatment. A land application unit is an area of land where wastewater or sludge is placed on or mixed in the soil for disposal and sometimes treatment.

Figure 1-3-Estimated Number of Active Subtitle D Waste Management Units, 1985



NOTE: Construction = Construction and demolition debris. Manufacturing includes only on-site facilities. Mining does not include waste piles or land application units, which EPA did not survey. Mining also does not include impoundments from 8 States (California, Kentucky, Missouri, Minnesota, New York, Utah, Vermont, Wyoming). Oil and gas does not include impoundments from 11 States (the 8 listed for mining, plus Indiana, Montana, and Rhode Island). In addition, each oil and gas oil well also may have (at least temporarily) an associated surface impoundment (i.e., reserve pit), which would bring the number of oil and gas impoundments to over 800,000.

SOURCES: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, "Screening Survey of Industrial Subtitle D Establishments," unpublished draft final report (Washington, DC: December 1987); Report to Congress: *Management of Wastes From the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy*, EPA/530-SW-88-003 (December 1987); U.S. Environmental Protection Agency, Report to Congress: *Wastes From the Combustion of Coal by Electric Utility Power Plants*, EPA/530-SW-88-002 (February 1988); Report to Congress: *Solid Waste Disposal in the United States*, vols. 1-2, EPA/530-SW-88-011 (October 1988).

niques varied among waste types, the great majority of wastes by quantity were managed in on-site surface impoundments.

EPA (114) also compiled data on pollution controls and monitoring at Subtitle D units in the mid- 1980s. Although many changes have occurred since then, no nationwide compilation of current conditions exists (with the exception of a recent survey on liners, discussed below). Nor do the EPA data reflect site- or waste-specific conditions for which controls might not be needed. Nevertheless, they still are useful in indicating that the frequency

of such controls varied greatly among waste management facilities, depending on the industry, waste type, and State requirements and enforcement.³⁶ Overall, 2 percent of the units contained a synthetic liner, 27 percent had a natural clay or dirt liner of unknown quality, and 1 percent had a leak detection system. Surface impoundments, which handled perhaps 70 percent of all Subtitle D wastes at some point, were frequently unlined and unmonitored (table 1-1). Among all Subtitle D surface impoundments, 29 percent had synthetic or natural liners and 27 percent had some groundwater monitoring (119).

³⁶In general, on-site facilities tend to receive less oversight from regulatory agencies than off-site commercial facilities. Any Subtitle D land-based unit located in a facility with a Subtitle C permit, however, is subject to RCRA corrective action requirements as a permit condition.

Table 1-1—Number of Subtitle D Surface Impoundments Using Various Release Prevention Methods, 1985

Management method	Type of waste		
	Manufacturing	Mining	Oil or gas
Synthetic liners	756 (5%)	200 (1%)	2,950 (2%)
Natural liners	2,818 (17%)	868 (4%)	33,768 (27%)
Leak detection systems	896 (6%)	335 (2%)	1,406 (1%)
Groundwater monitoring	1,396 (9%)	5,399 (27%)	165 (<1%)
Surface water monitoring	3,151 (19%)	8,679 (44%)	20,030 (16%)
Air emissions monitoring	<1%	<1%	<1%
Overtopping controls	3,672 (23%)	4,144 (21%)	28,541 (23%)
Bans on certain Subtitle D wastes	2,685 (17%)	4,358 (22%)	30,509 (24%)
Discharge permits	4,738 (29%)	4,970 (26%)	46,491 (37%)
Number of impoundments*	16,232	19,813	125,074

NOTE: These data indicate the status of pollution controls during the mid-1980s. They do not indicate the current status of such pollution controls, nor the recent development of additional State requirements. They also do not indicate whether variation in site-specific conditions and potential risks might or might not warrant such controls.

*Percentages may total more than 100 because some establishments used more than one management method.

SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Report to Congress: Solid Waste Disposal in the United States*, vols. 1-2, EPA630-SW-88-011 (Washington, DC: October 1988).

Table 1-1 indicates the variation in use of these controls among the manufacturing, mining, and oil and gas industries.

Clearly, updated information on the frequency of pollution controls and monitoring, and on their relationship to site- and waste-specific conditions, is needed. One recent survey examined State requirements for liners at Subtitle D industrial waste

landfills (33).³⁷ The survey found that fewer States require liners at these landfills than at municipal solid waste landfills. Thirty States required some form of liner, 12 did not require any liner, and 8 assessed the need for liners on a case-by-case basis (figure 1-4). The survey did not determine the extent of compliance with these requirements.

Environmental and Human Health Risks

Potential environmental and human health risks associated with different Subtitle D wastes may be significant for several reasons—e.g., relatively few controls at Subtitle D waste management facilities, the broad range of toxic constituents in these wastes, and the large volumes involved. EPA admits that the size and diversity of the Subtitle D universe, the relative lack of information on facility controls and waste characteristics, and violations of State standards at facilities are of concern (19).³⁸ The presence of old waste management sites, some of which would be considered Subtitle D facilities, on the National Priorities List (NPL) indicates the ineffectiveness of some past management practices; however, hazardous wastes may have been disposed of at some Subtitle D units, making it difficult to evaluate the contribution of Subtitle D wastes to these sites' problems.

Current management techniques for some Subtitle D wastes are less protective than those for hazardous wastes, which may be warranted in some or even many circumstances. Yet some Subtitle D wastes do not differ notably from those currently regulated as hazardous under Subtitle C, or they may exhibit other characteristics that are of concern. For example, manufacturing wastes could contain toxic constituents at levels just below those regulated as hazardous that nevertheless may be harmful in some way; they might contain constituents at levels known by EPA to be toxic, in wastes that EPA has not yet listed or for which the TC is inapplicable (e.g., pesticide manufacturing waste); they could contain constituents at levels above those regulated as hazardous but be exempt from Subtitle C regulation by statute or rule; or they might contain

³⁷The survey data do not distinguish between landfills that accept only manufacturing wastes and those that accept a broader range of Subtitle D solid wastes.

³⁸Sec. 8002 under Subtitle D authorized EPA to study, for the required reports to Congress, potential dangers from disposal and reuse of the special wastes. The authority, however, does not extend beyond the mandate for already-delivered reports. Even so, Sec. 3007 under Subtitle C allows the Agency to collect data on hazardous wastes, and EPA's broad interpretation that this applies to suspected or potential hazardous wastes has been supported by the courts (*National Standard Co. v. Adamkus*, 881 F.2d 352 (7th Cir. 1999)), although it has not been tested in the courts for Subtitle D wastes generally. Regardless, EPA routinely conducts risk assessments in support of its rulemakings and has been trying to at least qualitatively rank human health and environmental risks (129).

would be difficult to make such projections without a wide error range.⁴⁰

Regulatory Status

Congress did not require that a cradle-to-grave regulatory system be developed for Subtitle D wastes. Instead, it focused on issues such as establishing criteria for Subtitle D land-based disposal facilities, closing open dumps, and developing a State solid waste management planning process. Its intent was to retain State primacy in regulating these wastes while ensuring that an adequate overall structure existed for such regulation.

In 1979, EPA promulgated Federal Subtitle D criteria (40 CFR 257) for all facilities handling Subtitle D wastes—including landfills, surface impoundments, land application units, and waste piles. Any facilities not meeting these criteria were defined as open dumps and required to close. The criteria established minimum national performance standards that addressed floodplains, endangered species, surface water, groundwater, land application, air emissions, and occupational safety.

The criteria were generally considered incomplete (e.g., see ref. 95). For example, although they prohibited contamination of groundwater used for drinking water, they did not require monitoring or specify corrective action requirements should contamination occur. Nor did they address closure of facilities, postclosure care, financial responsibility, or appropriate engineering controls to minimize contamination.

HSWA required EPA to revise the Subtitle D criteria for facilities that may receive household hazardous waste or small quantity generator hazardous waste, especially by taking into account potential effects on groundwater. In response, EPA recently issued revised criteria for municipal solid waste landfills.⁴¹ The revisions address location restrictions; design criteria based on performance

goals; operating criteria; groundwater monitoring and corrective action requirements; financial assurance requirements for closure, postclosure care, and known releases; and closure and postclosure care standards based on performance goals.⁴²

The revision focuses on MSW landfills, even though only a small fraction of the Subtitle D universe consists of municipal solid waste (figure 1-2) and landfills are used to manage only a small fraction of the Subtitle D universe (figure 1-3). However, MSW landfills are the facilities most likely to receive hazardous wastes from households or small quantity generators (119).⁴³

RCRA (Sec. 4002(b)) also required EPA to promulgate minimum guidelines to assist States in the development and implementation of solid waste management plans; the guidelines were promulgated in 1979.⁴⁴ To receive EPA approval, State plans were to address resource conservation and the collection and subsequent management of solid wastes, including hazardous and Subtitle D wastes. Through 1981, 25 States had EPA-approved solid waste management plans. In that year, the Federal Government ceased routine finding for the development of State plans; however, many States have continued to update and implement plans on their own.

As noted earlier, the 1980 Bevill-Bentsen amendments exempted “special” wastes from regulation as hazardous, pending study and regulatory determination by EPA. Thus far, EPA has determined that mining extraction and beneficiation wastes, certain mineral processing wastes, and oil and gas exploration and production wastes should not be regulated under Subtitle C (chs. 2 and 4). EPA expects these wastes to be controlled by a combination of new programs under Subtitle D, existing programs under the Clean Water Act and other Federal statutes, improved State regulatory programs, and possibly

⁴⁰Nevertheless, considering this factor may be particularly important in rapidly growing States such as Florida, where considerable mining activities take place (J. Reese, State of Florida, review comments, February 1991).

⁴¹56 *Federal Register* 50978, Oct. 9, 1991.

⁴²The regulations as first proposed included a notification requirement for all industrial Subtitle D solid waste facilities and construction/demolition landfills, so that EPA could obtain information on their location, design, and environmental impacts. According to the preamble to the final rule, a notification requirement is no longer anticipated. Instead, EPA is exploring alternative information-gathering strategies, including a statistical survey or series of surveys to obtain detailed information that will enable the Agency to better assess potential risks and the need for developing any future industrial solid waste guidelines.

⁴³EPA's 1987 screening survey (116) estimated that only 5 percent of all industrial solid waste managers managed CESQG waste in their on-site, land-based units.

⁴⁴44 *Federal Register* 45709, July 31, 1979.

some new Federal statutory authorities.⁴⁵ It has not yet proposed Subtitle D regulations for these wastes, although it has drafted approaches for mining extraction and beneficiation wastes.

EPA has not made a regulatory determination for coal combustion utility wastes, and it is not statutorily required to do so for manufacturing wastes. However, its 1988 Report to Congress recommended that high-volume coal combustion wastes (i.e., ash, bottom slag, flue gas desulfurization sludge) be regulated under Subtitle D and that low-volume wastes be studied further to determine if regulation under Subtitle C is warranted (118). Cement kiln dust, also temporarily exempted in 1980, has been the subject of some rulemakings (see box 5-A inch. 5).

How these special wastes should be regulated continues to be disputed. Many industry representatives are concerned about overregulation, even under Subtitle D. Many environmental groups believe that some of the wastes should be regulated under Subtitle C and doubt that the combination of Subtitle D, existing State, and other Federal programs will be sufficient. All are concerned about the availability of EPA resources to develop and implement Subtitle D regulations in a timely manner.

GENERAL RCRA ISSUES

For hazardous wastes, Congress long ago established the now-familiar goals of reducing risks to the public and the environment by minimizing generation of these wastes and safely managing (particularly by recycling and treatment, as opposed to land-based disposal) any that are generated. Most people consider these to be prudent policies from the long-term perspectives of protecting human health and the environment and reducing future liabilities from environmental damages. During the late 1970s and the 1980s, EPA developed and implemented an extensive regulatory program under Subtitle C for hazardous wastes.

EPA's progress in establishing a Federal Subtitle D regulatory program has been highly variable, depending on the waste type. The Agency recently revised its municipal solid waste landfill criteria and, during the last few years, has made regulatory determinations on the classification of most mining wastes and oil and gas wastes. However, it has not

issued regulations or guidelines for a Subtitle D program for mining or oil and gas wastes. In addition, EPA has not made regulatory determinations for other special wastes (coal combustion ash, cement kiln dust), nor has it made significant progress in evaluating manufacturing wastes. Reasons for this include the magnitude of resources required to implement Subtitle C and the general lack of resources for work on Subtitle D wastes.

Thus, improving the management of Subtitle D wastes, including those covered under the Bevill and Bentsen amendments, poses many challenges for Congress and for EPA. One challenge facing EPA is how to devise a sufficiently stringent program(s) to attain the goals mentioned above without harming the economic viability of the regulated industries and facilities. This dilemma is reflected, for example, in EPA's recent decision to consider regulating mining wastes from phosphoric acid production under the Toxic Substances Control Act (TSCA), rather than under RCRA (ch. 2). To what extent should additional Federal regulation of Subtitle D wastes consider the impacts of such regulation on commodity production (e.g., domestic oil and gas, phosphate-based fertilizer), access to domestic reserves, domestic employment, balance of trade, and national security?

Another issue concerns the relationships among different Federal agencies and between the Federal Government and the States in regulating Subtitle D wastes. States already bear the primary responsibility for managing these wastes, and many have developed regulatory programs for specific Subtitle D waste categories. These and similar questions are even more germane given the relatively limited resources available to EPA to implement existing environmental protection programs or develop new ones.

Other challenges abound. Any discussion of Subtitle D wastes, for example, inevitably raises the questions of how wastes are identified as hazardous and whether the arbitrary division between Subtitles C and D is conducive to effectively reducing risks associated with solid waste management.

Issues specific to the mining, manufacturing, oil and gas, and coal combustion industries are discussed in chapters 2 through 5. This section is

⁴⁵For example, see 53 *Federal Register* 25446, July 6, 1988.

concerned with issues that cut across these categories to the heart of the Subtitle C and D systems.

Issues Regarding RCRA's Design and Structure

Separate or Uniform Regulation of Wastes Under Subtitle D?

Federal (and most State) programs are generally on separate regulatory tracks for manufacturing, mining, and oil and gas wastes; some States have separate tracks for coal combustion wastes, whereas others include them in their manufacturing waste regulatory programs. The status of Federal regulatory determinations and programs for these different industries varies greatly: the most advanced is for mining wastes; the least advanced, for manufacturing wastes. One issue, then, is whether EPA should attempt to develop a single program that encompasses all Subtitle D wastes, with regulations tailored to specific waste types where appropriate, or continue with the current approach of separate regulatory tracks but—perhaps—simultaneously study the feasibility and appropriateness of consolidating the different Subtitle D programs into a single program at some time in the future.

Representatives of various industries, as well as some State and Federal officials, generally believe that focusing separately on each industry is the best approach—because of differences in waste types and characteristics, environmental hazards, site conditions, production processes, management techniques, and economics, and because regulatory and industrial personnel are often most knowledgeable about a single industry. Industry representatives also contend that industry -specific standards would enable better coordination between existing programs and statutes at the State and Federal levels. In contrast, environmental groups and some other government officials believe that largely consistent regulation of the different industries is preferable because:

1. it would facilitate similar reductions in health and environmental risks across all industries;
 2. only a relatively limited number of overall technologies exist to manage waste anyway;
- and

3. developing several separate programs will be time-consuming and resource-intensive.

In addition, they believe that a tailored approach, where needed, can be accomplished within an otherwise generally applicable framework.

Federal and State Roles in Managing Subtitle D Wastes

Several factors influence one's view of State and Federal roles in regulating Subtitle D wastes. For example, how can a Federal program of any scope provide sufficient authority to EPA and direction to the States, without hindering existing State efforts that are proving effective? How can a need for minimum or "baseline" national controls and programs be balanced against a need for flexibility to address the diverse situations found among or within States (e.g., climate, hydrogeology, regulatory resources) and industries (e.g., type and size, nature of wastes)?

States are already responsible for developing and implementing most of the existing regulatory framework for Subtitle D wastes, and EPA believes that States should, in general, have the lead on all programs under Subtitle D. At the same time, EPA is moving toward issuance of minimum Federal guidelines for State programs pertaining to certain wastes, particularly mining wastes, while trying to avoid superseding adequately designed and operated State programs.

Not surprisingly, the States and regulated industries tend to disagree strongly with environmental groups about the nature and scope of an expanded Federal program. The former argue that State-level programs can adopt regulations appropriate to the nature and types of waste practices and environmental conditions in a given jurisdiction. This inevitably means great variation among States in regulatory requirements, resource allocations, and enforcement efforts, which is not necessarily bad because diverse wastes disposed of under different conditions might require distinct controls. However, environmental groups argue that a more stringent Federal program is needed to ensure some degree of consistency in State programs (including performance standards and enforcement), as well as to

⁴⁶EPA can already instigate enforcement actions under the substantial **threat and** imminent hazard provisions of **RCRA** (Sec. 7003), the Comprehensive Environmental Response, **Compensation**, and Liability Act (Sees. 104 and 106), and TSCA Sec. 7. However, this requires demonstration on a case-by-case basis, of a Federal cause for action and usually involves much litigation.

sufficiently regulate large companies that may have undue influence in some States.⁴⁶

One problem is that, although significant legislative and regulatory activity on solid wastes has clearly occurred at the State level during the last 5 years, little comprehensive, up-to-date information exists about these developments. An expedited data collection effort on the extent and effectiveness of State programs—for all sectors, but particularly for manufacturing—could help Congress and EPA in their legislative and regulatory efforts, provided that adequate resources are available to collect and analyze the data.

If Congress decides to expand EPA's role in managing Subtitle D wastes, several issues concerning EPA's authority to carry out such a role may need clarification, including the following:

- Should EPA be given the authority to regulate production processes (e.g., heap and dump leaching in the mining industry) or treatment and storage facilities (e.g., reserve pits in the oil and gas industry) under Subtitle D, in addition to its existing authority to regulate disposal processes? Should it instead rely on TSCA and other statutes, or on existing closure regulations?
- Should EPA enforce Subtitle D programs if a State either does not do so or requests assistance in its own enforcement efforts?
- Should EPA receive more authority, in the absence of known or suspected human health effects, to focus on environmental risks (e.g., bird and fish kills) and to regulate activities contributing to these effects? Or are programs of the U.S. Fish and Wildlife Service and other Federal or State agencies sufficient?

Another question is whether interim requirements are needed; precedent for such requirements at the Federal level exists in Subtitle C. Given the diversity of situations that could be regulated and the relative lack of Federal or State resources to finalize and implement programs, some wastes or practices that should be regulated may nevertheless remain unregulated for lengthy periods. In theory, interim requirements could be developed to address specific wastes

(e.g., from manufacturing) or practices (e.g., groundwater monitoring, closure of surface impoundments), or they could be applied generally with exemptions as needed. Chapter 5 describes an ongoing effort to develop a consensus on interim requirements for manufacturing wastes, requirements that would be as self-implementing as possible. EPA is participating in this effort, although the Agency believes that it lacks sufficient data and resources to support the development of interim requirements for manufacturing wastes.

Finally, another factor to be considered is the situation in which two or more Federal agencies, as well as their State counterparts, have overlapping jurisdiction over an industry's waste management practices. This is most relevant for the mining and the oil and gas industries, particularly on Federal lands. Activities there may be overseen or affected by, for example, the Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, and EPA, as well as by several agencies within a given State. The relationships among Federal agencies are often poorly defined, as is the authority of State agencies to intervene on Federal lands (see chs. 2 and 4). A related issue is whether facilities owned or operated by Federal agencies should be subject to EPA enforcement actions and State-levied fines for noncompliance with RCRA corrective action requirements.⁴⁷

Pollution Prevention and Recycling Under RCRA

RCRA's stated goal is to encourage the prevention of waste generation and the recycling or recovery of waste materials when possible. The Nation's experience with hazardous waste indicates that incentives to reduce waste generation and increase materials recovery have grown as the liabilities and direct costs of waste disposal and as right-to-know reporting under the Emergency Planning and Community Right-to-Know Act of 1986⁴⁸ have increased. To date, however, EPA has not strongly promoted prevention and recycling of Subtitle D wastes, which may reflect the general lack of resources and lower priorities given over the years to Subtitle D compared to Subtitle C wastes. In addition, EPA is unable under RCRA (see above) to regulate production processes in terms of their later

⁴⁷Legislation proposed in both the 101st and 102d Congresses would make Federal facilities subject to such compliance actions. Impetus for the legislation stems largely from hazardous waste contamination problems at Department of Energy nuclear weapons production sites and Department of Defense facilities.

⁴⁸This act was part of the Superfund Amendments and Reauthorization Act of 1986.

impacts on risks associated with the management of Subtitle D wastes (although EPA can regulate production processes under TSCA).

The success of pollution prevention efforts for Subtitle D wastes—at the Federal, State, and private sector levels—thus is likely to depend largely on the extent to which such efforts are accorded high priority and adequate resources. Many reports (e.g., 18, 38, 59, 86) suggest enhancing overall pollution prevention efforts, for example, by:

- increasing technical and financial assistance to businesses and States;
- increasing the use of market-based incentives (e.g., emissions taxes or trading systems) to encourage innovative technologies and practices, as well as to fund State and Federal pollution prevention programs;
- removing existing regulatory disincentives to prevention and recycling (e.g., overlapping and conflicting requirements under different statutes for pollution controls and compliance; see ref. 11); and
- increasing public disclosure of emissions.

In 1990, Congress enacted the Pollution Prevention Act,⁴⁹ requiring EPA to develop and implement a strategy to promote source reduction. This strategy is to include, among other requirements, development of a clearinghouse on managerial, technical, and operational approaches to source reduction; a program providing matching grants to States; and a data reporting provision covering the reduction and recycling of all toxic chemicals included in the Toxics Release Inventory (TRI) (which was established under Sec. 313 of the 1986 Superfund Amendments and Reauthorization Act). Significantly, the TRI and the reduction and recycling reports apply to many chemicals in both the Subtitle C and the Subtitle D universes.

EPA recently issued a pollution prevention strategy that has the stated goals of eliminating regulatory barriers to cost-effective investments in prevention efforts, encouraging voluntary actions by industry, and targeting up to 20 high-risk chemicals as an initial focus for these efforts (130). As part of this strategy, EPA intends to establish regulatory “clusters” (i.e., of different Agency offices with relevant jurisdiction) for certain chemicals and their sources

to foster improved cross-media evaluation and earlier investment in pollution prevention technologies. It also intends to include pollution prevention conditions in enforcement settlements and to provide financial assistance to the States for multimedia pollution prevention programs.

No consensus exists about how to regulate or encourage the recycling of industrial residues and byproducts that are considered hazardous (see box 5-B and ch. 2). Some industry representatives argue that existing burdensome regulations, primarily under Subtitle C, discourage the recycling of these materials, and they are concerned about regulatory intrusions into production processes. EPA, too, is concerned about the technological, economic, and administrative feasibility of regulating recycling facilities under Subtitle C. However, EPA and many environmental groups also are concerned about “sham recycling” companies that claim to be recycling and thereby circumvent regulation under Subtitle C as hazardous waste treatment facilities. The situation is even more complex because considerable variation exists in the potential risks associated with different recycling activities. Suggestions about how to regulate recycling exhibit a wide range, from continuing to rely on existing programs under Subtitle C and other statutes to control solid wastes and water or air emissions from recycling facilities, to regulating the facilities themselves under Subtitle C, to setting tailored standards for recycling under Subtitle D or a new subtitle (e.g., more stringent standards for materials and processes with greater risks).

From C and D Toward a New System?

The present system of identifying hazardous wastes relies on two approaches: whether a waste exhibits certain characteristics or is specifically listed as hazardous. As discussed above (see “The Subtitle C Universe”), these approaches may exclude some wastes that should be regulated as hazardous and may overregulate others. Moreover, the gulf between Subtitles C and D in the stringency of regulatory requirements and subsequent management costs is enormous, even for wastes that differ only slightly in toxicity or some other measure of risk. These factors tend to focus the debate about

⁴⁹As a part of the Omnibus Budget Reconciliation Act of 1990, Conference Report to accompany H.R. 5835, Report 101-964, Oct. 26, 1990, Sec. 6601.

how to regulate solid wastes on two contrasting views:

1. Include more wastes under Subtitle C, either by expanding the scope, or number of characteristics or listings; and/or by determining that some Bevill-Bentsen wastes are no longer exempt from Subtitle C.
2. Strengthen Federal and State Subtitle D programs, to avoid including more wastes in Subtitle C and/or to allow more flexibility in regulating relatively less hazardous wastes.

Subtitle D thus cannot be considered in isolation from the broader issue of whether we should continue to develop this system or should begin moving toward a different type of system. With this in mind, box 1-A describes two alternatives—“concentration-based” and “continuum of control” (or “tailored management standards”) approaches—for regulating solid wastes. Admittedly, developing and implementing alternative approaches such as these could require major rethinking and restructuring of current regulatory programs. Not least, defining what types of risks should be evaluated, determining relative levels of risk, and fitting or tailoring regulations to those risks will be difficult and time-consuming.⁵⁰ In addition, how various social, economic, and political factors should be considered in any new regulatory or management scheme must also be addressed.

Any such system is thus likely to have important consequences for priority setting, resource allocation, data collection, regulatory development, and research. Currently, at both the State and the Federal levels, such activities are affected by the need to meet the most immediate statutory requirements, which may not always result in long-term improvements in managing Subtitle D wastes. For example, data gathering may focus on immediate requirements to characterize a particular waste, which is important but could mean that insufficient resources are available to investigate pollution prevention

opportunities, current management practices, or potential risks associated with these practices.

Gaps and Inconsistencies Among Federal Statutes

Many Federal statutes besides RCRA affect the management of “solid” wastes generated by the industrial sectors of concern in this paper. These statutes include, for example, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Clean Water Act (CWA); Safe Drinking Water Act (SDWA); Clean Air Act; Toxic Substances Control Act; Surface Mining Control and Reclamation Act; and Federal Land Policy and Management Act. The States have primary responsibility for implementing some of these; the issue of Federal and State relationships has been discussed above.⁵¹ However, not all aspects of managing Subtitle D wastes are necessarily covered by Federal statutes, regardless of who has primary implementation responsibility.

In some cases this can result in varying (and often unknown) levels of overall risk reduction, even for similar wastes or management practices. Examples of such “gaps” include (but are not necessarily limited to) the following:

- SDWA regulates the underground injection of produced water from oil and gas operations and of process water from mining, but neither it nor RCRA regulates ponds used for storing such water prior to injection.
- CWA generally regulates effluent discharges to surface waters, but no effluent limitations guidelines have been promulgated for oil stripper wells.⁵²
- Few Federal (and apparently few State) regulations cover inactive and abandoned non-coal mining sites,⁵³ inactive and abandoned oil and gas pits, or inactive and abandoned waste sites containing naturally occurring radioactive material (NORM).

⁵⁰EPA’s ongoing effort to assess relative human health and environmental risks associated with different polluting activities (e.g., ref. 129) may shed light on some of these risk-related issues.

⁵¹State statutes and regulations generally are free to be more stringent than Federal programs. In practice, the Underground Injection Control program under SDWA and the National Pollution Discharge Elimination System (NPDES) under CWA, which are either delegated to the States by EPA or run by EPA in nonauthorized States, tend to be very similar across States.

⁵²However, permits based on best professional judgment (see ch. 4) can still be written for stripper wells.

⁵³However, EPA’s requirements for applying for stem water discharge permits (55 *Federal Register* 47990, Nov. 16, 1990) include inactive and abandoned mines; they also classify nonpoint source storm water discharges as point sources subject to NPDES regulations.

Box 1-A-Concentration-on-Based and Continuum of Control Approaches

In contrast to HSWA (which was passed in 1984), legislation proposed in the 101st Congress to reauthorize RCRA (i.e., H.R. 3735) did not require additional listing determinations. However, it did include two attempts to expand the Subtitle C universe: 1) explicit specification of additional characteristics (rather than authorizing EPA to determine them) for identifying hazardous waste,¹ and 2) a “concentration-based” approach.² The text of this chapter briefly discusses the issue of identifying these additional characteristics. This box discusses the concentration-based approach and a third approach known as “continuum of control” (EPA now uses the term “tailored management standards” for the latter). The overall potential for any of these approaches to move us toward RCRA’s goals of waste minimization and resource conservation is unstudied.

Concentration-Based Approach

In a concentration-based approach, EPA would set threshold concentrations in wastestreams for each of the almost 400 “Appendix VIII” constituents that it can use in determining whether to list a wastestream as hazardous.³ A threshold could be based on either a constituent’s total concentration in a waste or its concentration in leachate derived from the waste, which is the current Toxicity Characteristic approach. Several exposure pathways, not just groundwater, could be included. Any waste with an Appendix VIII constituent above the level specified could be considered hazardous.

RCRA uses a concentration-based approach in a few instances! For example, two Appendix VIII constituents (warfarin and zinc phosphide) are designated as “P” wastes when present above specified concentrations and as “U” wastes when below. According to one report, EPA also used total concentration as a factor in listing some wastes, for example, the presence of heavy metals in wastewater treatment sludge from electroplating operations (ref. 29, citing an unpublished EPA background document for electroplating wastes). Furthermore, EPA is considering establishing *de minimis* levels of hazardous constituents in treated, listed hazardous waste—a process that would employ a related concentration-based approach.⁵

Proponents of the concentration-based approach cite EPA’s slow progress in meeting HSWA’s deadlines to list more wastestreams and specify additional characteristics (see “The Subtitle C Universe” above). They contend that this approach would do a better job than the listing system in relating the stringency of management requirements to a waste’s hazard. Some suggest that the use of total concentration would acknowledge additional

¹Specified characteristics in the legislation included acute toxicity, persistence, bioaccumulation, aquatic toxicity, radioactivity, carcinogenicity, mutagenicity, and phytotoxicity.

²The provisions detailing this approach were dropped from H.R. 3735 (which itself was not passed) during the markup process in the 101st Congress.

³These constituents are listed in 40CFR 261, App. VIII, hence the name.

⁴Several States have similar, although generally more limited, approaches. Rhode Island uses a threshold level of 0.1 percent by weight for known carcinogens (as identified by EPA, the Occupational Safety and Health Administration (OSHA), the Food and Drug Administration, or the Consumer Product Safety Commission) or teratogens (as identified by OSHA) (Rhode Island Department of Environmental Management, Rule 3.53 (L)(1)(2), amended Oct. 20, 1988). California uses a threshold limit of 0.001 percent for any of 16 carcinogens listed by OSHA (California Administrative Code Title 22, R. 666(a)(5)). Oregon uses a level of 10 or 3 percent for any chemical on EPA’s U and P lists, respectively (Oregon Administrative Code 340-101-033(2)(a), (2)(b)). The State of Washington uses a level of 1 percent for known or suspected carcinogens recognized by the National Institute of Occupational Safety and Health or the International Agency for Research on Cancer (Wash. Admin. Code R. 173-303-103, 1983). Pennsylvania is considering using both total concentration and leachate concentration to evaluate wastes in its proposed residual waste regulations (*Pennsylvania Bulletin*, vol. 20, No. 8, Feb. 24, 1990).

⁵During the TC rulemaking process, commentators contended that although wastes with very low (*de minimis*) concentrations of hazardous constituents can be excluded via delisting from regulation as hazardous, the delisting process is expensive, time-consuming, and sometimes impractical (55 *Federal Register* 11831, Mar. 29, 1990). Thus, in 1989, the Chemical Manufacturers Association (13) petitioned EPA to establish self-implementing *de minimis* exemption levels for hazardous constituents in listed hazardous wastes. The CMA proposed that EPA make such determinations for constituents on both the App. VIII and IX lists—i.e., those App. VIII constituents for which an analytical method exists to detect the constituent in groundwater (the CMA also suggested extending the TC to all App. VIII constituents as one way to provide more control and eventually replace the listing and delisting programs (E. Males, review comments, Apr. 30, 1991)). In such an approach, listed wastes that meet the exemption levels would not be considered hazardous and could be managed as non-hazardous wastes unless they exhibited a hazardous characteristic. The CMA suggested this would reduce overregulation of dilute wastes while still maintaining Subtitle C regulation of wastes containing constituents above *de minimis* levels. EPA recognized that some inequities of this type do occur but also maintained that its rules are appropriate for dealing with waste mixtures and treatment residues (55 *Federal Register* 11831, Mar. 29, 1990). Nevertheless, EPA stated that it would consider amending the definition of hazardous waste to establish self-implementing *de minimis* exemption levels for hazardous constituents found in listed wastes. However, EPA has not yet done so; i.e., it has not yet responded to the CMA’s & *de minimis* petition (A. Collins, U.S. EPA, personal communication Oct. 3, 1991).

possible exposure pathways such as volatilization, inhalation, ingestion, and food chain contamination. They also suggest expanding the Appendix VIII list to include additional constituents (e.g., active ingredients in pesticides).

Opponents contend that this approach would result in overregulation because it does not account for the probability that potentially hazardous constituents might be released and, if so, whether they would be mobilized and reach a point of exposure.⁶ For example, some constituents can be in chemical or physical forms that restrict mobility or exposure (e.g., insoluble metal complexes, constituents encased in glassified slag). Opponents also contend that: 1) the approach would require great resource expenditures by waste generators because each wastestream would require testing; 2) the Appendix VIII list contains some constituents that it should not; and 3) EPA would find it difficult to set the required threshold levels within the proposed 18-month timeframe (and that using a default value in such cases would be arbitrary).⁷ Setting threshold levels would depend on health-based standards, which are lacking for many constituents, and on the availability of analytical methods for testing wastes.⁸

Neither the listing/characteristic nor the concentration-based approaches really solve the problem of distinguishing between a low-volume waste with a constituent just over a threshold value and a high-volume waste with a constituent just below the threshold. For example, lead has a threshold level of 5.0 milligrams per liter (mg/L) of soluble lead in the TC extract. A large amount of waste containing 4.8 mg/L in the TC extract would be classified as non-hazardous, whereas a small amount containing 5.1 mg/L would be classified as hazardous.

Continuum of Control Approach

An alternative strategy to bridge the gulf between Subtitles C and D might be to consider that the universe of solid wastes exhibits a spectrum of risks and that management requirements should be related to case-specific risk levels. EPA has examined at least one such alternative, known as "continuum of control" or "tailored management standards" (115).

A continuum of control approach recognizes that solid wastes exhibit a continuum of risks based on case-and site-specific factors such as: 1) constituents in the wastes (and their physical and chemical characteristics); 2) subsequent toxicity and mobility of wastes and constituents of concern; 3) exposure pathways; and 4) unique management needs (e.g., waste volumes, certain technologies, economics) that may require special management standards. It might encourage use of those management practices best suited to a given situation or waste, with the overall goal of regulating wastes at a relatively similar risk level (1 15).

This is consistent with suggestions elsewhere that wastes be managed on the basis of their physical and chemical characteristics and that consideration be given to multimedia issues (58, 95). EPA suggested that such an approach would improve its ability to write permits based on potential hazards of specific facilities, to set waste minimization goals, to monitor progress accordingly, and to better minimize risks in more economically efficient ways (115). Concerns about the concept, particularly in comparison with the current system, include its complexity and resource-intensiveness; its equal or greater dependence on testing; the need for many design and performance standards; and, possibly, greater difficulty in enforcement.

⁶Utility Solid Waste Activities Group, review comments, Aug. 23, 1991.

⁷The proposed legislation specified a default concentration of 0.1 percent for any one constituent if EPA did not promulgate threshold levels within 18 months; this level was intended in part to minimize overregulation of non-hazardous wastes.

⁸These problems are not necessarily insurmountable. As of August 1990, EPA had developed health-based standards and analytical methods for 204 App. VII and VIII compounds (App. VII, a subset of App. VIII, lists the constituents that caused the listing of a given wastestream) (S. Cochran, U.S. EPA, personal communication August 1990).

Moreover, Federal statutes other than RCRA define the terms "hazardous" and "toxic" differently, given their particular goals, the environments being addressed, etc. As a result, they regulate some substances as hazardous or toxic that would not be designated hazardous by RCRA: for example, PCBs are regulated by TSCA; asbestos is regulated by the

Clean Air Act and the Asbestos Hazard Emergency Response Act; and wastewater discharges are regulated by CWA. CERCLA (or "Superfund") designates as a "hazardous substance" any substance so designated by one of the other Federal statutes. This means that a waste that was legally managed under Subtitle D could contribute to the creation of a

Superfund site if it is mismanaged.⁵⁴ The TRI also requires companies to submit information on releases of specified toxic chemicals, many of which are not listed as hazardous under RCRA (128).⁵⁵

The definition and management of hazardous waste discharges under RCRA and CWA further illustrate the complexity of this issue. RCRA covers storage, treatment, or management of such wastes prior to discharge.⁵⁶ CWA **regulates** discharges to surface waters (ch. 5). This is not necessarily a problem, except that the two acts cover different constituents and regulate them differently. CWA focuses on 126 “priority pollutants” and uses technology-based standards, which often specify a required removal percentage for a particular pollutant. RCRA focuses on a much different list or on testing leachable concentrations of specified constituents. This means that different constituents may be regulated at different points in the processing of one wastestream.

For example, hazardous waste discharges are exempt from RCRA requirements (under the domestic sewage exclusion) if they are discharged into municipal sewers, where they mix with domestic sewage on its way to publicly owned treatment works (POTWs), which are regulated under CWA. Pretreatment regulations require dischargers to not@ the POTW of hazardous wastes entering the sewer, and POTWs can require monitoring and treatment of any constituents that might cause problems (see ch. 5). However, hazardous RCRA constituents may not be adequately addressed by POTWs unless they are covered by local “pretreatment” requirements (which must be developed and

implemented by the POTW) (ch. 5; ref. 92). Thus, a constituent that is contained in waste considered hazardous under RCRA could damage a POTW or pass through it and be discharged to surface waters if appropriate local limits were not in place.⁵⁷ (Also see the following section regarding the development of pretreatment standards themselves.) In addition, sewage sludges from POTWs are subject to RCRA to the extent that a sludge fails the TC leaching procedure and therefore is considered a characteristic hazardous waste.

HSWA required EPA to close these gaps by August 1987. In response, EPA promulgated regulations in 1990 that prohibit discharges to POTWs of pollutants that result in toxic vapors, require at least annual inspection and sampling of effluents from each of a POTW’s significant industrial users, and require industrial users to report hazardous waste discharges to POTWs.⁵⁸ However, some environmental groups believe that EPA should include more industries (e.g., the hazardous waste treatment industry, petroleum refineries, textile mills, paint manufacturers, commercial solvent reclaimers) in its schedule for promulgating pretreatment standards (1).⁵⁹ The new rule does not address potential air emissions from POTWs, although they may be addressed under the Clean Air Act.⁶⁰

Another potential problem concerns asbestos, which is considered a hazardous substance under Superfund because it is a hazardous air pollutant under the Clean Air Act. Under the Asbestos Hazard Emergency Response Act, asbestos removed as a result of abatement efforts should be disposed of in accordance with existing waste management regula-

⁵⁴Although this is technically correct, EPA believes that its current listing and characteristic approaches cover most of the worst substances; many of the organic chemicals now included in the TC, for example, were chosen because they were present at current Superfund sites and are measurable in leachate tests, and because toxicological data exist for them (U.S. EPA, review comments, Aug. 22, 1991). However, other compounds of potential concern were not included because data were lacking or they could not be measured in a leachate test (M. Williams, Browning-Ferris Industries, review comments, July 23, 1991). As noted above, environmental groups contend that the new TC is still inadequate. An additional issue, the merits and demerits of the Hazard Ranking System used to place sites on the NPL, is beyond the scope of this paper.

⁵⁵Since the TRI includes emissions into air and water, this should not be surprising. On the other hand, the TRI would not necessarily contain data on postproduction releases related to production transportation and use.

⁵⁶Unless tanks are used, which may be regulated as CWA wastewater treatment units.

⁵⁷For e-pie, the organic chemical industry discharged an estimated 2.5 times more nonpriority pollutants than priority pollutants to sewers in the mid-1980s (113).

⁵⁸55 *Federal Register* 30082, July 24, 1990. At the same time, HSWA’s prohibitions on land disposal of hazardous waste could result in some wastes being redirected to POTWs, making implementation of these requirements even more important.

⁵⁹J. Landman, Natural Resources Defense Council, personal communication, October 1990.

⁶⁰55 *Federal Register* 30082, July 24, 1990. Sec. 183 of the Clean Air Act Amendments of 1990 requires EPA to issue control technology guidelines for 11 stationary source categories of hydrocarbon emissions; POTWs may be one of the categories. States can use the guidelines as the basis for source-specific regulations required by the act.

tions. Although RCRA does not list asbestos as hazardous or specify special management requirements for it, the Clean Air Act includes some requirements on the transportation of asbestos wastes and the operation of disposal sites that accept such wastes (40 CFR 61.140ff). The requirements for disposal sites do not contain any provisions regarding liners, leachate collection, or monitoring. Although managing asbestos in accordance with these requirements may not necessarily pose a risk to human health, the need for more tailored requirements cannot be ruled out.

These inconsistencies might undercut RCRA’s ability to improve solid waste management, particularly if exempted or non-RCRA wastes and substances are not managed adequately under other statutes. Taken together with the issue of moving the solid waste regulatory system in a new direction (see “From C and D Toward a New System?” above), this suggests that RCRA’s definitions of solid wastes may need reexamination, that greater emphasis should be placed on filling the gaps, or that Subtitle D programs may require great flexibility to complement (or integrate) existing authorities under other statutes without becoming overly burdensome. It also raises the question of whether EPA should include a “multimedia” approach in its Subtitle D regulatory programs (also see ch. 2). On the other hand, if such wastes or substances are properly managed under other statutes, additional RCRA controls may not be necessary.

Implementation of Federal Statutes

Problems can also arise because regulations to implement existing statutory requirements are not fully developed. For example, some POTWs may not treat discharges from industries adequately because “categorical” pretreatment standards under CWA are lacking for that industry or the POTW does not develop and enforce its own local pretreatment standards for specific industrial facilities, rather than because of problems noted above in RCRA and CWA per se. Relatively few pretreatment standards fully cover priority pollutants, and some industries discharging priority pollutants are not covered by any standards (92). Another example involving the Clean Water Act is that effluent guidelines based on the best available technology have not yet been promulgated for coastal discharges of oil and gas

exploration and production wastes (ch. 4). Of course, enforcement of existing regulations is a continuing problem, as well.

Research and Data Needs

Some information about waste types, management methods, some types of risks, and regulatory programs exists for certain Subtitle D wastes, as described above and in subsequent chapters. However, it still is often difficult to readily evaluate the adequacy of management techniques, their impacts on reducing risks to human health and the environment, and the quality and efficacy of State or Federal regulatory programs. This is particularly true for manufacturing wastes (ch. 5), although it can also apply to other waste types.

The difficulty sometimes stems from a lack of, or lack of easy access to, data on environmental monitoring of facilities, compliance, and State or Federal enforcement efforts. Whether this means that steps to improve the regulation and management of Subtitle D wastes can or cannot be taken today is a matter of opinion. It is clear, though, that a concerted effort to gather and synthesize more current, relevant information would help in making additional regulatory decisions. For example, requirements for reporting data from environmental and other compliance monitoring could provide important feedback on the adequacy of existing regulatory programs, and improving the overall quality of data collection and management could allow better access to this and other information.

These data needs might be addressed at either the Federal or State level, depending on factors such as how the data will be used, the availability of resources, and the need for data that are comparable across States. Data collection and research efforts could potentially focus on many issues, including:

- design characteristics of existing facilities, particularly those built since the mid-1980s;
- environmental impacts of existing facilities, based on rigorous environmental monitoring;
- characterization of certain wastestreams (particularly different manufacturing wastestreams);
- costs of current management techniques, and types and costs of alternative techniques;
- incentives and disincentives (whether technical, economic, or political) to pollution preven-

tion, recycling, and improvements in waste management;
. the quality and efficacy of current State Subtitle D regulatory programs; and

. the relative risks involved in managing wastes under different management schemes and statutes.