CHAPTER 7

The Current Federal-State Hazardous Waste Program

Contents

List of Tables

List of Figures

CHAPTER 7

The Current Federal-State Hazardous Waste Program

Summary Findings

- Delays in implementation.—Despite the simplicity of approach of the Resource Conservation and Recovery Act (RCRA), devising and implementing an effective program regulating hazardous waste with maximum public involvement mechanisms has proved to be a complex, controversial task. The Environmental Protection Agency's (EPA) implementation of requirements of RCRA section 3004 to establish performance standards for hazardous waste treatment, storage, and disposal facilities has been a process characterized by delay, false starts, frequent policy reversals, and litigation. Delays in rulemaking have meant delays in compliance with standards to protect human health and the environment, and uncertainty for States and industry. The delays may have been an additional incentive for some firms not to seek effective and economic measures to dispose of hazardous waste.
- Universe of hazardous waste.—Identification of a solid waste as hazardous is the key to RCRA'S regulatory approach, The universe of hazardous waste is established by statutory definitions of solid and hazardous waste and EPA's interpretations of these definitions as further modified by various regulatory exclusions and exemptions. Many of these are not related to any determination of the actual hazard of the waste. This ad hoc system of exclusions and exemptions allows certain potentially hazardous waste to escape proper management or oversight. Exempted or excluded wastes, such as the small generator exemption, regardless of the reason for or the status of the exemption, can be disposed at subtitle D (municipal or sanitary) landfills that may not adequately control these wastes, Because of the design of these facilities, hazardous constituents may be released into the environment.
- Lack of adequate, reliable, and verifiable information on which **to** base decisions.—States, industries, and environmental groups have criticized the lack of information on: the amount and types of wastes, the effects of wastes disposal on the environment and on human health, and the adequacy of design, operating, and permitting requirements.
- inequities in application of regulatory requirements.—The current RCRA regulatory system, because of its single hazard classification of wastes, and various exclusions from regulation (including exemptions of existing facilities from certain land disposal standards), has resulted in overregulation of some wastes and facilities and underregulation of others. Existing facilities have been required to meet differing standards of performance; for example, existing land disposal facilities do not have to upgrade their design and operations to the maximum extent feasible to receive a permit. However, existing incinerators are being required, in some places, to operate at the limits of available technology.
- Lack of national consistency in hazard/risk determinations.—Current regulations do present the opportunity to consider degree of hazard of wastes and levels of risk associated with particular facilities in setting permit conditions and granting variances from standards but only in the most qualitative and site-specific manner. Together with the frequent lack of objective Federal standards, this leads to little assurance of consistent levels of protection nationwide.
- Continued use of inadequate waste management techniques.—As a result of these delays in implementation, there has been continued reliance on landfilling and other

99-1130 - 83 - 18

land disposal methods that have been proven inadequate to contain hazardous wastes. EPA's final land disposal regulations authorize continued use of these waste management practices by existing facilities.

- No incentive for innovative technologies. —The total national expenditure on hazardous waste activities, including the public and private sectors and RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (C ERCLA) related efforts, was $4 billion to $5 billion in 1982. Combined Federal and State expenditures were in the range of $200 million to $300 million. Even at this level, the initial economic analysis of the current RCRA regulatory program suggests that it will not provide a sufficient economic incentive to internalize the true costs of hazardous waste disposal. Continued use of inadequate disposal practices will persist unless more effective means are implemented for internalizing costs and encouraging use of other management options through, for example, the imposition of waste generation fees. The need to resolve current problems is compounded by the realization that we may not be better equipped in the future, technologically or financially, to solve them. Because of the potential for wide-ranging impacts on environment and health, additional attention should be focused on promoting the use of alternative waste treatment or destruction technologies.

- EPA's two-tiered approach for land disposal regulations.—OTA's analysis of the design technology used in land disposal facilities indicates that complete containment of hazardous waste constituents over long periods of time (30 years or more) is not possible with the current technology. All land disposal sites eventually will release mobile constituents to the environment. The first tier of EPA's regulatory strategy for land disposal facilities, containment of hazardous constituents and liquid management, provides only temporary protection against contamination. The effectiveness of EPA's second-tier strategy of monitoring and corrective action also has substantial technical uncertainties. EPA's monitoring requirements may prove inadequate to detect leakage before substantial contamination has occurred. Moreover, the long-term effectiveness of remedial action measures, which are relied on in EPA's second tier, such as ground water pumping, in situ treatment, and construction of barriers to ground water movement, has not been demonstrated. Additionally, EPA's own economic analysis indicates that such measures can be extremely expensive, particulary if long-term corrective action is required. Given such costs, the financial capability of land disposal facilities to pay for necessary corrective action becomes a critical consideration in allowing continued use of such facilities.

- Current regulations for monitoring RCRA facilities are inadequate to provide assurance that the public health and the environment are being protected. EPA has emphasized only ground water monitoring. If land disposal of all hazard levels of wastes is allowed to continue (as the July 1982 rules seem to permit), it is essential that a rigorous ambient monitoring program be implemented at all such facilities. Without it there can be little assurance that exposure of humans and ecosystems to hazardous constituents will be prevented through early detection and prompt corrective action. Major problems include the following:
  - —The number and frequency of required sampling are such that large differences between background and new samples will be required before a statistically significant change in ground water quality is shown.
  - —Proper location of monitoring wells is essential to the effectiveness of an ambient monitoring program to measure background water quality and to provide early detection of possible ground water contamination. However, location of sampling wells during interim status is left to judgment of the facility owners. Final permit guidelines for well placement are equally vague.
  - —Due to limitations in the state of the art for analytical methodology, certain data re-

quirements for compliance monitoring of permitted land disposal facilities will be difficult to meet.

- The use of quantitative risk assessment in environmental regulation is receiving prominent attention within EPA and Congress. Available evidence suggests that the art of risk assessment is not sufficiently advanced to be reliable in some suggested applications to hazardous waste regulation. Moreover, much of the information required to perform such assessment is not yet available. Results of quantitative risk assessment must be interpreted with caution if they are to be incorporated into the decisionmaking process. The difficulties of using risk assessment tools are generated primarily by limitations of the assumptions used in these models. Generalizations may be inaccurate for specific sites, inadequate data bases may be used, criteria for assessing hazard and risk are lacking, and long-range performance cannot be predicted using currently available data.
- Required insurance coverage for hazardous waste facilities and increased civil liability have had, and will continue to have, a substantial impact on waste management strategies, but these measures largely complement, or supplement the regulatory programs. Moreover, insurers depend on stringent regulatory standards and enforcement as an incentive for them to underwrite the risks associated with hazardous waste facilities. The adequacy of regulatory requirements will influence the availability of required insurance coverage.
- Although legal remedies exist, private parties who are injured may not be compensated because of procedural and substantive difficulties involved in such cases, the costs and delays of litigation, and the problems of collecting damage judgments against absent or insolvent defendants.
- Adequacy of funding and financial resources for implementation and enforcement.—Concerns over the adequacy of funding for the Federal program and for Federal grants for State programs have been raised repeatedly as EPA has sought to reduce its regulatory budget. The need for adequate financing at the Federal and State levels may only increase as permitting of existing facilities proceeds. States will need additional funds to administer and enforce hazardous waste regulatory programs, On the average, about 75 percent of State hazardous waste program budgets come from Federal grants. Existing State fees and taxes do not appear to be sufficient to finance their regulatory programs and cleanup actions.
- Lack of integration.—Unlike major environmental statutes, such as the Clean Air Act (CAA) and the Clean Water Act, which are directed at control of pollution in a single environmental medium, RCRA'S mandate for assuring proper hazardous waste management requires a multimedia approach to protect human health and the environment. Passage of RCRA unavoidably created an inherent potential for duplicative regulation of hazardous waste management under RCRA Subtitle C and regulation of environmental pollutants and control of hazardous substances under other Federal laws. Instead of leading to an all-inclusive integrated framework of environmental regulations providing better protection of human health and the environment, selective implementation of RCRA and other environmental laws has resulted in gaps in coverage so that some potentially serious impacts of hazardous waste activities have remained uncontrolled. For example, emissions of volatile organic chemicals from hazardous waste treatment, storage, and disposal activities are largely uncontrolled under RCRA and CAA regulations.
- Extent of Superfund cleanup.—The National Contingency Plan (NCP), the framework for Government action in cleaning up hazardous waste sites, does not establish any specific required environmental standard for the level of cleanup to be achieved, such as the maximum acceptable level of ground water contamination. EPA characterized the development of such standards for the hundreds (if not thousands) of substances that

could be found at uncontrolled sites as a potentially time-consuming and costly task that might detract from cleanup efforts. Nonetheless, EPA declined to specify cleanup standards even where they have already been set for other purposes. In contrast, the regulations for land disposal facilities require corrective action at permitted facilities to attain either background levels or the Safe Drinking Water Act standards. The NCP would allow contamination levels (that would trigger corrective action at permitted RCRA facilities) to continue to exist after remedial response actions have been taken or without requiring any response action at all.

- State Superfund costs .—States can nominate sites for inclusion on the National Priority List as candidates for Superfund cleanup and can designate one site in each State to be included in the 100 highest priority sites. CERCLA requires that States contribute at least 10 percent of the cleanup costs at privately owned sites and 50 percent or more at sites that were owned by a State when the hazardous substances were placed in them. However, States cannot determine which, if any, of their nominated sites will be cleaned up and when the cleanup will occur, This uncertainty makes it difficult for States to plan their own cleanup efforts and to arrange for financing of the required State contribution for Superfund actions. According to some State officials, proposed remedial actions at some National Priority List sites have not been taken because the States involved could not provide the required 10-percent share.
- State responses to perceived inadequacies of Federal program.—States are moving to more stringent requirements such as: limited bans on landfills, requirements for consideration of the use of feasible alternative technologies before approval of landfilling, imposition of hazardous waste fees and taxes, and establishment of strict liability standards for facility operators and generators for the consequences of hazardous waste activities. Many of these State actions were taken in response to the delays and perceived inadequacies in requirements of the Federal program.

Part 1: Federal Regulation of Hazardous Waste Management

The Resource Conservation and Recovery Act

The basic framework for a comprehensive national regulatory program for the management of hazardous waste from generation to final disposal was established by Subtitle C of the Resource Conservation and Recovery Act of 1976 (RCRA).1 This "cradle-to-grave" system consists of a minimum Federal program with the following major components:

- identification and listing of hazardous waste;
- a national manifest system for tracking wastes;
- standards for hazardous waste management treatment, storage, and disposal facilities; and
- a permit system for treatment, storage, and disposal facilities.

All hazardous waste activities would be subject to the Federal program, however, RCRA also provided for a State to exercise its primary administration and enforcement authority over hazardous waste in lieu of Federal regulation provided that the State program was as stringent, comprehensive, and effective as the Federal requirements.

[1]Public Law 94-580, 90 Stat. 2795, Oct. 21, 1976, as amended by Public Law 95-609,92 Stat. 3081, Nov. 8, 1978, the Solid Waste Disposal Act Amendments of 1980, Public Law 96-48294, Stat. 2334, Oct. 21, 1980, and The Used Oil Recycling Act of 1980, Public Law 96-463, 94 Stat. 2055, Oct. 15, 1980. (Codified at 42 U.S.C. 6901 et seq.). Public Law 96-482 changed the title of RCRA to the Solid Waste Disposal Act. (In 1976, RCRA completely amended the Solid Waste Disposal Act of 1965, Public Law 89-272, 79 Stat. 997 (1965).) In this report, the Solid Waste Disposal Act will be referred to as RCRA in keeping with common usage.

The House Report on RCRA summarized the general advantage of having a Federal regulatory program, with optional implementation by the States.z There would be uniformity among the States as to how hazardous wastes are regulated; and uniform standards would be provided for industry and commercial establishments that generate such wastes. The establishment of this uniformity would also ensure that States which, for economic reasons, might otherwise decide to be dumping grounds for hazardous wastes will not attract businesses from States with environmentally sound laws.

The House Report added:

> The committee believes that Federal minimum standards are necessary if the hazardous waste problem is to be understood and solutions are to be found. Waiting for States to solve this problem without Federal assistance is not likely since each State would take a different approach and there would be too many gaps in both the receiving of information and enforcement. [3]

Subtitle C was part of the larger statutory scheme in RCRA for dealing with national solid waste disposal problems. Congress recognized that the hazardous waste problem presents serious dangers to health and the environment from improper disposal and very little information was available on which to establish effective policies. Accordingly, the conference committee report characterized the bill as "making the best of a bad situation, " and gave the Environmental Protection Agency (EPA) broad authority to use its special expertise to define and identify hazardous waste and its characteristics and to develop a comprehensive system for the control of hazardous waste management and disposal. As additional mechanisms for responding to hazardous waste problems, Congress required maximum public participation in the process and provided access to courts for review of rulemaking and agency enforcement activities. RCRA includes an imminent hazard authority for immediate action to correct dangers posed by hazardous waste management activities and created civil and criminal penalties for improper hazardous waste activities.

RCRA is one of the simplest environmental laws enacted in the last decade. Unlike the Clean Air Act (CAA) and Clean Water Act (CWA) (which set many technical standards, emissions limits, and procedural requirements in the actual statutory language), RCRA leaves the task of designing and implementing a comprehensive regulatory system to EPA within the broad directive of a single overriding statutory goal—the protection of human health and the environment. Unlike implementation of air- and water-pollution control strategies that developed incrementally over more than a decade, Congress directed EPA to establish a comprehensive regulatory program defining the area to be regulated, the standards of protection, and a permitting system, all within a relatively short period of time.

The task was a large one. But faced with growing public concern and its own perceptions of the problem, Congress felt immediate action was required, even if the result might be overregulation of some substances. The RCRA scheme was sufficiently flexible to allow continued tailoring or fine tuning of the basic structure once it was established.

Despite the simplicity of RCRA'S approach, devising and implementing an effective and timely program with maximum public involvement mechanisms has proved to be a complex and controversial task. It was widely believed that if RCRA was to result in a comprehensive hazardous waste management system, such a system would have the following essentiaI attributes:[4]

1. A minimum Federal regulatory program would control and define the universe of regulated hazardous waste, which would evolve in response to greater knowledge about the hazards of the wastes and their interactions with public health and the environment.

'House Report 94-1491; 94th Cong., 2d sess. (1976), at 30

[3]Id.

[4]See generally, House Report 94-1491, supra note 2, at 24-32.

2. The combined Federal and State programs would promote the availability of adequate treatment and disposal capacity.
3. The program would encourage generators to use process modification, product substitution, and recycling to reduce the volumes of wastes generated.
4. The program would receive adequate funding through Federal assistance to States (and other mechanisms).
5. Permitting and enforcement responsibilities eventually would be handled primarily by the States with Federal oversight.
6. The system would promote public participation in rulemaking (setting of standards) and permitting of facilities and would recognize private lawsuits to alleviate hazardous waste problems in the absence of effective Federal or State action.
7. The **act's** criminal and civil penalties for noncompliance would be a further incentive to comply with standards.
8. The regulatory program would require financial responsibility of those parties engaging in hazardous waste activities and would end the system of anonymous dumpers and unmarked, unrecorded sites.
9. The comprehensive regulatory system would force internalization of the true **costs** of hazardous waste disposal and eventually would assure that hazardous wastes are properly disposed, protecting public health and the environment.
10. The system would combine onsite treatment 'of some wastes with offsite treatment for others and secure land disposal methods for residues that remain hazardous after treatment.

The Federal hazardous waste regulatory system still falls short of the ambitious goals of RCRA. In the more than 6 years since passage of RCRA, in 1976, implementation of the act through required rulemaking by EPA has been slow. Many important statutory deadlines were missed and several major regulations were promulgated only after court orders directed EPA to meet its responsibilities. Among the reasons cited by EPA for these delays were budgetary limitations, need for more scientific and technical information, and the complexity of developing a comprehensive regulatory program based on a general statutory mandate.' On July 26, 1982, EPA issued interim final regulations governing land disposal facilities and final authorization of State regulatory programs. When the land disposal regulations became effective on January 26, 1983, the basic Federal regulatory program for hazardous waste activities **was** in place. EPA acknowledges that the program is not complete—standards for permitting chemical and biological treatment facilities have not yet been promulgated, for example, and further modifications and additions to the rules already in effect will be made. However, the institutional framework has been established by which most existing and new facilities can be permitted, and State programs can receive final authorization to operate in lieu of the Federal program, According to EPA, full implementation of RCRA through issuance of detailed technical standards, permitting of all existing facilities, and final approval of State programs likely will take an additional 5 to 7 years.

Identification and Classification of Hazardous Waste–The Trigger

Hazardous waste enters the system at the point at which it is generated. Under EPA rules, each generator of solid waste must analyze its wastes to determine whether there is hazardous waste. If waste is a hazardous waste and not exempted by statute or rule, it must be managed in compliance with EPA regulations or the requirements of an approved State regulatory program. The waste must be properly packaged and manifested if shipped offsite, and must be sent for treatment, storage, or disposal only to a hazardous waste facility operated according to EPA standards.

The requirements of the RCRA Subtitle C regulatory program are triggered by the identification of a solid waste as hazardous waste.

%ee preamble to EPA land disposal regulations, 47 F,R. 33, 27633,278, July 26, 1982 which summarizes the history of and changes in EPA's implementation of subtitle C.

The universe of hazardous waste is established by statutory definitions and EPA's regulatory interpretations of these definitions are further modified by various statutory and regulatory exclusions and exemptions, Solid waste is defined in section 1004(27] of RCRA as:'

> any garbage, refuse, sludge . . . and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities . . .

Hazardous waste is defined in section 1004(5) of RCRA as:[7]

> . ,. a solid waste, or combination of solid waste, which because of its quantity, concentration, or physical, chemical, or infectious attributes, 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.

Section 3001 of RCRA directs EPA to develop: 1) criteria for identifying the characteristics of hazardous waste and 2) criteria for listing particular hazardous wastes. In adopting these criteria, section 3001 requires EPA to take into account "toxicity, persistence, and degradability in nature, potential for accumulation in tissue, and other related factors such as flammability, corrosiveness, and other hazardous characteristic s." Using the characteristics and listing promulgated based on theses criteria, EPA is to define the universe of hazardous waste to be regulated (see table 51).

Table 51 .—Identification of Hazardous Waste

/s it a solid waste?

The material is an RCRA solid waste if:

1. It is garbage, refuse or sludge, or other solid, liquid, semi-liquid or contained gaseous material that:
   a. is discarded or is sometimes discarded, or
   b. has served its original intended purpose and is sometimes discarded; or
   c. is a manufacturing or mining byproduct and is sometimes discarded; and
2. It is not excluded from the definition of RCRA solid waste by statute or rule.

If the waste meets the above two conditions, it is a RCRA solid waste irrespective of whether it is discarded, used, reused, reclaimed, or recycled, or stored or accumulated before such activities.

Materials that do not meet these conditions are not RCRA solid wastes and cannot therefore be regulated as hazardous waste,

Is it a hazardous waste?

A material will be considered as RCRA hazardous waste if it meets the following conditions:

1. It is a RCRA solid waste and is not excluded from regulation by statute or rule;
2. The waste is listed as hazardous waste or is a mixture containing a listed waste, and the waste or mixture has not been specifically del isted; or the waste (or a mixture containing the waste) exhibits one of the characteristics of hazardous waste: ignitability, reactivity, corrosivity, or EP toxicity.
3. The waste has not been excluded by statute or rule from the definition of hazardous waste.

SOURCES 40 CFR 261 4(b), 40 CFR 261.3, 260.20, 26022, and 40 CFR 261, Subpart G

Exclusions From the Definitions of Solid Waste and Hazardous Waste

RCRA excludes from this definition of solid waste ***certain*** materials that are regulated under other Federal laws or that would be impractical to regulate under the RCRA scheme. These statutory exclusions from the definition of solid waste and thus from the universe of hazardous waste are: materials in domestic sewage and irrigation return flows, industrial point source discharges permitted under CWA, and source, special nuclear, or byproduct material defined under the Atomic Energy Act of 1954, as amended.

EPA has further interpreted the meaning of solid waste for purposes of hazardous waste regulation as a material that:

- is discarded, or being stored, or physically, chemically, or biologically treated before being discarded; or
- has served its original intended use and is sometimes discarded; or
- is a minin, or manufacturing byproduct and is sometimes discarded.[8]

'42 U.S. C. 6903 (14).
[7]42 U. SC. 6903 (5).

[8]40 CFR 261 (1982].

The heart of EPA's regulatory definition is that the material is discarded or sometimes discarded. EPA defines discarded as "abandoned (and not used, reused, reclaimed or recycled) or disposed of or burned or incinerated or otherwise treated instead of, or before, being disposed of." This broad regulatory concept of solid waste excludes primary and intermediate industrial, commercial, mining, and agricultural manufacturing products, but asserts jurisdiction over the broad range of activities involving recycling, reclamation, and reuse. Materials that are recycled, reclaimed, or reused are not regulated only when that is the universal practice in the industry.

There are two important regulatory exclusions from the definition of solid waste. EPA excepts the burning or incineration of solid waste as a fuel for the purpose of recovering usable energy from the meaning of "discarded" and thus from being a solid waste. EPA also has excluded materials subject to in situ mining techniques which are not removed from the ground as part of the mining process from the definition of solid waste,

The Solid Waste Disposal Act (SWDA) Amendments of 1980 temporarily exclude from regulation under Subtitle C of RCRA, hazardous wastes from oil, gas, and geothermal energy exploration and production; from burning of coal and other fossil fuels; from mineral mining and processing, and cement-kiln dust waste. [g]

EPA is to study these wastes and to report back to Congress with recommendations on whether they should be regulated under Subtitle C of RCRA. * During the study period, management of these wastes will be regulated under other Federal and State laws, including Subtitle D of RCRA. The amendments provide that EPA may promulgate regulations governing disposal of fossil fuel combustion, mining, and cement-kiln dust wastes under section 2002 of RCRA that require placing in the public record the location of any closed disposal sites and an analysis of the wastes deposited there. This temporary exclusion is effective until at least 6 months after submission of the required report to Congress and promulgation of regulations on these wastes, or publication of EPA's determination based on these studies that such regulations are unwarranted. For oil, gas, and geothermal wastes, the amendments include a "sense of the Congress" provision that existing Federal and State regulatory programs governing these wastes during the interim period should require at a minimum the recording of the location of any waste disposal sites that are closed and an analysis of produced waters and drilling fluids deposited there that are suspected of containing hazardous substances. The temporary exclusion for drilling fluids, produced waters, and other wastes for oil, gas, and geothermal energy exploration, development, or production is effective until Congress approves any regulations recommended by EPA as a result of the study.

In addition to the statutory exclusions, EPA's regulations interpreting the statutory provisions exclude certain solid wastes from the definition of hazardous wastes for the purpose of subtitle C.[10] These exclusions are shown in table 52.

A solid waste is a hazardous waste if it is not excluded from regulation as a hazardous waste and it meets any of the following criteria:

- it is listed by EPA in 40 CFR 261, subpart D, and has not been specifically delisted; or
- it is a mixture of a listed waste and a solid waste and has not been specifically delisted; or
- it exhibits any of the four characteristics for identifying hazardous waste in 40 CFR 261, subpart C: ignitability, corrosivity, reactivity, and extraction procedures (EP) toxicity.

[g]Public Law 96-482, sec. 7, 94 Stat. 2336, Oct. 21, 1980; 42 U.S.C. 6921.

*The EPA studies are to look at items such as: 1) the source and volume of the waste, 2) present disposal/utilization practices, 3) potential danger to human health or the environment, 4) documented cases of proven danger, 5) alternatives to current disposal practices, 6) cost of alternatives, 7] impact of alternatives on the use of natural resources, and 8) current and potential use of these materials.

1040 cFR 261.4 [1982).

Table 52.—Exemptions and Exclusions From the Universe of Hazardous Waste

Exclusions frorn the statutory definitlon of solid waste:
- solid or dissolved materials i n domestic sewage;
- solid or dissolved materials i n irrigation return flows;
- industrial discharges that are point sources subject to National Pollutant Discharge Elimination System (N PDES) permits under sec. 402 of the Clean Water Act; and
- source, special nuclear, or byproduct material defined under the Atomic Energy Act of 1954, as amended.

Exclusions by rule from the definition of solid waste:
- statutory exclusions above;
- waste burned as fuel for purposes of recovering usable energy; and
- in-situ mining wastes not removed from the ground,

Temporary statutory exclusions from the definition of hazardous waste:
- drilling f l u ids, produced waters and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy;
- fly ash waste, bottom ash waste, slag waste, and flue gas emission control waste generated primarily from combustion of coal or other fossil fuels;
- solid waste from the extraction, beneficiation, and processing of ores and minerals, including phosphate rock and the overburden from the mining of uranium ore; and
- cement kiln dust waste.

Solid wastes excluded from the definition of hazardous wastes in EPA regulations:
- household waste;
- agricultural and livestock raising wastes used as fertilizers;
- mining overburden returned to the minesite;
- temporary statutory exclusions above;
- certain wastes containing exclusively (or almost exclusively) trivalent chromium from leather tanning and finishing industries, shoe manufacturing and other leather product industries, and wastewater treatment sludge from production of TiO, pigment from chromium-bearing ores by the chloride process (if not hazardous under any other provision except failure of EP toxicity test for chromium);
- solid waste from coal mining and processing;
- arsenical treated wood or wood products which: 1) fail the test for EP toxicity and 2) are discarded by persons using the wood or wood products for its intended end use (unless the waste meets other tests for hazardous waste);
- any waste, sludge, or residue for hazardous waste treatment that is no longer hazardous because it no longer displays a characteristic of hazardous waste;
- hazardous waste generated in a product or raw material storage tank, transport vehicle, or in a closed manufacturing process unit or waste treatment unit before it exits from or is removed from the unit;
- samples of solid waste, or of water, soil, or air collected solely for testing subject to special handling requirements to qualify for this exemption); and
- a delisted solid waste or sludge or residue from treatment of a delisted hazardous waste (provided that it does not exhibit any characteristics of hazardous waste).

SOURCE 40 CRF 261 Subpart C

Hazardous Waste Characteristics

Section 3001 of RCRA requires that EPA develop and promulgate criteria to be used to identify the characteristics of hazardous waste. A waste which exhibits any of these characteristics will be considered as a regulated hazardous waste. EPA regulations use the statutory definition of hazardous waste—i.e., the potential effects that exposure to such waste may have on human health or the environment as two of these criteria. The third criteria is that the characteristics must be capable: 1) of being measured by standardized testing protocols that are reasonably within the capabilities of the regulated community or 2) of being reasonably detected by generators of solid waste through their own knowledge of their waste stream. Using these critieria, EPA identified four characteristics:

- ignitibility—posing a fire hazard during routine management;
- corrosivity—ability to corrode standard containers or to dissolve toxic components of other wastes;
- reactivity—tendency to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases;
- EP toxicity (as determined by a specific extraction procedure) —presence of certain toxic materials (as listed in 40 CFR 261.24) at levels greater than those specified in the regulation.

Table 53 shows in more detail the tests to be used in determining whether a waste exhibits a hazardous characteristic.

Other properties of some solid wastes that pose a threat to health and the environment, such as carcinogenicity, teratogenicity, infectiousness, and mutagenicity, are not included in the characteristics for identifying hazardous wastes because EPA considers that reliable testing protocols for these effects are not generally available to the regulated communi-

Table 53.—Characteristics of Hazardous Wastes

Ignitability-(wastes that during routine handl start fire or exacerbate fire once started):
- liquid with a flash point below 60° C (140° F);
- nonliquid capable under standard temperature and pressure of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and, when ignited, burns so vigorously and persistently that it creates a hazard;
- ignitable compressed gas as defined by the U.S. Department of Transportation; and
- oxidizer as defined by the U.S. Department of Transportation.

Corrosivity-(wastes that under normal conditions could corrode through their containers and leach out other waste constituents):
- Ž aqueous material with pH less than or equal to 2 or greater than or equal to 12.5; or
- liquid that corrodes steel at a rate greater than 6.35 millimeters (0.25 inch) per year under specified test procedures.

Reactivity—(wastes that are extremely unstable under normal conditions with tendency to react violently, explode, or give off dangerous gases):
- normally unstable 'material that readily undergoes violent change without detonating; or
- material that reacts violently with water; or
- material that forms potentially explosive mixtures with water, or when mixed with water generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment; or
- a cyanide or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment; or
- material that is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement or it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or
- a forbidden explosive, Class A explosive, or Class B explosive, as defined by U.S. Department of Transportation regulations.

Toxic/ty—(wastes are likely to leach out hazardous concentration of toxic chemicals.) Waste is "EP toxic" if a specified extraction procedure test yields an extract equal to or exceeding following levels:

Contaminant	*Maximum concentration (milligrams per liter)*
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0
Endrin	0.02
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4-D	10.0
2,4,5-TP Silvex	1.0

SOURCE 40 CFR 261 Subpart C

ty. Waste exhibiting these characteristics, however, may be brought under the subtitle C regulations through the listing mechanism.

Each 'generator must determine if a solid waste exhibits one or more of the specified characteristics by testing a "representative sample" of the waste. The testing maybe based on protocols described in the regulations, on other protocols approved by EPA as "equivalent," or the generator may simply apply his own knowledge of the solid waste or its constituents.

Unlike mixtures containing listed wastes (which are automatically considered hazardous), mixtures containing unlisted waste are considered hazardous and subject to regulation only if the entire mixture exhibits one or more of the specified characteristics.

Listing of Hazardous Waste

The second method for determining if a solid waste is a hazardous waste is whether the waste is listed as a hazardous waste or is a mixture of a solid waste and a listed waste. Section 3001 of RCRA requires EPA to develop criteria to be used in listing particular hazardous wastes and waste streams. The listing criteria are that the solid waste:

- hexhibits one of the four characteristics of hazardous waste (ignitability, corrosivity, reactivity, or EP toxicity); or
- has been found to be fal al in humans in low doses or, in the absence of human data, has been shown to be dangerous in animal studies; or is otherwise capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible, illness (such waste is designated "acute hazardous waste"); or
- contains any of the toxic constituents listed in Part 261, Appendix VIII which have been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on human or other life forms, unless it is determined that the waste cannot pose a hazard when improp-

erly managed. This class of waste is designated "toxic waste. "

Based on these criteria and available scientific and technical information, in May 1980, EPA published three generic lists of wastes that are considered to be hazardous and subject to RCRA Subtitle C regulation:

1. hazardous waste from nonspecific sources (40 CFR 261,31);
2. hazardous waste from specific sources (40 CFR 261.32); and
3. discarded commercial chemical products, off-specification species, containers, and spill residues thereof (40 CFR 261.33). The discarded commercial chemical products list is further divided into wastes designated as toxic wastes (40 CFR 261,33(f)) and as acutely hazardous wastes (40 CFR 261.33(e)).

Any listed waste is regulated unless it is delisted either through removal of the listing of the generic waste or of the specific waste from a particular facility in response to a petititon for regulatory amendment.

Delisting of Hazardous Waste[11]

Because the lists of hazardous waste include a broad range, it may subject some wastes or individual generators to regulation in circumstances when their wastes do not pose a threat to human health or the environment even when improperly managed. To deal with the potential for "overregulation," frequently inherent in precautionary health and safety regulatory schemes involving complex scientific and technical issues, EPA has provided an "escape hatch" through the delisting process.

Delisting is accomplished by petitioning for a regulatory amendment as authorized under section 7004 of RCRA. A delisting petition as a rulemaking procedure is subject to requirements for public notice and comment. Delisting petitions generally fall into one of two categories, One type of petition seeks a determination that a listed waste from a particular generator is not hazardous by demonstrating that this specific waste under its individual circumstances does not meet any of the criteria that caused the waste to be listed generically. If the petition is granted, waste from that generator only is no longer considered as listed hazardous waste. The second type of petition seeks to remove a listed waste from the hazardous waste lists by demonstrating that EPA erred in its original generic listing and that the waste in fact does not meet any of the criteria for listing. If a generic delisting petition is granted, the waste is no longer listed hazardous waste. The delisting provision allows consideration of the variations in individual waste streams resulting from differences in raw materials, industrial process technologies, and other factors. It provides an incentive for some firms to modify their processes or products so that their wastes are not classified as hazardous wastes. By September 30, 1982, over 200 delisting petitions had been submitted to EPA and were under review.

EPA rules provide for the granting of a temporary exclusion based on a finding of substantial likelihood that a delisting petition will ultimately be granted. Temporary exclusions can be issued without advance public notice or opportunity for comment, however, EPA retains an opportunity to reconsider its decision in the future based on new information received in response to request for comments published when the temporary exclusion is granted. Several environmental groups have criticized granting a temporary exclusion without the procedural safeguards of public notice and comment. These groups contend that temporary exclusions lifting the requirements for proper management and tracking of the waste could result in inadequate protection of health and the environment, during the interim before a final determination is made, if more detailed review in response to public comment indicated that the waste was properly listed as hazardous. On several occasions, EPA has granted such temporary exclusions without prior opportunity for public comment.[12] In some cases

[11] 40 CFR 260.20 and 260.22 (1982).

[12] See, for example, temporary exclusions at 47 F.R. 52,667, Nov. 22, 1982,

EPA's final determination later modified its temporary exclusion based on the comments received and more intensive review.[13]

The delisting of a facility's waste does not mean that it is not subject to hazardous waste regulation. The facility must continue to analyze its solid waste, and if it exhibits one of the four characteristics of hazardous waste or if it later includes a listed waste, the waste is subject to subtitle C regulations. Generators have the burden of demonstrating that their waste is not hazardous because under RCRA they are responsible for determining whether their wastes are hazardous, and because they are uniquely aware of the contents of their waste streams.

Changes in the Universe of Hazardous Waste

In general, because of various exemptions and exclusions and the listing and delisting processes, the universe of waste covered by the RCRA Subtitle C regulations can be expected to change. Moreover, EPA is required to review periodically the lists and the criteria for identifying waste, and to make appropriate additions and deletions as more information becomes available, However, EPA has not made any additions to the list of hazardous waste since 1980. Under section 3001(c) of RCRA, State governors may also petition EPA to add substances to the list. The Governor of Michigan, for example, has submitted a petition requesting that EPA add over 200 additional chemical substances regulated as hazardous waste in Michigan to the Federal list of hazardous wastes.

Special Exemptions for Certain Categories of Hazardous Wastes

All wastes in the universe of hazardous waste are not necessarily subject to the full requirements of the RCRA program, For example, EPA regulations include special limited exemptions for generators which produce hazardous waste in small quantities, for hazardous wastes that are used, reused, recycled, or reclaimed, and for residues of hazardous wastes in containers. These limited exemptions have the advantage that EPA retains regulatory jurisdiction over the wastes and activities involved and could impose additional requirements or invoke its enforcement authority where necessary to protect human health or the environment,

Small Quantity Generator Exemption

EPA has exempted certain small quantity generators from the standards generally imposed on hazardous waste generators. These small generators are exempted from the notification, recordkeeping, reporting requirements, and from the manifest system. As a consequence of this exemption, unknown quantities of hazardous waste exit the regulated universe of hazardous waste. In the preamble to the May 1980 regulations, EPA explained its reason for creation of this administrative exemption because:

> . , . (the) enormous number of small generators, if brought entirely within the subtitle C regulatory system, would far outstrip the limited Agency resources necessary to achieve effective implementation.[14]

To qualify for the the small quantity generator exemption, generators must not generate or accumulate more than a specified amount of hazardous waste each month. The small quantity limits are:

- no more than 1 kilogram per month (kg/me) for acutely hazardous waste,
- no more than 100 kg/mo of residues or contaminated soils, water, or other debris resulting from the cleanup of any spill of any acutely hazardous waste; or
- no more than 1,000 kg/m.o (2,200 lb) of any other hazardous waste, 15

[13] See 47 F.R. 52,667, Nov. 22, 1981, at 52,685.

[14] 45 F.R. 33,104, May 19, 1980.

[15] Identified in 40 CFR 261, subpart C (1982). Many States have been more restrictive than EPA in granting exemptions for some of the small quantity generators. In some States, small quantity generators are thought to be responsible for the most serious hazardous waste problem, See the discussion of State small generator provisions later in this chapter.

In addition, the generator must either treat or store the hazardous waste in an onsite facility or ensure delivery to an approved offsite storage, treatment, or disposal facility. This offsite facility must be a facility that has interim status or is permitted under the Federal RCRA program or an authorized State program, a State-approved municipal or industrial solid waste facility (subtitle D facility), or a facility that beneficially uses or reuses or legitimately recycles or reclaims the waste or treats it before such reuse or recycling.

Small quantity generators who mix hazardous waste with nonhazardous waste may take advantage of the small quantity exemption provided that the amount of hazardous waste in the mixture remains below the specified limits and that the mixture does not exhibit any of the characteristics of hazardous wastes.

Exemption for Wastes That Are Used, Reused, Recycled, or Reclaimed

EPA has recognized the need to achieve a workable balance between the requirement in subtitle C that hazardous waste be properly managed and RCRA'S overall objective of promoting the use, reuse, recycling, and reclamation of energy and material from wastes. Despite objections that regulation might thwart the resource recovery goals of RCRA, EPA has included hazardous wastes that are used, reused, recycled, or reclaimed within the universe of hazardous waste, but has temporarily exempted many of these wastes from most hazardous waste regulation until special provisions can be developed.

Listed hazardous wastes, mixtures containing listed hazardous wastes, and sludges, which are transported or stored before being recycled, are subject to limited notification, recordkeeping, transportation, and storage requirements. However, other hazardous wastes are exempted from regulation altogether if they are:

- being beneficially used or reused or legitimately recycled or reclaimed; or
- being accumulated, stored, or physically, chemically, or biologically treated prior to beneficial use or reuse or legitimate recycling or reclamation; or
- spent pickle liquor reused in wastewater treatment in a National Pollutant Discharge Elimination System (NPDES) permitted facility or that is being stored or treated before such use.[16]

Exemption for Residues of Hazardous Waste in Empty Containers

EPA has decided that any hazardous waste residues remaining in an "empty" container, or in an inner liner removed from an "empty" container, are not subject to hazardous waste regulation. A container is considered "empty" if:

- it has held a hazardous waste that is a compressed gas, but the pressure in the container now approaches atmospheric; or
- it has held an acutely hazardous commercial chemical, but has since been triple-rinsed with an appropriate solvent or cleaned by some other means shown to achieve equivalent removal; or
- it has held any other type of hazardous waste, but all waste has since been removed using the practices commonly used to remove materials from that kind of container (e.g., pouring, pumping, aspirating) and no more than 2.5 centimeters (1 inch) or 0.3 percent by weight of residue remain on the bottom of the container or inner liner.[16]

If a container is not "emptv" according to one of these three definitions then any hazardous waste remaining in the container is subject to full regulation unless the generator qualifies for the small generator exemption or the container residues qualify for the recycling exemption.

Provisions of General Applicability to Hazardous Waste Generators, Transporters, and Treatment, Storage, Disposal Facilities

Notification

Section 3010 of RCRA'[7] requires that all generators, transporters, and owners or operators of treatment, storage, and disposal facilities (TSDFS) must have notified EPA that they are

[16] 40 CFR 261.7, as modified at 47 F.R. 36092, Aug. 18,1982.
[17] 42 U.S. C. 6930.

handling hazardous waste within 90 days of the date EPA issues rules defining hazardous waste (i.e., by Aug. 19, 1980). The generation, transportation, treatment, storage, or disposal of hazardous waste after that date is illegal if the required notification has not been made.

EPA encountered practical difficulties in applying the notification requirement to firms that engaged in hazardous waste activities after the initial notification date had passed but that had not been in violation of the requirements on that date. (For example, small generators who later exceeded the permissible 1,000 kg/mo level, generators whose wastes were listed subsequent to the date.) Accordingly, EPA provided that such firms are not in violation of section 3010 if they were not required to notify EPA on the Aug. 19, 1980 notification date. These firms must notify EPA that they are engaged in hazardous waste activities after they become subject to regulation.

The Manifest System

RCRA provides that EPA regulations must require that waste generators, transporters, and TSDFS comply with the manifest system. The manifest system is an integral part of the comprehensive hazardous waste regulatory scheme under RCRA as envisioned by Congress. All waste shipped offsite of generation must be manifested; the manifest must accompany the waste and identify the waste; specify its quantity, origin, and destination; and the identity of the transporter. The manifest allows tracking of the waste for enforcement. The manifest requirement also works to discourage the practices that produced midnight dumping and orphan dump sites. Additionally, it provides information on which to base regulation. The requirement is largely self-executing because it relies on the regulated community to monitor compliance and to report possible violations.

Originally, EPA declined to establish a uniform national manifest. Consequently, States imposed their own manifest requirements. Interstate shippers of hazardous waste faced the possibility of having to carry a different manifest for each State they traveled through. In practice, however, many States accepted manifests of other States for purposes of complying with their requirements if the necessary identifying information was included. In response to industry complaints about lack of uniformity, EPA has proposed, but not yet finalized, a national manifest form.[18]

Regulation of Hazardous Waste Generators

RCRA places several critical responsibilities on generators of hazardous wastes. The generator is responsible for assuring that hazardous waste enters the regulatory system by analyzing its solid waste to determine whether it is a regulated hazardous waste. If it is, the generator must meet notification and reporting requirements, prepare a manifest for shipping waste offsite, and properly pack and label the waste for shipment. Generator activities are not, however, as directly controlled as those of hazardous waste TSDF operators. The 1980 RCRA Amendments to section 3002 emphatically placed on the generator the responsibility to assure that waste is transported to, and arrives at, an appropriate facility.[19]

EPA regulations define a generator as:

> . . . any person, by site, whose act or process produced hazardous waste identified or listed in part 261 of this chapter and whose act first causes hazardous waste to become subject to regulation.[20]

EPA's definition of generator means that each individual plant or facility that produces hazardous waste is considered a separate generator. The definition of generator does not distinguish between those who produce hazardous waste as a normal consequence of their activities or processes, or those who create hazardous waste as a result of an accident or other unusual circumstances. Exclusion of some substances (e. g., mine waste) from the definition of hazardous waste has the effect of removing the firms that produce these substances from being considered as generators and from having to comply with reporting and recordkeeping requirements, Additionally, a generator

18 47 F.R. 9,336, Mar. 4, 1982.
19 42 U.S.C. 6922.
20 40 CFR 260.10 (1982).

must obtain a TSDF permit if the waste is accumulated on the property for more than 90 days or if the generator treats or disposes of the waste on site.[21]

Requirements for Transporters of Hazardous Waste

RCRA directs EPA to establish standards for transporters of hazardous waste. Safe transport of hazardous waste from generators to disposal sites is an important part of the comprehensive regulatory system. Requirements for hazardous waste transport were included to allow tracking of wastes and to prevent the abuses of midnight dumpers as well as the safety threats posed by moving hazardous waste materials unlabeled and undisclosed in interstate commerce and from accidents.

Section 3003 of RCRA provides for EPA to issue regulations for transporters which include requirements for recordkeeping, compliance with the manifest system, transportation only of properly labeled and packaged waste, and transportation of the waste only to the permitted or interim status TSDFS designated on the manifest.[22] Transporters are not themselves required to have permits under RCRA, but they must obtain identification numbers from EPA and they may not accept waste from generators who do not also have identification numbers.

Transporters of hazardous waste are subject to both EPA's regulations under RCRA[23] (or those issued under an approved State program), regulations issued by the Department of Transportation (DOT) under the Hazardous Materials Transportation Act[24] (many of which have been jointly adopted with EPA), and any additional requirements of State laws. RCRA imposes two additional responsibilities to the DOT hazardous materials regulatory scheme: notifying of hazardous waste activities and obtaining an EPA identification number and complying with the manifest system, The RCRA regulations do not apply to onsite transportation of hazardous waste by generators or by owners or operators of TSDFS. They also do not apply to transporters of waste from small quantity generators or (except for limited provisions) to transporters of recycled waste or empty containers, because of their exclusion from most of the subtitle C regulatory system.

Special rules may apply when a discharge occurs during transportation (i. e., when there is an accidental spilling, leaking, pumping, emptying or dumping of hazardous waste onto or into the land or water, Furthermore, transporters who hold waste for more than 10 days (except under limited circumstances) must comply with the applicable regulations for storage and for obtaining a RCRA storage facility permit.[25]

Requirements for Hazardous Waste Treatment, Storage, and Disposal Facilities

Section 3004 of RCRA authorizes EPA to promulgate "such performance standards for hazardous waste treatment, storage, and disposal facilities as maybe necessary to protect human health and the environment," The 1980 amendments require EPA to distinguish, where appropriate, between new and existing facilities in setting these standards.[28]

The performance standards are intended to serve a threefold purpose:

1. to establish design and operating practices that are adequate to protect health and environment,
2. to provide the technical basis for permitting facilities, and
3. to set minimum standards for authorizing State hazardous waste programs,

Section 3004 provides that the EPA performance standards must include, but are not limited to, requirements for:

- maintenance of records of all hazardous wastes handled by the facility and of treatment, storage, or disposal practices used;

[21] 40 CFR *262.34* (1982).
[22] 42 U.S. C, *6923,*
[23] 40 CFR part *263 (1982).*
[24] 49 U.S. *C. 1801-1812,* (1 *978).*
[25] John Quarles, *Federal Regulation of Hazardous Waste: A Guide to RCRA* (Washington, D.C.: Environmental Law Institute, 1982], pp. 86-87,
[26] 42 U.S.C. 6924.

- reporting, monitoring, inspections, and compliance with the manifest system;
- operating methods, techniques, and practices for treating, storing, or disposing of hazardous wastes;
- location, design, and construction of the facility;
- contingency plans for effective action to minimize unanticipated damage from hazardous waste treatment, storage, or disposal;
- maintenance of operation of the facility and such additional qualifications as to ownership, continuity of operations, training for personnel, and financial responsibility as may be necessary or desirable; and
- compliance with the requirements of RCRA section 3005 relating to permits for facilities.

Performance standards commonly are used to establish the level of effectiveness that a pollution control technology or managerial practice must achieve—e,g., a requirement that a landfill-liner system must prevent waste constituents from entering the environment for 200 years is a possible formulation of a performance standard. The use of the term "performance standard" in section 3004, however, is to be given a broad meaning since the objective to be met is the "protection of human health and the environment" from the impacts of hazardous waste management activities. In the achievement of this overall goal, section 3004 authorizes the use of both the typical performance standard and the more specific design standard in setting detailed facility requirements. EPA has used both types of standards in regulations on the operating methods, techniques, and practices, and the location, design, and construction of hazardous waste facilities.

Regulated Facilities

Facilities must be operated and permitted according to the standards established by EPA under section 3004. EPA regulations have defined "treatment," "storage," and "disposal" quite broadly for the purposes of identifying activities that are subject to regulation.

A hazardous waste treatment facility is an operation that uses: "any method, technique, or process, including neutralization, designed to change the physical, che:mical, or biological character or composition of any hazardous waste so as to neutralize such wastes, or so as to recover energy or material resources from the waste, or so as to render such waste nonhazardous, or less hazardous; safer to transport, store or dispose of; or amenable for recovery, amenable for storage, or reduced in volume. "[27] This definition of treatment is broad and includes such activities as dewatering or neutralizing hazardous waste, or mixing a nonlisted hazardous waste with a solid waste to render the resulting mixture nonhazardous. Recycling facilities are clearly within this definition, however, EPA has given them a broad exemption from most facility standards. The cleanup of an accidental spill of hazardous material may also fall within the definition of treatment and thus trigger the regulatory requirements.

A hazardous waste storage facility is any facility that is used for: "the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere."[28] EPA rules provide that generators may store hazardous waste onsite for up to 90 days, and transporters may hold hazardous waste for up to 10 days, without becoming subject to the storage facility standards and permit requirements.

A facility operator is engaged in disposal activities under EPA rules if he engages in:

> ,,. the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwaters.[29]

[27] 40 CFR 260,10 (1982).
[28] 40 CFR 260.10 (1982).
[29] 40 CFR 260.10 (1982).

However, EPA defines a hazardous waste disposal facility more narrowly as: "a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure. "3° The distinction between disposal as an activity and disposal facilities is made to allow EPA to maintain jurisdiction over an unintentional spill or other similar act that might occur, without necessarily requiring a facility permit based simply on the possibility of such an occurrence. The key to being a disposal facility therefore is that the waste is placed in the land or water so that it may enter the environment and that waste remains at the facility after closure.

Standards for TSDFS

EPA's implementation of requirements of section 3004 to establish performance standards for hazardous waste TSDFS has been a process characterized by delay, false starts, frequent policy reversals, and litigation.[31] One result of the complexity and delay encountered in developing a comprehensive regulatory system for hazardous waste is that EPA has promulgated three different sets of standards for TSDFS.

Interim Status Standards (40 CFR part 265).– These regulations, originally published on May 19, 1980, establish administrative and nontechnical facility standards applicable to all existing facilities operating under interim status and to special technical standards for different types of facilities. Existing facilities will continue operating under these requirements until a final facility permit is issued or denied.

General Status Standards (40 CFR part 264) (Permanent Program Standards) .—Regulations establishing these final technical standards for permitted hazardous waste facilities were published over a 2-year period. These standards are applicable to new and existing facilities at the time the facility permit is issued. They generally impose more stringent detailed requirements that are adapted to the individual facility conditions and that are specified in the permit after the permit review.

Interim Standards for New Facilities (40 CFR part 267).—Because RCRA requires that issuance of a permit before the construction and operation of new hazardous waste facilities, the delays encountered in establishing final permitting standards threatened to stop construction of additional waste treatment and disposal capacity and the development of new, safer waste management technologies. EPA issued a set of temporary interim standards for permitting new facilities in January 1981 to remedy this situation. (A new facility is any facility that does not qualify as an existing "interim status" facility,) These interim standards were superseded as part 264 final permit standards became effective.

Interim Status Standards (ISS)

RCRA originally provided that no hazardous waste facility could operate without a permit beyond 24 months after the passage of the act (the date on which the original facility standards would have become effective if they had been issued on time). Section 3005 provided that an existing facility could apply for interim status allowing it to operate as if permitted, pending issuance of the standards and action on the permit application. The 1980 RCRA amendments changed the date on which facilities had to be in existence in order to qualify for interim status to November 19, 1980 (the effective date of the May 1980 implementing regulations). [32]

On May 19, 1980, EPA issued its initial hazardous waste regulations. This rulemaking included general administrative and nontechnical standards applicable for all TSDFS and more specific technical standards for different types of facilities. Table 54 summarizes the general interim status requirements applicable to most facilities.

3040 CFR 260.10 **(1982).**

[31]This **history** is detailed in the preamble to the final land disposal facility regulations issued in July 1982. See 47 F.R. 32,276-32,278, July 26, 1982.

[32]Solid Waste Disposal Act Amendments of **1980,** Public Law 96-482, sec. 10, 94 Stat. 2338, Oct. 21, 1980.

99-113 O - 83 - 19

Table 54.—interim Status Standards: General Administrative and Nontechnical Standards for interim Status Facilities

General requirements for all Interim status facilities:

- **Notify EPA of hazardous waste activities.**
- **Obtain EPA identification number.**
- **Ž Submit Part A permit application.**
- **ŽFile annual or other periodic reports required** by EPA.
- Comply with manifest system:
  - —Sign for receipt of waste shipment and return manifest copies to transporter and generator;
  - —Inspect shipment and report to EPA any significant discrepancies in amount, type of waste;
  - —Report unmanifested waste (except shipments from exempted small generators); and
  - —Maintain manifest copy at facility for 3 years.
- . Notify EPA before receiving waste shipments from outside the United States.
- Notify new owner in writing of duty to comply with RCRA regulations.
- Maintain facility operating record over life of facility covering:
  - —Type, quantities, and location of each waste at facility;
  - —Method of treatment, storage, and disposal;
  - —**Waste** monitoring, testing, inspection results, and analytical data (maintain monitoring data for disposal facilities through post-closure period);
  - —Accidents requiring action under contingency plan; and
  - —Closure cost estimate (and post-closure costs estimate for disposal facilities).
- **Waste** analysis:
  - —Prepare and follow written waste analysis plan specifying **detailed chemical and physical analyses to be conducted, sampling methods, and special analyses for ignitable, reactive or incompatible wastes, and for inspecting shipments for compliance with manifest;**
  - **—Test a representative sample of wastes before treatment, storage, or disposal; retest if change in waste generating processes or if off site wastes do not match manifest description; and**
  - **—Maintain record of waste analyses results.**
- **Inspections and monitoring:**
  - **—Prepare and follow written operator's inspection schedule** describing types of problems to be detected, and frequency of inspection;
  - —Inspect for spills at least daily; follow specific technology inspection and monitoring requirements under technical standards; and
  - —Maintain record of inspection results for 3 years.
- **Ground water monitoring (landfills, surface impoundments, and land treatment facilities only):**
  - **—By Nov. 19, 1981, develop and implement ground water monitoring program for assessing the effects of the facility on the uppermost aquifer underlying the facility. Program must include:**
    - **(i) written ground water monitoring plan, including sampling and analysis specifications and methods;**
    - **(ii) installed system of ground water monitoring wells (at least one upgradient well and 3 downgradient wells); and**
    - **(iii) outline of ground water quality assessment program to be implemented if contamination is detected.**
- **Conduct sampling and testing of ground water:**
  - **—First year: quarterly samples of all monitoring wells to establish background levels of specified parameters:**
    - **(i) Maximum contaminant levels** in National Interim **Primary Drinking Water Standards** (21);
    - **(ii) Water** quality indicator parameters: chloride, iron, **manganese,** phenols, sodium, and sulfate; and
    - (iii) Ground water contamination indicator parameters: pH, specific conductance, total organic carbon, and total organic halogen.
  - —Subsequent years: Test for each well quarterly for 6 background water quality indicator parameters; semi-annually for 4 contamination indicator parameters.
- Continue monitoring program for life of facility and during 30-year post-closure period for disposal facilities.
- Report ground water monitoring results (for landfills, surface impoundments, and land treatment facilities):
  - —Waivers of ground water monitoring program available: (i) by demonstrating low potential for migration of waste constituents from facility via uppermost aquifer to water-supply wells. (Written determination is made by facility operator and certified by qualified geologist or geotechnical engineer.) and (ii) for surface impoundments neutralizing corrosive waste if demonstrate no potential for migration from impoundment.
  - —Use of alternative ground water monitoring program similar to ground water assessment program allowed if monitoring of indicator parameters would show statistically significant changes in water quality.
- Handling ignitable, reactive, and incompatible wastes—waste analysis and special safety precautions such as waste segregation, smoking restrictions, and limits on mixing these special wastes are required.
- Site security:
  - —Maintain site security to prevent unknowing entry, and to minimize unauthorized entry into facility through 24-hour surveillance, barriers, fencing, posted warnings; and
  - —Control entry to active portion of facility.
- Ž Personnel training:
  - —Assure that facility personnel are trained in waste management, operating, and emergency procedures; and
  - —Maintain personnel training records until closure.
- Emergency preparedness and prevention and contingency plan:
  - —Provide internal alarm and emergency communications system, fire, spill control, and decontamination equipment, and device for summoning local emergency assistance;
  - —Test and maintain systems and equipment for emergency readiness;
  - —Develop written contingency plan for accidents and emergencies;
  - —Designate emergency coordinator; and
  - —Provide written report to Regional Administrator within 15 days of events requiring implementation of contingency plan.
- Closure:
  - —Develop written closure plan May May 19, 1981, including: methods of closing (or partially closing) facility at any time during life of facility and at end of operating life, estimate of largest inventory of waste in storage or treatment during life of facility, how facility and equipment will be decontaminated; estimated date of closure; estimated closure costs; and schedule for final closure;
  - —Notify EPA 180 days before closure begins;
  - —Submit closure plan within 15 days of loss of interim status or receipt of order to stop receiving waste;
  - —Follow closure plan;
  - —Complete all treatment, storage disposal activities within 90 days after receiving last waste shipment; and
  - —Complete closure within 180 days of beginning of closure period (unless date is extended by RA).

Table 54.—interim Status Standards: General Administrative and Nontechnical Standards for Interim Status Facilities—Continued

- Obtain engineer's and operator's certification that closure is completed according to plan and all equipment and facilities have been decontaminated or disposed of according y.
- Post-closure (disposal facilities only):
  —Develop written post-closure plan by May 19, 1961, specifying monitoring and planned maintenance activities to be carried on during 30-year post-closure period and identifying responsible person;
  —Follow ground water monitoring plan and reporting requirements;
  —File survey plat showing location, type and quantity of waste i n disposal facility after closure, and amend title records showing use of land for waste disposal and restrictions on future use.
- Financial responsibility:
  —Maintain on file at facility: (i) written estimate of closure costs, adjusted at least annually for inflation, and (ii) demonstration of mechanism facility will use to guarantee coverage of closure costs.
- Liability insurance:
  —Maintain liability insurance or self-insurance for at least $1 million dollar per occurrence for sudden accidental injuries to persons or property from facility operations up to annual aggregate of $2 million (exclusive of legal costs);
  —Owners of surface impoundments, landfills, and land treatment facilities must provide insurance or self-insurance of at least $3 million per occurrence for non-sudden accidental occurrences up to an annual aggregate of $6 million (exclusive of legal costs). (Variations may be approved by RA for State insurance requirements or for State assumption of liability.)

SOURCE 40 CFR Part 265

The interim status standards have generally been characterized as "good housekeeping" requirements. Except for the ground water monitoring, closure, and post-closure care for disposal facilities, the interim status standards were intended by EPA to be "capable of being interpreted and applied in a straightforward manner without substantial expenditures by September 19, 1980.[33] (As explained later in this chapter, EPA's analysis of the ground water monitoring, closure, and post-closure requirements indicated that these imposed the major economic impacts of the interim status standards. However, of these, only ground water monitoring requirements imposed significant immediate expenses, and these were tempered somewhat by economies of scale enjoyed by larger facilities,)

Another significant feature of the interim status standards is that they are largely self-executing. That is, the facility owner or operator is responsible for being aware of, interpreting, and assuring compliance with the regulations. EPA and the States will conduct periodic inspections to determine if a facility is in compliance. Adhering to the interim status standards will not insulate a facility from having to comply with administrative orders or being subject to an imminent hazard action or other enforcement measure if the operation of the facility poses a threat to human health or the environment.

Interim Status Ground Water Monitoring Requirements

Any interim status landfill, surface impoundment, or land treatment facility must have a ground water monitoring program to assess the effects of the facility on the uppermost aquifer underlying the facility. The facility program must be in place by November 19, 1981. The program must be continued throughout the life of the facility and during the post-closure period for disposal facilities.[34] The ISS ground water monitoring program consists of three parts:

1. a written ground water monitoring plan (including sampling and analysis plan),
2. an installed system of ground water monitoring wells, and
3. a written outline of a ground water quality assessment program to be implemented if contamination is suggested by analysis of monitoring data.

The ISS ground water monitoring system must include at least one upgradient well to monitor background water quality and at least

3345 F.R, 33,159.60,

[34]See 40 CFR 265.90, 45 F.R. 33,239, May 19, 1980 and 47 F.R. 1254, Jan. 11, 1982.

three downgradient wells sufficient to detect immediately any migration of a statistically significant amount of waste from the facility to the uppermost aquifer. The location, depth, and number of wells must be sufficient to yield representative measures of background water quality and to detect contamination.

Initial background levels for all monitoring wells must be established by sampling at least quarterly in the first year. The operator must test each well quarterly during the first year for 31 specified parameters. These parameters include the maximum contaminant levels established in the National Interim Primary Drinking Water Standards under the Safe Drinking Water Act regulationsss, ground water quality indicator parameters* and four ground water contamination indicator parameters. * * These results are to be reported to EPA. After the first year, the operator must test quarterly for the six background water quality parameters and semiannually for the four parameters that indicate possible leakage.

By November 19, 1981, ISS facilities must prepare a written outline of a ground water quality assessment program to be implemented if monitoring indicated a statistically significant change in ground water quality. The assessment program must be designed to determine whether waste constituents have entered ground water, the extent of any contamination, the rate and extent of migration, and the concentration of the contaminant.

Within 7 days of obtaining results indicating significant changes in ground water, the facility must notify the Regional Administrator. within an additional 15 days, the facility must submit its ground water quality assessment plan based on its previously prepared written outline and implement the plan. Additional reports based on the assessment plan must also be submitted to the EPA Regional Administrator. The facility must continue to monitor under the assessment program at least quarterly until closure. Unlike the standards for permitting land disposal facilities, the interim status standards do not require implementation of corrective action, only continued monitoring of the contamination. However, EPA may accelerate the call up of the facility's part B permit application, or initiate imminent hazard action or a section 3013 administrative order after receiving notice that the facility may be affecting ground water quality.

All or part of the ground water monitoring requirements can be waived under certain circumstances. If, based on evaluation of certain specified site conditions, the operator demonstrates that "there is a low potential for migration of hazardous waste constituents from the facility via the uppermost aquifer to water supply wells, " the facility need not implement a ground water monitoring program. This demonstration must be in writing, certified by a qualified geologist or "geotechnical" engineer, and maintained at the facility.

The ground water monitoring requirements may be waived for surface impoundments that are used only to neutralize corrosive wastes if the operator demonstrates that there is no potential for the migration of hazardous wastes from the impoundment. This determination must be in writing, and certified by a qualified professional.

These waivers of the ground water monitoring standard are made by the facility operator and are not reported to EPA or the State. However, the determinations must be maintained in the facility file and will be reviewed during compliance inspections and permit review by EPA or the State agency. If this review indicates that the waiver was unwarranted, the facility is subject to penalties for violation of RCRA regulations.

The facility may implement an alternative ground water monitoring system other than the one specified in the regulations if the required ground water indicator parameters would show statistically significant changes in water quality. The alternative ground water monitoring plan must be submitted to the Regional Ad-

See 40 CFR Part 265, App. III (1982).
"Chloride, iron, manganese, phenols, sodium, sulfate.
● *Specific conductance, pH, total organic carbon, and total organic halogen.

ministrator and certified by a qualified geologist or geotechnical engineer.

ISS Closure and Post-Closure Requirements

Interim status facilities that close before a permit is issued must comply with ISS closure and post-closure requirements. These standards are similar to the permanent program standards, except that they do not require more extensive corrective action and ground water monitoring requirements for land disposal facilities. Closure is a period after which hazardous waste is no longer accepted at facility, all treatment, storage, and disposal operations are completed, and the facility is closed by, for example, installing the final cover on a landfill or draining and cleaning storage tanks. The closure period generally will last 6 months, Post-closure is the 30-year period after closure when operators of disposal facilities must perform monitoring and maintenance activities.

The purpose of the ISS closure regulations is to ensure that facilities are closed properly: 1) to minimize need for further maintenance, and 2) to control, minimize, or eliminate post-cIosure escapes of hazardous waste or constituents into the environment,

There are specific requirements for different technologies as well as general requirements. Under general requirements, by May 19, 1981, all TSDF operators were to have prepared a written closure plan to be maintained on file at the facility and identify the steps necessary to completely or partially close the facility at any point during its intended operation and at the end of its operating life.[36] The plan also must include estimates of the largest inventory of waste that will be in storage or treatment during facility life, the anticipated closure date, and an estimate of closure costs, The operator must amend the plan to reflect changes in the TSDF operations affecting the closure plan or planned closing date, The plan must be available to EPA on request and at inspection,

When an operator decides to close a facility, the plan must be submitted to the EPA Regional Administrator 180 days before closure begins (comments and hearings may be required). (If an operation loses interim status or is ordered to stop receiving waste, it must submit a closure plan to EPA in 15 days.)

Closure begins when the last shipment of hazardous waste is received, the operator then has 90 days to complete all treatment, storage, and disposal activities or to remove waste from the site. All closure activities must be completed within 6 months or 180 days. This time can be extended by the EPA Regional Administrator for certain conditions, Finally, the operator and a professional engineer must certify that the facility has been closed in accordance with an approved plan and that all equipment and structures have been disposed of or decontaminated,

Post-Closure Plan

By May **19, 1981,** all disposal facility operators must also have a written post-closure plan identifying the activities to be carried on for 30 years after closure. The plan must at a minimum include provisions for ground water monitoring and reporting, the planned maintenance activities to ensure the integrity of the final cover or containment and the functioning of monitoring equipment; and the identity of the persons to be contacted about the facility during post-closure.

Within 90 days after closure, the operator must provide the Regional Administrator and local land use authorities with a professional survey plan showing the disposal areas, types, location, and quantities of the disposed waste. The owner must amend the deed or title records to note that the land was used for hazardous waste disposal and that its future use is restricted.

ISS Financial Responsibility and Insurance Standards

The ISS financial responsibility requirements apply to all TSDFS except those operated by Federal or State Governments. They were imposed to assure that funds will be available to pay for closure and post-closure care and to compensate third parties for any injuries suf-

[36] 40 CFR 265, subpart G (1982).

fered as a result of facility activities. The interim status financial responsibility and liability insurance standards are nearly identical to the standards for permitted facilities.

Each facility must have on file a written estimate of closure costs (to be adjusted annually to reflect inflation) demonstrating how the facility plans to cover its closure costs. One or a combination of several mechanisms can be used to meet closure costs, including:

- a trust fund,
- a surety bond guaranteeing payment into a trust fund,
- an irrevocable letter of credit,
- a financial assets test, or
- an insurance policy.

The same mechanisms can be used to demonstrate financial responsibility for post-closure care. For permitted facilities, the rules allow the posting of a surety bond guaranteeing the performance of the closure plan as an additional means of demonstrating financial responsibility. The interim status standards also impose liability insurance requirements for hazardous waste TSDFS. The facility owner or operator must maintain liability insurance or self-insurance of at least $1 million per occurrence with an annual aggregate of $2 million for claims of sudden accidental injuries to persons or property from facility operations (exclusive of legal costs). Owners or operators of surface impoundments, landfills, and land treatment facilities must carry additional insurance of at least $3 million per occurrence and $6 million annual aggregate (excluding legal fees) for nonsudden accidental occurrences. These nonsudden liability requirements will be phased in over 3 years beginning January 1983 for owners who obtain an optional policy for both sudden and nonsudden occurrences that provide coverage of at least $4 million per occurrence and $8 million annual aggregate (exclusive of legal fees) .37

variations in these requirements are allowed to provide for use of State insurance requirements in States where Federal program requirements apply if the coverage is consistent and includes at least the same amount of funds and coverage. If a State assumes the responsibility for closure, post-closure care, or liability coverage at a facility (an aspect of some State siting programs), this assumption may be approved by the Regional Administrator as an alternative to liability insurance.

Interim Status Standards for Landfills

Interim status landfills are subject to the general facility standards, some additional technical standards for ground water monitoring, financial responsibility, and closure and post-closure care. Basically, the interim standards are directed at controlling the general problems associated with landfill operations: fire, explosion, toxic fumes, and contamination of surface and ground waters. The facility must be operated to divert rainwater run-on into, and to collect runoff from, the active portion of the landfill. Measures to control wind dispersion of contaminated soils must be adopted (if necessary). Ignitable and reactive wastes must be treated or mixed before landfilling so that they no longer meet ignitable or reactive waste characteristics,

Specific requirements are imposed to limit the disposal of liquids in landfills that could form leachate that would allow waste constituents to enter the environment. The May 1980 rules banned most landfilling of free liquids or wastes containing free liquids after November 19, 1981, An exception was made for disposal of bulk liquids or noncontainerized liquids in a landfill with a liner that is chemically and physically resistant to the liquid and with a leachate collection and removal system to remove any leachate. The rules also allowed landfilling of liquids in very small containers (e.g., capsules) and in containers (e.g., batteries) that were not designed for the purpose of storage.

Among the exceptions to the original restrictions on disposal of liquids in landfill are the following:

- containerized liquid Ignitable wastes until May 26, 1982, if they were protected from

[37] See 40 CFR 265.147 (1982).

materials or conditions that would cause them to ignite:[38]

- labpacks (overpacked metal drums holding smaller nonleaking containers of hazardous waste and absorbent material to absorb any leaks) as long as certain restrictions on ignitable, reactive, and incompatible wastes are met:[39]
- liquid containerized waste that is treated or stabilized so that free liquids are no longer present (e.g., absorbent material is added to the drum); and
- containers holding free liquids if the liquids are removed from the container or absorbent material is added before landfilling so that free liquids do not remain.

The July 1982 land disposal regulations modified the interim status standards applicable to landfills to make them consistent and conforming with final technical standards for permitting, Further provisions were added to landfilling of containerized liquid waste to reduce the likelihood of subsidence and leading by requiring the filling of a container with 90-percent absorbent solid material or crushing, shredding, or "similarly reducing" the container in volume before landfilling.

The function and design of the final landfill cover must be specified in the closure and postclosure plans. Also, the plan must include strategies to: control surface water infiltration and migration of pollutants from the facility and prevent erosion; maintain the final cover; monitor leachate and gas control systems; maintain and protect surveying benchmarks; and restrict access to the facility.

Interim Status Standards for Incinerators

The interim status standards for incinerators impose general operating requirements aimed at reducing the potential hazards involved. No special technical performance or design standards were imposed. Additional analysis of the wastes to be incinerated is required to determine their heating value, halogen content, sulfur content, and concentrations of lead and mercury. The incinerator must be operating at steady state conditions before waste is added. The existing combustion and emission control instruments must be checked every 15 minutes. Outside stack gases must be visually inspected every hour, and the incinerator and associated equipment must be inspected daily. At closure, all wastes and residues must be removed from the facility. Hazardous waste residues must be sent to an approved facility. (Note: many incinerators also qualify as treatment and storage facilities because they accumulate or treat wastes before incineration and must comply with those standards as well.)

EPA has made two significant exemptions to the interim status standards for incinerators. Boilers that burn hazardous waste to recover energy are currently excluded from the definition of disposal by incineration and are not subject to any standards under Subtitle C of RCRA. A limited exemption from interim status standards is granted to incinerators that burn waste that is considered hazardous solely because it is corrosive or ignitable, or both, or waste that is listed because it possesses certain reactivity characteristics (described in 40 CFR 261.23 (a)(l),(2),(3),(6),(7), or (8)) and will not be burned when other hazardous wastes are present in the combustion zone.

The subpart O standards for additional waste analysis, monitoring, and inspection are not required of these incinerators if the operator demonstrates in writing that such ignitable, corrosive, or reactive waste would not reasonably be expected to contain any of the Appendix VIII toxic constituents. The written demonstration must be maintained at the facility and will be reviewed when the facility is permitted. These special incinerators, however, must comply with the general facility interim status standards including reporting, recordkeeping, initial waste analysis, facility operation and inspection, compliance with the manifest system and financial responsibility, and compliance with the special standards for incinerator closure.

The interim status standards for incinerators were amended in January 1981 and June 1982

[38] 47 F.R. 8,307, Feb. 25, 1982, 40 CFR 265.312 (b).
[39] 46 F.R. 56,592, Nov. 17, 1981, 40 CFR 265.316.

to make them conform with changes adopted for permanent program permitting standards.

Interim Status Standards for Surface Impoundments

Regulations imposing operating requirements for existing surface impoundments used for storage, treatment, or disposal of hazardous wastes are intended to minimize or control the major problems encountered with these facilities—leakage of hazardous waste constituents to ground water, air emissions from volatile wastes, and overtopping of the impoundments and spilling of the wastes because of overfilling, precipitation, run-on, or wind.

The standards require that surface impoundments be operated to maintain at least 2ft of freeboar[40] to protect against overtopping. Impoundments with earthen dikes must have protective covering such as grass, rocks, or plastic sheeting to limit erosion and maintain structural integrity. Additional waste analyses are required before use of the impoundment for new wastes or use of new treatment processes, Ignitable or reactive wastes must be pretreated to remove the hazardous characteristics before being placed in a surface impoundment. Incompatible wastes must not be put in surface impoundments. The level of freeboard in an impoundment must be inspected daily to detect or prevent overtopping, and the structure and associated equipment must be inspected weekly for leaks or deterioration. Surface impoundments must comply with the ground water monitoring regulations for interim status facilities.

At closure, all wastes, residues, and contaminated soils must be removed from the facility and sent to an approved treatment or storage facility. If the surface impoundment is a disposal facility, it must follow final closure procedures similar to those for landfills, meet financial responsibility requirements, and provide post-closure care.

[40] 40 CFR 265.222 (1982).

General Facility Standards for Permitting Hazardous Waste TSDFS

The interim status standards govern facility operation until a permit is issued. Before a facility is issued a final permit, it undergoes a detailed review to determine that its future generation will be in compliance with the general Phase II standards.

More than 10,000 existing facilities submitted part A permit applications to obtain interim status. Most of these facilities will have to be permitted under the final standards. This process is expected to take 5 years or more. EPA anticipates that a significant number of smaller interim status landfills and surface impoundments will close rather than incur the expenses of upgrading the facility to obtain a permit.

Table 55 summarizes some of the key elements of EPA's final part 264 permit standards. These standards incorporate and build on the interim status requirements. For example, ground water monitoring at landfills during interim status will indicate if any contamination may have occurred and thus be used to decide what type of monitoring and corrective action may be demanded as a permit condition if the facility continues to operate (see table 56).

A major criticism of the adequacy of interim status requirements has been that they will govern TSDF operations until a permit is issued-which could be 5 years. Neither the interim status standards nor the permit standards have addressed whether more stringent standards for inspection, prepermit reviews, and monitoring are necessary to identify and correct situations that may pose a threat to human health and the environment before the ISS facility is called in for its permit review.

The permanent program standards of 40 CFR part 264 are largely identical to the interim status requirements for waste analysis, personnel training, emergency prevention and preparedness, contingency planning, closure and

Table 55.—Technical Performance Standards for Containers, Tanks, Incinerators, Landfills, and Surface Impoundments

Design and operating conditions	Inspection arm monitoring	Closure/post closure
Containers (Subpart 1)		
Container and/or liners must be compatible with wastes. Storage area containment system must control the larger of 10 percent of the volume of the wastes or the volume of largest container. Storage area must have impervious base, run-on controls, and collection system designed for control of and removal of liquids, spills, and run-on unless containers are elevated or protected from contact with liquids. No spill containment system required for wastes that do not include free liquids if the storage area is designed so that liquids cannot come in contact with containers. Containers must be closed except when adding or removing wastes.	Weekly inspections of containers, storage areas, and containment systems for leaks, spills, or deterioration.	Remove all wastes, residues, decontaminate containers; send hazardous wastes to TSDF.
Tanks (Subpart J)		
Applicable to all treatment and storage tanks, except covered underground tanks that cannot be entered for inspection. Tank must have sufficient shell strength to prevent rupture or collapse; minimum shell thickness to be specified by RA in permit. Tanks and/or liner must be compatible with wastes. All tanks must have controls to prevent overfilling. Covered tanks must have pressure controls. Uncovered tanks must have controls for preventing run-on and maintain sufficient freeboard to prevent overflow as specified by RA in permit. Special contingency plan for spills or leaks must provide for expeditious waste removal and repair of tanks.	Check overfilling controls and any monitoring equipment daily. Check liquid level of open tanks daily. Weekly inspection of aboveground construction and surrounding areas for corrosion or leaks. Schedule for emptying of tank and entry for inspection of interior to be specified in permit.	Remove wastes, residues, decontaminate tanks and equipment. Send hazardous waste to TSDF.
Incinerators (Subpart O)		
Incinerators must achieve: 99.99 percent destruction removal efficiency (DRE) for principal organic hazardous constituents (POHCS) specified in permit and specific emissions limits for HCl and particulate set in permit. Facility must install monitoring equipment and process controls necessary to assure operation within permit limits at all times, to control fugitive emissions, and to provide automatic waste feed shutoff if operations exceed permit conditions. Permit will specify acceptable range in composition and operating limits for each waste feed. Facility must burn only waste feeds approved in permit under specified operating conditions based on trial burn or alternative data. Exemptions.' Facilities burning only ignitable, corrosive, or reactive wastes that contain no, or insignificant amounts of, Appendix Vlll constituents and that will not pose a threat to human health or the environment if incinerated can receive a limited exemption. These facilities must be permitted and comply with Subpart O waste analysis and closure standards and with general Part 264 TSDF standards.	A Submit trial burn emissions monitoring results for different waste feeds for permit. Special 'trial burn permit for new facilities required. B. During operation: daily visual inspection of incinerator and equipment for spills, leaks, fugitive emissions; continuous monitoring of temperature, feed rate, air flow, stack gas CO, and other indicators of operating conditions and possible malfunctions. At RA request, sample and analyze waste feeds and stack gas emissions to verify compliance with standard. Weekly test of waste feed cutoff system and alarms unless RA specifies less frequent period.	Remove wastes and residues, decontaminate equipment; send hazardous wastes to TSDF.

Table 55.—Technical Performance Standards for Containers, Tanks, Incinerators, Landfills, and Surface Impoundments—Continued

Design and operating conditions	Inspection and monitoring	Closure/post closure
Landfills (Subpart N)		
All landfills (except existing portions) must have a liner to prevent migration of wastes to soils, ground, or surface waters through closure. Material must prevent waste passing into liner during active life of unit, resist failure and degradation, and be compatible with wastes. Liner must cover all earth likely to be in contact with wastes or leachate. Liner base must support and resist pressure gradients to prevent failure. RA will set liner design and operating specifications to achieve performance standards in permit. All landfills (except existing portions) must have a *leachate collection and removal system* above the liner designed and operated to prevent liquids accumulation of more than 1 ft above the liner and to function without failure, clogging, or degradation through scheduled closure. RA will set design and operating specifications for leachate collection system in permit. *Exemptions* from liner-leachate collection system requirements can be granted by RA if alternative design and operating practices and locations prevent migration of *any* hazardous constituent to ground or surface waters at *any* time in the future. All landfills must install run-on controls and runoff management systems sufficient to control flow into or out of the unit from a 24-hr 25-yr storm and control wind dispersal of particulate. Disposal of bulk liquids in landfills is limited to facilities with liners and leachate collection and removal systems. Design and operating conditions necessary to achieve performance standards will be specified in the permit by RA.	Inspect liner, leachate collection system and cover, during and after construction or installation for defects, damage, or nonuniformities that may affect performance. Inspect weekly for improper operation, deterioration, malfunction of run-on or runoff, and wind dispersal controls, and for liquids in leakdetection system or leachate in the leachate collection system and proper functioning of systems. All "regulated" units must implement ground water monitoring program as specified in permit. *Exemption from detection monitoring program for* facilities that install double liners with leak-detection system between the liners. If any liquid is detected between liners, facility must repair the liner or lose the exemption. *Exemption from ground water monitoring* may be granted if RA finds that there is *no potential* for migration of liquid from a regulated unit to the uppermost aquifer during the active life and closure and post-closure care periods.	Final cover should minimize liquid migration through closed unit, require minimal maintenance, promote drainage, resist erosion or abrasion of cover, accommodate settling, subsidence while assuring cover integrity. Cover permeability should be less than or equal to the liner or natural subsoils. Facility must comply with permit specifications on closure and post-closure care for maintenance of final cover, monitoring, and leakdetection systems. Leachate collection system must be operated until leachate is no longer detected. Ground water monitoring and response program requirements must be observed.
Surface Impoundments (Subpart K)		
All surface impoundments (except existing portions) must have a liner that prevents migration of any wastes out of the impoundment to adjacent soil, or surface or ground water at any time during the active life of the facility (including closure). *Exemption* from liner requirement for alternative design and operating practices and location characteristics that prevent migration of any hazardous constituent into ground or surface water at any future time. Impoundment must be designed, built, and operated to prevent overtopping from overfiling, run-on, malfunction, or human error. Dikes and containment must be designed, built, and maintained to prevent massive failure without relying on the assumption that the liner will function without leakage during the active life of the unit. Special contingency plan provisions for immediate shut down, spill containment, emptying of unit, and emergency repairs. The RA will specify all design and operating requirements necessary to meet these standards in the permit.	Inspect liner and cover during and after installation for defects, damage, or nonuniformities that may affect performance. At least weekly and after storms, inspect for evidence of deterioration, malfunction, improper operation of overtopping controls, drops in level of contents, liquids in the leak-detection system, severe erosion, or deterioration in dikes or other containment. Implement appropriate ground water monitoring program specified in permit unless an exemption applies (see landfills).	Remove all wastes and residues, decontaminate equipment at storage impoundments; send wastes to TSDF. At disposal impoundments: eliminate free liquids and/or solidify wastes and residues to stabilize waste to support final cover. Final cover should minimize liquid migration through unit, require minimal upkeep, promote drainage, resist erosion and abrasion of cover, and accommodate settling and subsidence while maintaining cover integrity. Cover permeability should be less than or equal to liner or natural subsoils. Observe closure and post-closure care, maintenance, inspection, and monitoring of cover, run-on, runoff controls, ground water monitoring system, and leak-detection system. If leak-detection system indicates presence of liquid, notify RA for permit modification for appropriate ground water monitoring program under Subpart F. Ground water monitoring and response program requirements must be observed.

NOTE: RA—Regional Administrator.

SOURCE: 40 CFR Parl 264.

Table 56.—Ground Water Monitoring Program for Permitted Land Disposal Facilities

- Sam-pie each monitoring well at least semiannually for the indicator parameters, waste constituents, or reaction products specified in the permit; and
- Determine ground water flow rate and direction in the uppermost aquifer at least annually.

If detection monitoring results indicate a statistically significant increase over background values of ground water concentrations of any specified parameter at any well at the compliance point, the owner/operator must notify the RA and:

- Immediately sample ground water at all monitoring wells to determine the concentration of all Appendix VIII constituents that are present in ground water and establish a background value for each Appendix VIII constituent at the compliance point;
- Submit a permit modification application for a compliance monitoring program (including" a proposed concentration limit for each hazardous constituent found at the compliance point) or alternatively, demonstrate that the statistically significant increase is caused by a source other than a regulated unit, or results from an error in sampling, analysis, or evaluation.

Exemption from detection monitoring program is provided for double-lined facilities with leak detection system between the liners and which are located above the seasonal high water table. If liquid is detected between the liners, the liner must be repaired and certified to maintain the exemption.

Compliance monitoring program— *To be implemented whenever hazardous constituents are detected at the compliance point and* to be *carried out during a specified compliance period.*

The owner/operator must track the migration and concentration of hazardous constituents from the regulated unit to determine if the units are in compliance with the ground water protection standard specified in the permit consisting of:

- A list of the hazardous constituents to be monitored; and
- A concentration limit for each hazardous constituent based on:
  (a) background level;
  (b) maximum concentration limits (MCLS) for 14 constituents under the SDWA regulations, if the MCL is higher than background level; or
  (c) an alternate concentration limit approved by the RA,

Under the compliance monitoring program, the owner operator must:

- Measure the concentrations of specified hazardous constituents in ground water at each monitoring well at the compliance point at least quarterly;
- Determine the ground water flow rate and direction in the uppermost aquifer at least annually; and
- Sample all monitoring wells at least annually for Appendix VIII constituents to determine if additional constituents not identified in permit are present in ground water and report any additional constituents to the RA.

If monitoring results indicate that the ground water protection standard specified in the permit is being exceeded for any hazardous constituent at any monitoring well at the point of compliance, the facility owner/operator must notify the RA and:

- Submit a permit modification application for establishment of a corrective action program; or
- Demonstrate that the ground water protection standard is being exceeded because of an error in sampling, analysis, or evaluation or because of contamination from a source other than a regulated unit.

Corrective ***action program—*** *To be undertaken if compliance monitoring indicates that the ground water protection standard is exceeded and to be continued unitl the levels of hazardous constituents are reduced below their respective concentration limits.*

The corrective action program to be specified in the permit consists of:

1. Specific corrective measures to remove the hazardous waste constituents or to treat them in place to prevent levels of hazardous constituents exceeding the ground water protection standard at the compliance point; and
2. A monitoring program for determining the success of corrective actions and for measuring compliance with the ground water protection standard.

If concentrations of hazardous constituents in the around water between the compliance point and the downgradient facility boundary exceed the ground water protection standard, the operator also must take corrective actions specified in the permit to remove or treat in place those hazardous constituents,

The owner operator must report annually on the effectiveness of the corrective action.

Corrective action measures may be terminated and the facility may resume compliance monitoring once the concentration of hazardous constituents is reduced to below the specified limits,

If the owner/operator is conducting corrective action at the end of the compliance period, the corrective action must be continued until monitoring data shows that the ground water protection standard has not been exceeded for a period of three consecutive years.

SOURCE: 40 CFR 264, *Subpart F*

post-closure care, and financial responsibility (see table 54 and discussion of these provisions under interim status standards above). The permanent program standards do add some additional requirements—two location criteria for facilities in seismically active areas and in 10()-year flood plains. The part 264 standards impose more detailed monitoring and inspection than the interim status standards. During permit review, the general standards of the regulations will be tailored to the specific conditions of each facility, and special operating stipulations will be incorporated into the permit by the Regional Administrator. EPA guidance documents will provide detailed instructions for interpreting and applying the part 264 standards and measuring the adequacy of each permit application.

Among the most important part 264 standards are the requirements for permitting new and existing incinerators and land disposal facilities (landfills, surface impoundments, waste piles, and land treatment units). EPA has adopted general performance standards for these facilities that will be converted into specific and detailed permit conditions by the permit writer based on consideration of information supplied with the part B permit application and EPA guidance materials. The general strategy of the part 264 permit standards are discussed below. Criticisms of the adequacy of these standards are addressed in part III of this chapter.

Storage Facilities

The standards applicable to surface storage facilities (tanks and containers)* and their related treatment operations focus on the containment of wastes to prevent their uncontrolled release into the environment. All storage facilities must have a primary containment system to hold the waste and to prevent spills and leaks. In order to detect cracks, corrosion, deterioration, and leaks, an inspection program is required, to the extent practical. Design specifications for the tanks will be reviewed by the Regional Administrator who will require a minimum shell thickness to be maintained. This design standard will be set on a case-by-case basis by the Regional Administrator applying appropriate industrial design standaras.[41] Where primary containment devices are easily damaged or are impractical to inspect, a secondary containment system is also required. Standards for underground storage or treatment tanks have not been promulgated.

Incinerators

The Phase II regulations, for incinerators include the "good operating practice" standards established for interim status facilities as well as additional performance and design requirements. Before an incinerator can receive a permit, it must conduct trial burns for the waste feeds that it proposes to incinerate. New facilities must obtain a trial burn permit granted for a limited duration following submission and approval by EPA of a detailed plan for the test burns. Permitted incinerators must meet three performance standards: 1) a minimum (99.99 percent) destruction and removal efficiency rate (DRE) for each principal organic hazardous constituent (P(IHC) designated by EPA for each hazardous waste feed; 2) a maximum emissions rate of 1.8 kg/hr or a minimum removal rate of 99 percent for hydrogen chloride from the exhaust gas emitted from incinerators burning hazardous waste containing more than 0.5 percent chlorine; and 3) a maximum emission rate of particulate of 180 milligrams per dry standard cubic meter.[42] In addition, incinerators must meet specified operating conditions, and provision must be made for continuous monitoring with respect to combustion temperature, waste feed rate, air feed rate, and carbon monoxide content of the exhaust. Daily inspections are required of incinerators and associated equipment, including alarm systems and emergency shutdown controls. Incinerators must upgrade and install necessary monitoring equipment and emissions controls. Limited exemptions for in-

*Note: the storage facility regulations issued in January 1981 originally included waste piles and surface storage impoundments—these provisions were superseded by the July 1982 and land disposal regulations.

4140 CFR 264.191 (1982).
4240 CFR 264,343 (1982).

cinerators burning certain ignitable, corrosive, or reactive wastes can be generated if it is demonstrated that the waste either does not contain or contains very small concentrations of Appendix VIII hazardous constituents,

Land Disposal Facilities

Promulgation of final standards for land disposal facilities (landfills, surface impoundments, waste piles, and land treatment units) was delayed owing to EPA's decision in February 1981 to repropose these standards in a form substantially revised from the approach originally proposed in December 1978. The emphasis was shifted from the setting of uniform design requirements to the use of more general performance standards. (The original design standard approach was subject to opportunities for variances when alternative designs could achieve equivalent environmental protection. These variances included use of risk assessment.) The July 1982 performance standards rely on a site-specific approach allowing specific measures for the protection of ground water and the environment to be developed during the permitting process. Final regulations governing land disposal facilities were promulgated on July 26, 1982, and became effective on January 26, 1983, 6 months later.[43] These regulations are discussed in part 111 of this chapter and summarized in tables 55 and 56.

Facility Permitting

Section 3006 of RCRA requires that owners and operators of hazardous waste TSDFS must obtain a permit. Permits are to be issued either by EPA under the Federal part 264 final technical standards and part 122 and 124 consolidated permit procedures or by a State under an authorized State hazardous waste program. Existing facilities that qualify for interim status may continue operating without a permit pending review of their applications, Interim status facilities are treated for purposes of RCRA as if a permit has been issued.

To qualify for interim status, a facility must: 1) have existed on November 19, 1980, 2) have notified EPA of its hazardous waste activities under section 3010, and 3) submitted its part A permit application, The interim status is valid as long as requirements continue to be met.

EPA has divided the permit application for hazardous waste facilities into two parts:

1. Part A.—The initial permit application, which includes information on the facility location, design capacity, types and quantities of hazardous waste handled, and proximity to drinking water wells, and which was in most cases to be submitted by November 19, 1980.
2, Part B.—The final permit application to be submitted to demonstrate compliance with the part 264 general facility standards, which includes more detailed technical information on facility design and operating procedures.

With the promulgation of technical standards for most TSDFS, it is now possible for EPA to process part B applications. However, existing facilities have been asked to wait until EPA requests them to submit their final applications. The agency expects it will take several years to complete the initial round of permit-granting activities. Applications for new facilities are being given a high priority since neither construction nor operation can begin without a permit.

Each part B permit application is first reviewed for completeness. If it is complete and indicates compliance with standards, a draft permit is prepared and made available for public notice and comment, and (if warranted) public hearings, The draft (and final) permit will contain the specific conditions applicable to each facility and may include additional requirements that the Regional Administrator may impose (e. g., as added liability insurance coverage, the specific indicator parameters to be included in a ground water monitoring program, or the wastes that may be burned at an incinerator), After considering the comments, EPA issues a final decision on the permit ap-

[43] 47 F.R. 32,274.

plication responding to all significant comments. Appeals may be made within 30 days. State procedures may differ slightly, but all State procedures must include adequate opportunities for public participation.

Final permits generally will be issued for a fixed term not exceeding 10 years. The facility operation will be reviewed at the end of the permit term, before renewing the permit. (A modification of the permit period from 10 years to the lifetime of the facility is under consideration by EPA.) A facility must operate under a permit throughout its active life and any postclosure period as well as during any compliance period required of the facility. The EPA Regional Administrator can review a permit at any time to determine whether it should be modified, revoked, reissued, or terminated.

EPA will grant RCRA permits-by-rule to certain hazardous waste facilities that are permitted under other Federal laws provided that they meet special RCRA conditions.[44] Eligible facilities include barges or vessels used for ocean disposal of hazardous waste (Marine Protection, Research, and Sanctuaries Act), underground injection wells (SDWA), and publicly operated treatment works (CWA).

To simplify the permit application and review process and to avoid duplicative requirements, EPA adopted the consolidated permit regulations. These provisions allow an applicant to submit information required for several different permits on a single standardized form. The rules also establish a uniform permit review and approval process applicable to all permit applications under the following programs:

- the Hazardous Waste Management Program under RCRA;
- the Underground Injection Control Program under SDWA;
- the National Pollutant Discharge Elimination System under CWA; and
- the Prevention of Significant Deterioration Program under CAA, where this program is operated by EPA.

[44] 40 CFR 122.26 (1982).

Imminent Hazard and Enforcement Provisions

RCRA provides EPA with a variety of mechanisms to measure and enforce compliance with the Federal program requirements and to take necessary action to mitigate threats to human health and the environment from hazardous waste management activities.

Section 3007 of the act authorizes any EPA employee (or representative, such as a contractor) or an employee of a State with an approved program, to inspect at reasonable times the premises of any generator, transporter, or facility operator (including any person who was engaged in such activities in the past).[45] Access to records and property relating to hazardous waste is also required for inspection purposes. Failure to cooperate with an inspection may subject the party to enforcement penalties. This inspection authority is not 'Limited to hazardous waste as defined in RCRA regulations, but may also be used whenever EPA has reason to believe that the material involved may be hazardous under the broad statutory definition. (Generators or facilities that are currently excluded or exempted from RCRA regulations are subject to EPA's inspection authority to determine if they are properly claiming such exclusion or if a hazard exists.)

Section 3013 is an important information-gathering tool added by the 1980 amendments.[48] Section 3013 of the act authorizes EPA to issue an administrative order requiring site monitoring, assessment, and reporting. If EPA believes that hazardous waste on the site may pose a substantial hazard to health or the environment, EPA may order the past or present owner or operator of an active or inactive hazardous waste facility to implement a monitoring and testing program. EPA has invoked this provision on several recent occasions for facilities that have violated hazardous waste rules possibly resulting in environmental contamination.

RCRA provides EPA with a range of administrative and judicial enforcement options

[45] 42 U.S.C. 6927,
[46] 42 U.S.C. 6934.

and civil and criminal penalties that may be used against persons who violate RCRA, its implementing regulations, or permit conditions. The civil enforcement options include issuance of administrative compliance orders requiring immediate action or action according to a specified schedule for correcting violations of subtitle C requirements. Alternatively, EPA may sue in Federal court for an injunction requiring correction of the violations. Noncompliance may result in permit suspension or revocation and/or imposition of civil penalties of $25,000 for every day of violation.[47]

RCRA imposes criminal sanctions for violation of administrative or judicial compliance orders. It is a Federal criminal offense for any person knowingly:

1. to transport a hazardous waste to an unpermitted facility;
2. to treat, store, or dispose of hazardous waste without a permit or in knowing violation of any material condition of a permit;
3. to make a false statement or representation in any application, label, manifest, report, record, or other document used in the RCRA program; or
4. to generate, store, treat, transport, dispose of 'or otherwise handle any hazardous wastes and knowingly to destroy, alter, or conceal any record required to be maintained under RCRA regulations.[48]

Conviction of these knowing violations can result in fines of up to $25,000 or $50,000 per day and imprisonment of up to two years. These penalties are more severe than the criminal sanctions imposed under, for example, CWA. Criminal proceedings may be brought against corporations or individuals. Individual employees of firms that violate RCRA hazardous waste regulations can be prosecuted, fined, and imprisoned for their part in the offense. The corporate shield does not insulate them from the consequences of their actions.

The 1980 amendments created an additional felony offense for particularly egregious violations which carry severe criminal penalties or fines of up to $250,000 for individuals or up to $1 million for corporations and/or imprisonment of up to 5 years.[49] A felony of "knowing endangerment" exists if a person violates a RCRA requirement with the knowledge that another person may thereby be placed in imminent danger of death or serious bodily injury, and if the violator manifests an unjustified and inexcusable disregard or an extreme indifference for human life. The RCRA violations covered by the knowing endangerment provision are transporting waste to an unpermitted facility or treating, storing, or disposing of waste without a permit or in violation of a permit or omitting material from a permit application; or failing to abide by interim status regulations and standards for TSDFS.

Imminent **Hazard**

Under section 7003 of RCRA, EPA may sue in Federal court for injunctive relief upon receipt of evidence that the handling, storage, treatment, transportation, or disposal of any solid or hazardous waste may present an "imminent and substantial endangerment to health or the environment. "[50] EPA interprets "imminent and substantial endangerment" as posing a "risk of harm" or "potential harm" but not requiring proof of actual harm. EPA is expressly authorized under the 1980 amendments to take any necessary action under the imminent hazard section, including the issuance of administrative orders, to protect public health and the environment.

Citizen Suits.-Section 7002 of RCRA provides that any person may initiate a citizen suit against any other person alleged to be in violation of a permit, regulation, or provision of RCRA whether or not Federal authorities have taken action.[51] Before filing suit, the plaintiff must give 60 days' notice to EPA, the States involved, and the alleged violator. A citizen suit may also be brought against EPA for failure to perform a nondiscretionary duty under RCRA. No advance notice need be given to EPA if the

[47] RCRA sec. 3008, 42 U.S. C. 6928.
[48] 42 U.S.C. 6928 [d).
[49] Public Law 96-482, sec. 13, 94 Stat, 2339; 42 U.S. C. 6928 (e].
[50] 42 U.S.C. 6973.
[51] 42 U.S.C. 6972.

hazardous waste provisions of RCRA are involved. Citizen suits are an additional and potentially powerful mechanism for assuring that the intent of RCRA is carried out by those engaged in hazardous waste activities and by State and Federal agencies. Section 7002 authorizes the award of attorneys fees and litigation costs to any party whenever the court determines that such award is appropriate. (The party need not be the prevailing party in the case to recover the costs of bringing the lawsuit.)

State Programs

Under RCRA section 3006, States may exercise primary responsibility for administration and enforcement of a hazardous waste management regulatory program under State law in lieu of the Federal EPA program provided that the State program meets certain minimum Federal standards.[52] RCRA also provides for interim authorization of existing State programs that allow the State to continue to administer its regulatory program instead of the Federal program while the final Federal program is being developed and the State permanent program applications are prepared and reviewed. In States with interim authorization or final authorization, generators, transporters, and facility operators are subject to a single hazardous waste regulatory program—without such authorization they would have to comply with both the Federal and State program requirements.

Congress anticipated that all States eventually would assume primacy for regulating hazardous waste management. RCRA offers two incentives for State participation: first, the opportunity for the State to administer its own program instead of having the Federal Government regulate hazardous waste in the State; and second, Federal grants and technical assistance for development and operation of State programs, Current economic conditions and budgetary constraints have made the continued availability of adequate Federal grants and technical assistance uncertain. Some State officials have suggested that uncertainty about the availability of these grants may induce some States to decline to regulate hazardous wastes and to allow the Federal Government to finance and operate the regulatory program within these States. Those instances, however, are expected to be few if Federal grants are maintained.

[52] 42 U.S.C. 6926,

State Program Approval

Section 3006 of RCRA establishes the requirements and procedures for approval of State programs by comparing them to the Federal program. Implementation of the Federal RCRA program was then a precondition for State hazardous waste program development, Delays in promulgation of the Federal regulations delayed State program efforts. To help States develop acceptable regulatory programs, RCRA directed EPA to issue guidelines for State programs within 18 months (i.e., by April 1978). EPA missed this deadline. The guidelines were eventually issued in January 1980, and implementing regulations were finally issued in May 1980.

Section 3006 provides for two types of program authorization: interim authorization and final authorization.

Interim authorization is available to State programs in existence before 90 days after promulgation of the standards for the Federal permanent program (EPA has set this date as October 26, 1982) if the State program is substantially equivalent to the Federal program requirements. Final authorization is given to State programs that are fully equivalent to the complete Federal regulatory program.

EPA has divided the State interim authorization process into two phases which correspond roughly with the phases in development of TSDF standards.

Phase I Interim Authorization,–States may apply for phase I approval to operate State program requirements for identification and listing of hazardous waste, reporting, a manifest system, and preliminary standards for generators, transporters, and interim status TSDFS.

Phase II Interim Authorization.—States can receive interim authorization to permit TSDFS under State programs before final authorization. Phase II authorization includes permitting requirements, standards of general applicability, and technical standards for different types of TSDFS. Phase II approval is divided according to "components" corresponding to the facility standards issued by EPA:

- Component A.—Permitting of storage facilities: containers and tanks, based on Federal permit standards published on January 12, 1981,[53]
- Component B.—Permitting of incinerators and other treatment facilities based on EPA regulations issued January 23, 1981,[54] and
- Component C.—Permitting of land disposal facilities: landfills, surface impoundments, waste piles, and land treatment facilities based on EPA standards issued July 26, 1982.[55]

States cannot be authorized to issue RCRA permits for those TSDFS for which EPA has not issued technical permitting standards, for example, underground storage tanks, or chemical and biological treatment facilities, These facilities remain subject to Federal permitting and to any independent State requirements. States applying for interim authorization must obtain phase I authorization as a prerequisite to receiving phase II authorization, however, they may be granted simultaneously.

Demonstration of Substantial Equivalence

To obtain interim authorization, a State must show that it has an existing State program as defined by EPA rules, the State program is substantially equivalent to the Federal program requirements, and the State has an acceptable authorization plan outlining what changes will be made in the State program to qualify for final authorization,

Three tests are applied to demonstrate the substantial equivalence of a State program to the Federal interim status program.

1. The State program must control substantially the same universe of waste as the Federal program so that there are no major gaps in coverage. The State program must have provisions for identifying the characteristics of hazardous waste and for listing hazardous wastes so that the State program controls substantially the same universe of waste as the Federal program. In practice, this has meant that the States's listing requirements and hazardous waste characteristics must be nearly identical to the Federal regulations. If they are not the same, the State program must effectively control the same universe of waste plus contain a commitment to expand the State program to cover currently unregulated hazardous wastes within a reasonable period of time after interim authorization. (States may regulate a larger universe of hazardous waste than the EPA program; however, all wastes regulated under the Federal program must be in the State's universe of waste.

2. The State program must have adequate regulatory authority to control generators, transporters, and operators of hazardous waste TSDFS including provisions for requiring compliance with permitting standards, reporting requirements, and with a manifest system. The State program standards for permitting TSDFS must provide substantially the same level of protection for human health and the environment as the Federal facility standards.

3. The State must show that it has adequate funding and personnel for administration and enforcement of the State program.

During the interim authorization period, State programs can vary from the Federal program in listing and characterization methods, States that do not control certain hazardous wastes because those wastes are not generated or disposed of in the State may receive author-

[53] 46 F.R. 2804. Note, the storage facility standards including standards, for surface storage impoundments and waste piles, were modified and became part of component C land disposal facilities published on July 26, 1982.
[54] 46 F. R. 7666, Note, these were modified for incinerators on June 24, 1982, 47 F.R. 27,520.
[55] 47 F.R. 32,274.

ization provided that they commit to develop regulatory requirements to cover those wastes in the future.

A State may operate its program under interim authorization until it receives final authorization. Under RCRA, the State must receive final authorization by January 26, 1985, or the Federal Government will resume regulatory authority over hazardous waste activities in the State. If a State does not apply for or receive interim or final authorization, hazardous waste activities in the State are subject to both the Federal program requirements and to other State regulations, if any.

States may apply for interim authorization at any time until close of the interim authorization period. With publication of the land disposal rules in July 1982, EPA announced that establishment of the permanent Federal program was largely complete and that it would begin to accept applications for final State authorization. Interim authorization lasts until 24 months after the effective date of the Federal permanent program regulations. EPA has announced that the interim authorization period will expire January 26, 1985. In applying for interim authorization, States commit to plan for upgrading their programs to qualify for final authorization by the end of the interim authorization period. Obtaining interim authorization is not a precondition for receiving final authorization. In fact, some States with existing programs may skip the interim authorization route and apply directly for final authorization. As of November 1, 1982,35 States had qualified for phase I interim authorization and 5 States had received phase II interim authorization for components A and B. (See table 73 in in part II of this chapter.)

Partial Authorization and Cooperative Arrangements

Because some States may not have all the necessary authority or regulations to operate an acceptable State regulatory program during interim authorization, EPA has initiated partial program authorization and cooperative agreements.

Under partial authorization, EPA will approve those portions of **a** State program that meet the minimum Federal requirements for substantial equivalency with the Federal program while EPA administers and enforces the remaining elements of the Federal program. For example, if the State lacks adequate authority under State law to require compliance with a manifest system, EPA will nevertheless approve the rest of the State program for controlling hazardous waste activities provided that the State plan specifies the steps to be taken to get final authorization by the end of the interim authorization period. EPA will then administer and enforce the Federal manifest requirements for that State, while State requirements control other activities.

For States that cannot qualify for partial interim authorization, EPA has initiated a cooperative arrangement that allows the States to administer some functions of a hazardous waste management system for EPA, while EPA administers and enforces the remaining functions under the Federal program. These cooperative arrangements are different from partial authorization. The purposes of cooperative arrangements is to encourage States to adopt a State hazardous waste program by allowing them to administer portions of a State program in coordination with EPA while giving the States the time and opportunity to develop a satisfactory State program that can qualify for interim and/or final authorization.

Final Authorization of State Programs

Once final authorization is granted, the State hazardous waste regulatory program operates in lieu of the Federal program. The State assumes full authority to administer and enforce the RCRA hazardous waste regulatory system. On authorization, EPA's regulatory and permitting responsibilities will largely cease. Thereafter, if EPA exercises its enforcement power, it will enforce compliance with State program and permit requirements, not the Federal standards. EPA will retain its oversight and enforcement authority over the State

program to ensure that it continues to operate effectively according to its approved plan. The Federal program requirements are not applicable in the State unless EPA revokes the State's final authorization. EPA will initially retain some regulatory responsibility for those waste management technologies for which Federal permitting standards have not been issued and which cannot therefore be permitted under an approved State program, States can, however, regulate and permit these facilities under State law, As EPA further refines and adds to the Federal program, States will be expected to make similar modifications and additions to their State program and to maintain equivalency and consistency.

Requirements for Final Authorization

To receive final authorization, a State must demonstrate that its program meets the requirements of section 3006(b):

- the State program is equivalent to the Federal program;
- the State program is consistent with the Federal program and with other State programs;
- the State has adequate administrative resources to operate a comprehensive program regulating hazardous waste generators, transporters, facility owners, and operators; and
- the State has adequate enforcement authority to require compliance with its program.

These requirements are more comprehensive than the substantial equivalency tests for interim authorization. The State must regulate the full universe of waste controlled under the Federal program with no gaps in coverage. The State must regulate generators, transporters, and TSDFS. The State facility standards must provide at least the same degree of protection of human health and the environment as the Federal standards, The State program must also have adequate opportunities for public participation in program development and in permitting procedures.

EPA has announced that it will now accept applications for final authorization of State programs.[56] Because RCRA requires a minimum period for review by EPA and public comment and hearing, EPA estimates that final program authorization will take a minimum of 6 months after submittal of a complete application. States must obtain final authorization by the end of the interim authorization period. If the State program is not given final authorization by the end of the 24-month period (by Jan. 26, 1985), or if EPA makes a final determination rejecting the State's final program application, EPA must operate the Federal program in that State. EPA and the State must complete program development, review, public participation, and program approval within the next 2 years to meet EPA's announced goal of final authorization of 45 States by January 1985.

One of the significant issues to be faced in final authorization will be how to treat State programs that are significantly different from the Federal program. Guidance will have to be developed to demonstrate equivalency, consistency, and adequacy. Under RCRA section 3009, once EPA has issued regulations dealing with any aspect of hazardous waste activity, any State regulations on the same subject may not be less stringent than the Federal requirements.[57] The 1980 Solid Waste Disposal Act amendments reinforced, however, that a State may have more stringent provisions than the Federal program. However, just how much more stringent State program requirements may be without being considered inconsistent with the Federal or other State programs, or being held unconstitutional as a restraint on interstate commerce, is an open question. This question will become more controversial as some States adopt considerably more stringent restrictions on hazardous waste activities, such as banning land disposal of certain recyclable or extremely dangerous wastes or imposing more difficult technical requirements on existing and new facilities.

[56] 47 F. Il. 32,382, July 26, 1982.
[57] 42 U.S.C. 6929.

Superfund

Introduction

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (C ERCLA), or "Superfund," was a compromise measure.[58] Legislation to provide for emergency response and cleanup for chemical spills and releases from hazardous waste sites and to provide compensation for damages from these incidents had been considered in previous Congresses. But such legislation had met substantial opposition because of several controversial provisions dealing with liability for damages and creation of a cleanup trust fund financed by taxing the oil and chemical industries.

CERCLA authorizes the Federal Government to respond directly in the event of chemical spills and releases of hazardous substances into the environment. The framework for coordinated Government response is established by the National Contingency Plan (NCP). To pay for emergency response and cleanup actions, CERCLA created the Hazardous Substance Response Trust Fund financed by a tax on crude oil, imported petroleum, and certain chemicals. The collection of the Superfund tax is authorized for 5 years (until the end of fiscal year 1985) or until the total unobligated balance in the Response Trust Fund established under CERCLA reaches $900 million or a total of $1.38 billion has been collected, whichever occurs first. The total amount expected to be available in the Superfund trust fund is $1.6 billion.[59]

CERCLA also created a second fund, the Post-Closure Liability Trust Fund, to pay for post-closure care, remedial action, and damages from releases at qualifying hazardous waste facilities. The $200 million post-closure trust fund is financed by a tax on hazardous waste received at treatment or disposal facilities and which will remain in the facility after closure.

One of the most important provisions of CERCLA allows the Government to recover the costs of such response and remedial action. CERCLA imposes strict liability for the cost of Government response actions and damages to natural resources on those responsible parties whose actions cause release of hazardous substances. The liability for cleanup costs under CERCLA is far-reaching. It places the ultimate responsibility for cleanup costs on the past and present owners or operators of facilities, on the transporters who accepted waste for transport and selected the facility, and on the generators whose wastes were sent to the facility.

Hazardous Substances Under CERCLA

The Government may take response action under CERCLA whenever there is a release or threat of release of a hazardous substance or of any pollutant or contaminant which may present an imminent and substantial danger to public health, welfare, or the environment.

The range of substances for which response action is authorized in CERCLA is significantly broader than the universe of hazardous waste under RCRA. A hazardous substance as defined in section 101(14)[60] of CERCLA includes:

> (A) any hazardous substance designated pursuant to section 311(b) (2)(A) of the the Clean Water Act;
> (B) any element, compound, mixture, solution, or substance designated pursuant to section 102 of CERCLA;
> (C) any RCRA hazardous waste;
> (D) any toxic pollutant listed under section 307(a) of the Clean Water Act;
> (E) any hazardous air pollutant designated under section 112 of the Clean Air Act; and
> (F) any imminently hazardous chemical substance or mixture under section 7 of the Toxic Substances Control Act.

Response actions are not limited to releases of the hazardous substances defined above; releases of "pollutants or contaminants" are

[58] Public Law 96-510, 94 Stat. 2767, Dec. 11, 1980; 42 U.S.C. 9601 et seq.

[59] Of the total $1.6 billion, $1.38 billion will come from the Superfund tax and $0.22 billion from appropriated funds.

[60] 94 Stat. 2769; 42 U.S.C. 9601 (14)

also covered. For example, a material excluded from regulation under RCRA or other laws could nevertheless be considered as a "pollutant or contaminant" under CERCLA. Under section 104(b) of CERCLA "pollutant or contaminant" includes but is not limited to:

> . . . any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.[61]

The definitions of "hazardous substance" and "pollution or contaminant" specifically exclude petroleum, natural gas, natural gas liquids, liquified natural gas, and synthetic gas unless designated as a hazardous substance under CERCLA or other laws.

Reportable Quantities,–Section 102[62] of CERCLA provides for the establishment of reportable quantities of hazardous substances, Any release of these substances exceeding specified amounts must be promptly reported to the National Response Center (NRC). The initial reportable quantity is 1 lb except for those hazardous substances for which different reportable quantities have been set under section 311(b)(4) of CWA.[63] EPA is authorized to adjust the initial reportable quantities, as appropriate, EPA may designate additional "hazardous substances" subject to the reporting requirements if release of such substances may present a substantial danger to the public health, welfare, or the environment, Failure to report a release of a reportable quantity is punishable by fine or imprisonment. To encourage reporting, section 102(b) provides that neither the notification nor any information derived from it may be used against the person reporting in any criminal action except in prosecutions for perjury or false statement,

Notification of Inactive Waste Management Sites

Section 103 of CERCLA requires that the location of any facility where hazardous substances have been treated, stored, or disposed of and which is not permitted or accorded interim status under RCRA must be reported to EPA by June 10, 1981.[84] This notification requirement applies to the past or present owners or operators of the facilities and to any persons who accepted hazardous substances for transportation and selected a facility for storage treatment or disposal. The notification must identify the location of the facility, the amount and type of hazardous substance found there, and any known, suspected, or likely release of such substances from the facility. EPA is to notify a State of the existence of any such facility in that State. Section 102 directs EPA to issue regulations specifying the types of records to be maintained by the persons giving notice. These records must be maintained for 50 years from enactment of CERCLA or from the date the record was established, whichever is later.

Section 103 imposes stiff penalties for failure to comply with notification or recordkeeping requirements. In addition, persons who fail to report as required may not invoke the defenses against liability and the limitations on liability for cost recovery and environmental damages available to responsible parties.

The reportable quantities, notification, and recordkeeping requirements are not applicable to:

- permitted or interim status facilities under RCRA;
- federally permitted releases (as defined in sec. 101(10) of CERCLA);[65]
- application or storage of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) registered pesticides by an agricultural producer;

13194 Stat. 2775; 42 U .S. C. 9604 (a)(2).

6294 Stat. 2772; 42 U.S. C. 9602.

63A list of these reportable quantities is found at 40 C.F. R. 117.3 (1982).

6494 Stat, 2773; 42 U.S. C. 9603 (c).

6594 Stat. 2 768; 42 U. S.C. 9601(10).

- releases of a consumer product;
- releases of hazardous substances that are required to be reported or that are exempted from reporting under RCRA; or
- continuous releases that are stable in quantity and regularity, and which have already been reported to the NRC. (Continuous releases must be reported annually, and the NRC must be notified immediately of any statistically significant increases in quantity.)

Response Authority Under CERCLA

Section 104 of CERCLA establishes an extremely broad Federal response mechanism to deal with releases or threatened releases of hazardous substances into the environment.[66] The section authorizes the President to take whatever action is deemed necessary to remove, arrange for removal, provide remedial action, or any other action consistent with the NCP necessary to protect public health or welfare or the environment. By Executive Order, the President has delegated primary responsibility for carrying out the response activities under CERCLA to EPA.[67]

Direct Government action is authorized in cases of a release or a threatened release unless it is determined that response action will "be done properly by the owner or operator of the facility or vessel from which the release or threat of release emanates, or by any other responsible party."[68] The term "facility" is also given an expansive definition in CERCLA:

> ... "facility" means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise came to be located; but does not include any consumer product in consumer use or any vessel.[69]

CERCLA authorizes the President to take direct Government action to remove or mitigate the threat in the event of a release or threatened release of a hazardous substance, pollutant, or contaminant which presents an imminent and substantial threat to human health and welfare or to the environment. Two types of response actions can be financed by the Response Trust Fund: removal actions and remedial actions.

A removal action is a short-term emergency response action designed to remove or mitigate an immediate threat to health, welfare, or the environment. Fund expenditures for removal actions are limited to $1 million or 6 months duration from the date of the initial response. These limits may be exceeded if there is a continued and substantial immediate threat to human health and the environment and the required action is unlikely to be performed by any other party.

In contrast, remedial action is a long-term action directed at a permanent remedy to remove or correct the threat caused by the release of hazardous substances to the environment. Remedial actions are limited to sites that are listed on the National Priority List and where no responsible party will take prompt effective action to correct the situation. Before a fund-financed remedial action can be taken, the State must enter into a cooperative agreement or contract with EPA to assure all future maintenance of the remedial response at the site for the life of the response action, to assure the availability of adequate offsite treatment, storage, or disposal capacity, and to contribute 10 percent of total remedial action costs. [if, however, the site was owned by a State or locality at the time the hazardous substance was deposited, the required contribution is 50 percent or more of the costs depending on the degree of culpability.) CERCLA requires that any remedial actions must be consistent to the extent practicable with the NCP.

Government action under section 104 of CERCLA is not limited to instances when the occurrence or threat of a release is known. The act authorizes investigative actions, monitor-

---

[66] 94 Stat. 2774; 42 U.S.C. 9604.
67 Executive Order 12316, 46 F.R. 42,237, May 12, 1981.
[68] 94 Stat. 2774; 42 U.S.C. 9604 (a)(l).
[69] 94 Stat. 2769; 42 U.S.C. 9601 (9). Vessels are separately defined as any watercraft.

ing, testing, and surveys to determine whether a suspected release has occurred or might occur. A release might be suspected on the basis of an outbreak of illness or disease, or complaints of illness or disease that might be attributable to exposure to a hazardous substance, pollutant, or contaminant. Section 104 also authorizes expenditures for any additional planning, legal, fiscal, economic, engineering, architectural, or other studies or investigations necessary or appropriate to plan or direct response actions, or to pursue cost recovery and enforcement actions under section 107.

Abatement Orders

In addition to direct Government response, CERCLA also provides for administrative and judicial abatement actions to compel cleanup by responsible parties. Section 106 authorizes EPA to issue administrative orders to owners or operators of facilities or to other persons to take necessary action to abate an imminent and substantial threat caused by a release or threatened release.[70] These administrative orders are enforceable in Federal court. Alternatively, the Administrator may ask the Department of Justice to seek appropriate relief from a Federal court, such as an injunction against a responsible party requiring cleanup or performance of necessary investigations, or supplying alternate drinking water supplies to the affected communities. Fines of $5,000 per day can be assessed for violations of abatement orders. Additionally, the Government may seek punitive damages of three times the cleanup costs under a section 107 cost recovery action if a responsible party does not comply with an abatement order.

Cost Recovery Actions

Under section 107 of CERCLA, the Government may sue to recover the costs of remedial action, damages for harm to natural resources, and administrative costs.[71] In appropriate cases, the Government may sue for punitive damages from owners and operators of facilities, transporters, generators, site owners, and other responsible parties.

It is generally agreed that CERCLA imposes strict liability in cost recovery actions. CERCLA specifies that it imposes the same standard of liability as section 311 of CWA. Courts have held that section 311 imposes strict liability and joint and several liability. A major issue in cost-recovery actions is the extent to which CERCLA may impose joint and several liability for remedial action costs, CERCLA is silent on the issue. Language that would have expressly applied the doctrine of joint and several liability to Superfund actions was dropped as part of the compromise to pass the legislation. Congress left the issue to be resolved by the courts applying common law theories. EPA and the Department of Justice have taken the position that joint and several liability is available under statutory and common law principles in Superfund actions,

A second issue is the degree of contribution available from others to responsible parties who have been held liable. This issue has not yet been litigated to conclusion and is expected to become increasingly prominent as Federal and State enforcement actions proceed.

Initial settlements negotiated between the Federal Government for several interim National Priority List sites have involved many responsible parties, The potential availability of joint and several liability may have prompted many of these parties to settle. Section 107 can also be used prospectively to seek advance payment for cleanup from parties who contributed to the problem at a particular site. Before filing suit, notices of the planned section 106 and 107 actions are usually sent by Federal enforcement officials to potentially responsible parties in an attempt to encourage the parties to enter settlement negotiations with EPA to achieve site cleanup. This advance notice and the opportunity for negotiations are not required. As an incentive to negotiate, EPA might agree not to proceed further against the settling parties for additional site cleanup costs in appropriate cases.

[70] 94 Stat. 2780; 42 U.S. C. 9606.
[71] 94 Stat. 2781; 42 U.S. C. 9607.

The National Contingency Plan

The principal mechanism for implementing the Government response under CERCLA and for determining the extent of liability under the cost-recovery provisions of section 107 is the NCP. Section 105 of CERCLA directs EPA to revise and republish NCP—which was originally established under section 311 of CWA to deal with oil and chemical spill emergency response and cleanup—to include a new national hazardous substance response plan specifying the procedures and standards for Government response to hazardous substances releases.[72] The revised NCP was to be published within 180 days of enactment of CERCLA after opportunity for public review and comment (i.e., June 1981). This deadline was missed, and the NCP was eventually published under court order on July 16, 1982.[73]

NCP is intended to provide a comprehensive framework for the national response program for hazardous substance spills and releases. Section 105 requires that NCP specify the procedures, techniques, materials, equipment, and methods to be used in identifying, removing, or remedying releases of hazardous substances. It must also include methods for ranking sites, analyzing costs, and determining the appropriate remedy. The plan should specify appropriate roles for Federal and State agencies and nongovernmental groups in responding to releases. After the revised NCP becomes effective, all response actions must be in accordance with NCP to the maximum extent practicable.

By far the most important aspects of NCP are the methods for evaluation of releases, for determining the appropriate extent of remedy, and for assuring cost effectiveness of the response action and the criteria for establishing the National Priority List (NPL). The July 1982 NCP sets forth EPA's basic approach to these congressional directives. Overall, EPA has preferred a flexible, site-specific approach.

[72] 94 Stat. 2779; 42 U.S.C. 9605.
[73] 47 F. R, 31,180, to be codified at 40 CFR part 300.

The National Priority List

Criteria for Ranking Sites for NPL.–Congress directed EPA to develop and apply criteria for establishing priorities among sites for response actions based on their relative degree of risk or danger to public health, welfare, or the environment. In ranking the sites by the degree of risk posed, EPA was to consider to the extent practicable:

- the population at risk;
- the hazard potential of the hazardous substances at the facility;
- the potential for contamination of drinking water supplies;
- the potential for direct human contact;
- the potential for destruction of sensitive ecosystems;
- State preparedness to assure State costs and responsibility; and
- other appropriate factors.

Based on these criteria and on consultation with and recommendations from the States, EPA was to publish, as part of NCP, the NPL, which will rank actual or threatened releases across the country. Sites must be on the NPL to qualify for Superfund-financed remedial actions. Section 105 requires that the list contain to the extent practicable at least 400 of the highest priority facilities, to be referred to as "top priority among known response targets. " Section 105 further provides that to the extent practicable, the top 100 of these priority targets should include one site designated by each State as the facility posing the greatest danger to public health, welfare, or the environment among known facilities in that State. The States are to use the ranking criteria in establishing priorities among their sites, EPA is to revise the NPL at least annually in consultation with the States.

The NCP published in July 1982 did not contain the final NPL because more time was needed to gather adequate information to complete the list, and to allow the States to apply the ranking criteria to their recommended sites as required under CERCL.A and the NCP. An

initial proposed NPL of 115 sites was published for comment in October 1981, and 45 additional sites were added to that list in July 1982. EPA published in December 1982 its proposed NPL of 418 sites as appendix B to the NCP.[74]

The Hazard Ranking System.—In response to the directive to establish criteria for setting priorities among releases of hazardous substances for the purposes of taking removal and remedial action, EPA adopted the Hazard Ranking System (HRS), published as appendix A of NCP. (The HRS is also known as the "Mitre Model.") EPA and the States apply the HRS using data from observed or potential releases to obtain a score representing an estimate of the risk presented by each release. The score for each release is then used with other considerations in determining whether a site is placed on the NPL.

The States apply the HRS in submitting their recommended sites and in designating the sites posing the greatest hazard. The EPA regional offices will review the States' ranking before forwarding their recommendations for inclusion on the NPL. Among the most significant practical problems encountered by the States is that the HRS requires more detailed information on the sites than is generally easily available, Although the system does allow the use of standardized factors in the absence of detailed site information, if too many data requirements are missing, the site cannot be ranked. No Federal funds are currently available for States to obtain this information. OTA and others have raised questions about the adequacy or appropriateness of the methodology used in the HRS to distinguish between the relative degrees of risk posed at different sites. (See part III and the appendix to this chapter for a discussion of some of the scientific and technical difficulties in the design and use of the HRS.)

State Participation

Under section 104(d) of CERCLA, the Federal Government can enter into contracts or cooperative agreements with States or local governments to carry out any authorized response actions in accordance with the NCP. Under such an agreement, the States or local governments will be reimbursed by Superfund for their reasonable response costs consistent with the NCP, These contracts will be subject to the above cost-sharing requirements, Section 105 requires that the NCP specify appropriate roles for Federal, State, and local government agencies. The NCP calls for State and local government participation on regional response teams. Additionally, under a contract or cooperative agreement, a State agency may be designated as the lead agency and as the on-scene coordinator in response activities. Preliminary EPA experience with site evaluations for response actions has been that State agencies have assumed "lead" responsibilities in over 70 percent of these cases.[75] EPA may advance 90 percent of the estimated evaluation costs to the state agency under a contract or cooperative agreement.

Responses to Hazardous Substance Releases Under the National Contingency Plan

The NCP establishes the overall approach that EPA will use in dealing with releases or threatened releases of hazardous substances or of pollutants or contaminants that pose a substantial and imminent danger. EPA has segmented its site evaluation and response procedures under the NCP so that fund-financed activities are carried out in a series of limited, highly structured, sequential phases. At the same time, EPA will, in appropriate cases, pursue settlement negotiations or enforcement actions against known potentially liable parties to secure private cleanup or to recover costs. Under subsection F of the NCP, EPA has set up a response procedure with seven phases as shown in table 57. At various phases in the response procedure, sites can be excluded from further response activities.

Phase I–Site Discovery and Notification.–A release or threatened release is reported to

[74] 7447 F.R. 58,475, Dec. 30, 1982.

[75] "Remarks of William N, Hedeman, Director, EPA Office of Emergency and Remedial Response Before the AL I-ABA conference on Hazardous Wastes, Superfund, and Toxic Substances, Washington, D. C., Nov. 4, 1982.

Table 57.—National Contingency Plan—Phases of Response Actions

Criteria	Action
Phase 1: Site Discovery and Notification	
Possible release or threatened release of hazardous substances indicated by notice of inactive site, of release in reportable quantities, or of other complaint.	Release reported to National Response Center and to affected State.
Phase ii: Preliminary Assessment	
Site recommended for further evaluation or immediate removal. No further action at site recommended: 1) there is no release; 2) a hazardous substance, pollutant, or contaminant is not involved; 3) the source is not subject to CERCLA; 4) release amount does not warrant Federal response; or 5) a responsible party is taking appropriate action and government monitoring is not needed.	Determine nature, extent, and source of release and the magnitude of hazard based on available data. Make recommendation for further action.
Phase Iii: immediate Removal Action	
Rapid emergency response required if site poses threat of immediate and significant harm from: 1) human, animal, or food chain exposure to acutely toxic substances; 2) contamination of drinking water supplies; 3) fire or explosion; or *4)* other acute situation.	Take appropriate immediate removal action, such as: 1) measuring and sampling; 2) removing hazardous substances from site; 3) restraining spread of release by physical, chemical, or other means; 4) preventing access to site by fencing or other means; 5) providing substitute drinking water; 6) controlling source of release; 7) recommending evaluation of threatened population; or 8) any other appropriate emergency measures.
Phase IV: Site Evacuation and Determination of Appropriate Level of Response	
Appropriate level of response: • Immediate removal —emergency threat to health or the environment (see Phase Ill). • Planned removal —short-term, but not emergency response (see Phase V). • Site recommended for National Priority List remedial action (see Phase VI). • No further action/evaluation recommended.	Conduct site evaluation, data collection, and site Investigations; determine type, amounts, and locations of hazardous substances and potential for migration; determine appropriate level of response; recommend site for immediate removal, planned removal, National Priority List remedial action candidate (apply H RS), or no further action.
Phase V: Planned Removal	
Planned removal is authorized where: • Substantial cost-saving can be achieved by continuing an immediate removal action; or Ž A serious risk to public health or the environment exists from exposure to hazardous substances which requires short-term, but not emergency response at a facility not ranked on the National Priority List. A serious risk may involve: 1) actual or potential direct contract with hazardous substances by nearby populations; 2) contaminated drinking water at the tap; 3) hazardous substances in drums, tanks, or other bulk storage containers; 4) highly contaminated soils at or near the surface; 5) threat of fire or explosion; or 6) weather conditions that may cause substances to mitigate.	• Determine whether site qualifies for planned removal. • Take appropriate response action to reduce or remove serious risk to public or the environment: State requests removal and agrees to assure future operations and maintenance at site, and availability of off site treatment, storage, disposal capacity and to provide State cost-share. • Planned removal action completed when serious risk is abated or 6 months/$7 million limit is reached.
Phase Vi: Remedial Actions	
Responses to sites ranked on the National Priority List that are consistent with a permanent remedy to prevent or mitigate migration of release of hazardous substances into the environment. *The appropriate extent of remedy is. 1) the lowest cost remedial alternative that is technologically feasible and reliable and which effectively minimizes or mitigates danger to or provides adequate protection of public health, we/fare and environment.* Remedial actions include: 1. *Infitial remedial measures—those* measures which should begin quickly if they are feasible and necessary to limit exposure or threat of exposure to a significant health or environmental hazard and if they are cost effective. Situations where initial remedial measures are appropriate are similar to planned removals at unranked sites.	Evaluate National Priority List sites and determine appropriate remedy (see also fig. 22): ~ Conduct *preliminary assessment* of type(s) of remedial action which may be appropriate: —initial remedial action, —source control remedial action, and —offsite remedial action, . Take initial remedial action if indicated. • Perform remedial investigation to determine nature and extent of problems posed by release and necessity for and extent of proposed remedial action. . Assess remedial alternatives: —"initial screening"—develop and analyze potential alternative remedial actions considering relative costs, effectiveness (including potential adverse effects), and feasibility according to acceptable engineering practices; and

Table 57.—National Contingency plan—phases **of** Response Actions—continued

Criteria	Action
2. *Source control remedial* actions—may be appropriate if a substantial concentration of substances remain on-site and inadequate barriers exist to retard migration offsite; alternatives include containing wastes at the site or removing them. 3. Offsife *remedial* action—may be appropriate to minimize the migration of hazardous substances and the effects of such migration where source control actions may not be effective to remove or reduce a significant threat to human health or the environment, 4. No action—appropriate where response action may pose greater danger to the health or the environment than no action, Approval of fund-financed remedial action at a site must balance need for immediate action to protect health and welfare or the environment at that site against availability of money In the fund to respond to problems at other sites.	—"detailed analysis''—conduct detailed "feasibility" study of limited number of alternatives selected after initial screening with focus or relative costs. • Determine appropriate extent of remedy from alternatives. • Proceed with selected remedial action if State assurances and contribution requirements are met (and if timely and adequate response will not be taken by responsible parties or others) and if fund-financing request is approved,
Phase Vll: Cost Recovery and Documentation Response Trust Fund will compensate authorized government or private response costs that are consistent with the NCP. (Cost recovery action may be pursued against responsible parties to reimburse Response Trust Fund).	Complete documentation of government response action, including nature of release, circumstances of response, costs to Federal Government, impacts on health, welfare or the environment, and identities of potentially responsible parties,

SOURCE 47 F R 31.213 July 16 1982 to be codified at 40 CFR 300 Subpart F

NRC as a result of notification requirements under CERCLA or Federal permits, or through the inventory of inactive dump sites, citizen complaints, or other action. NRC will notify the appropriate State and Federal agencies to begin initial investigation.

Phase n-Preliminary Assessment.–The lead agency will make a preliminary investigation of the site to determine the magnitude of the hazard, the source and nature of the release, whether non-Federal parties will take prompt and appropriate response, and whether immediate removal is necessary. This assessment is based on readily available data, interviews, and site visits, if appropriate. The preliminary assessment phase ends with a recommendation for further evaluation of the site, a request for any necessary immediate removal action, or a recommendation that no further action be taken at the site.

Phase 111–immediate Removal.—Short-term emergency response action is taken to prevent or mitigate immediate and significant risk of harm to human life, health, or the environment, Circumstances under which immediate removal action may be indicated include threats of:

- human, animal, or food-chain exposure to acutely toxic substances;
- contamination of drinking water supplies;
- fire or explosion; or
- similarly acute situations,

Immediate removal actions are primarily defensive and include sampling, removing containerized wastes, fencing the site, or providing alternative drinking water supplies, Immediate removal operations are subject to an expenditure limit of $1 million or a duration of 6 months from the initial response unless continued response actions are urgently required because of an emergency situation involving an immediate risk to health or the environment and no other party will provide the necessary response on a timely basis.

Immediate removal operations are complete when the original acute situation is abated and any contaminated materials moved offsite have been treated or disposed of properly.

Phase IV–Evaluation and Determination of Appropriate Response.—If a preliminary assessment indicates that further response is necessary beyond any immediate removal actions, site evaluation

is begun to determine the appropriate response required, if any. The lead agency will obtain the necessary information and conduct a site inspection to determine if there is any immediate danger to persons living or working nearby. These efforts are directed at identifying immediate threats to the public or the environment, the need for any immediate removal action; the amounts, types, and location of the hazardous substances at the facility; and the potential for the substances to migrate from their original location. As a result of site evaluation, States may suggest that the facility be added to the NPL. States must use the EPA ranking system in recommending priority sites. The results of the evaluation are used to decide whether the site is a candidate for immediate removal or planned removal, or should be added to the NPL as a candidate for fund-financed remedial action.

Phase V–Planned Removal.–For situations that pose a risk to public health, welfare, or the environment, and that require short-term, but not emergency response, planned removals may be undertaken. Planned removals are contemplated under the NCP for facilities that are not "ranked" (listed on the NPL) and where either a substantial cost-saving could be achieved by continuing a Phase III immediate removal action, or where the public or the environment will be at risk from exposure to hazardous substances. Planned removals are a "hybrid" response created by EPA for the NCP based on the two CERCLA response actions, removal and remedial action, and on EPA's general administrative authority over Federal grants. Planned removals are subject to the $1 million and/or 6 months expenditure limitation of removal actions and also to State contribution requirements nearly identical to those for remedial actions.

Table 57 summarizes the factors to be considered in determining whether a serious threat to public health and safety exists and whether planned removal actions are appropriate. Planned removal actions end when the conditions causing serious risk have been abated and any substances moved offsite have been properly treated or disposed of, or when 6 months have elapsed, or $1 million has been spent, whichever occurs first. Planned removal actions can exceed the 6 month/$1 million limit if an immediate threat remains or it is cost effective to continue cleanup.

Phase Vi–Remedial Actions.—Remedial actions are responses to "ranked" sites on the NPL that are consistent with a permanent remedy to prevent or mitigate the migration of a release of hazardous substances into the environment. A detailed evaluation of the proposed appropriate remedial action and the alternatives, including relative costs, must be conducted before a determination is made on the appropriate extent of remedy to be applied at the facility. The NCP identifies three distinct types of remedial actions: initial remedial measures, source control actions, and offsite remedial actions. The appropriate extenlt of remedial action for a particular release may include one or more of these options or a "no action" response.

Initial remedial measures are actions that should begin quickly if they are feasible or necessary to limit exposure to a significant health or environmental hazard and which are cost effective. Unlike immediate removal actions, initial remedial actions are subject to State cost-share requirements. Initial remedial actions are begun before detailed analysis and final selection of an appropriate remedy.

Source control remedial actions might be appropriate if a substantial concentration of substances remains onsite and existing barriers are inadequate to retard migration offsite. Source control remedial actions may include alternatives to contain the hazardous substances where they are located or to eliminate potential contamination by moving the substances to a new location.

Offsite remedial action may be taken to minimize and mitigate the migration of hazardous substances and the effects of the migration that pose a significant threat to public health, welfare, or the environment. Offsite measures frequently involve ground water contamination problems. These actions can include providing permanent alternate drinking water supplies,

controlling of a drinking water aquifer plume, or treatment of drinking water aquifers.

Assessment of Remedial Action.—The NCP requires EPA to assess the site before deciding which type or combination of remedial actions should be taken. This assessment process for NPL sites is shown in figure 22. Scoping is the first step in deciding the type and extent of remedial action to be taken in response to a release. The lead agency in cooperation with the State will examine the available information and decide, based on factors in the NCP, the type of remedial action needed. The scoping results will then be used as the basis for requesting funding for remedial investigation and feasibility studies. As the remedial investigation proceeds, the approach can be modified if indicated.

A remedial investigation is performed to determine the nature and extent of the problems posed by the release, This may include sampling, monitoring, and other information-gathering sufficient to determine the need for and the extent of proposed remedial action.

The lead agency then develops a limited number of alternatives for source control and/or offsite remedial actions depending on the type of response identified as appropriate. One alternative may be "no action" which could be appropriate if the response action could pose a greater environmental or health danger than no action, The alternative remedial actions are developed based on the assessments of the factors considered for each type of remedial action,[76] and the results of the remedial investigation,[77]

The alternatives are then subjected to an initial screening to narrow the list of potential remedial strategies for further detailed analysis, Three broad criteria are used in the initial screening:

- the cost of installing or implementing each alternative remedial action, including operation and maintenance;
- the effects of each alternative and feasibility according to each and feasibility according to each alternative; and
- acceptable engineering practices.

After the initial screening, more detailed analysis will be conducted of the remaining alternatives; this analysis will include:

1. refinement and specification of alternatives with emphasis on the use of established technology;
2. detailed cost estimation including distribution of costs over time;
3. evaluation in terms of engineering implementation or constructability;
4. an assessment of each alternative in terms of the extent to which it is expected to mitigate and minimize damages to, and provide adequate protection of, public health, welfare, and the environment relative to the other alternatives analyzed; and
5 an analysis of any adverse environmental impacts, methods for mitigating these impacts, and costs of mitigation,

Based on this comparative evaluation of the alternative remedial actions, the lead agency will then determine the appropriate extent of remedy. This alternative is to be the one that the agency determines is cost effective (i.e., "the lowest cost alternative that is technologically feasible and reliable and which effectively mitigates and minimizes damage **to** and provides adequate protection of public health, welfare, and the environment'').[76] In selecting the appropriate extent of remedy, the lead agency must also consider the need to respond to other releases with fund money. Section 104(c) of CERCLA requires that the need for protection at the facility under consideration be balanced against the amount of money in the fund available to respond to other sites present or future problems, taking into consideration the need for immediate action.

The determination of appropriate remedy will decide what action, if any, will be taken to remove or reduce the danger to the public and the environment from a release, and how

[76]47 F.R. 31,216, to be codified at 40 CFR 300.68(e],
[77]47 F.R. 31,216, to a codified at 40 CFR 300.68 (f_).
[78]47 F.R. 31,217, to be codified at 40 CFR 300.68(j).

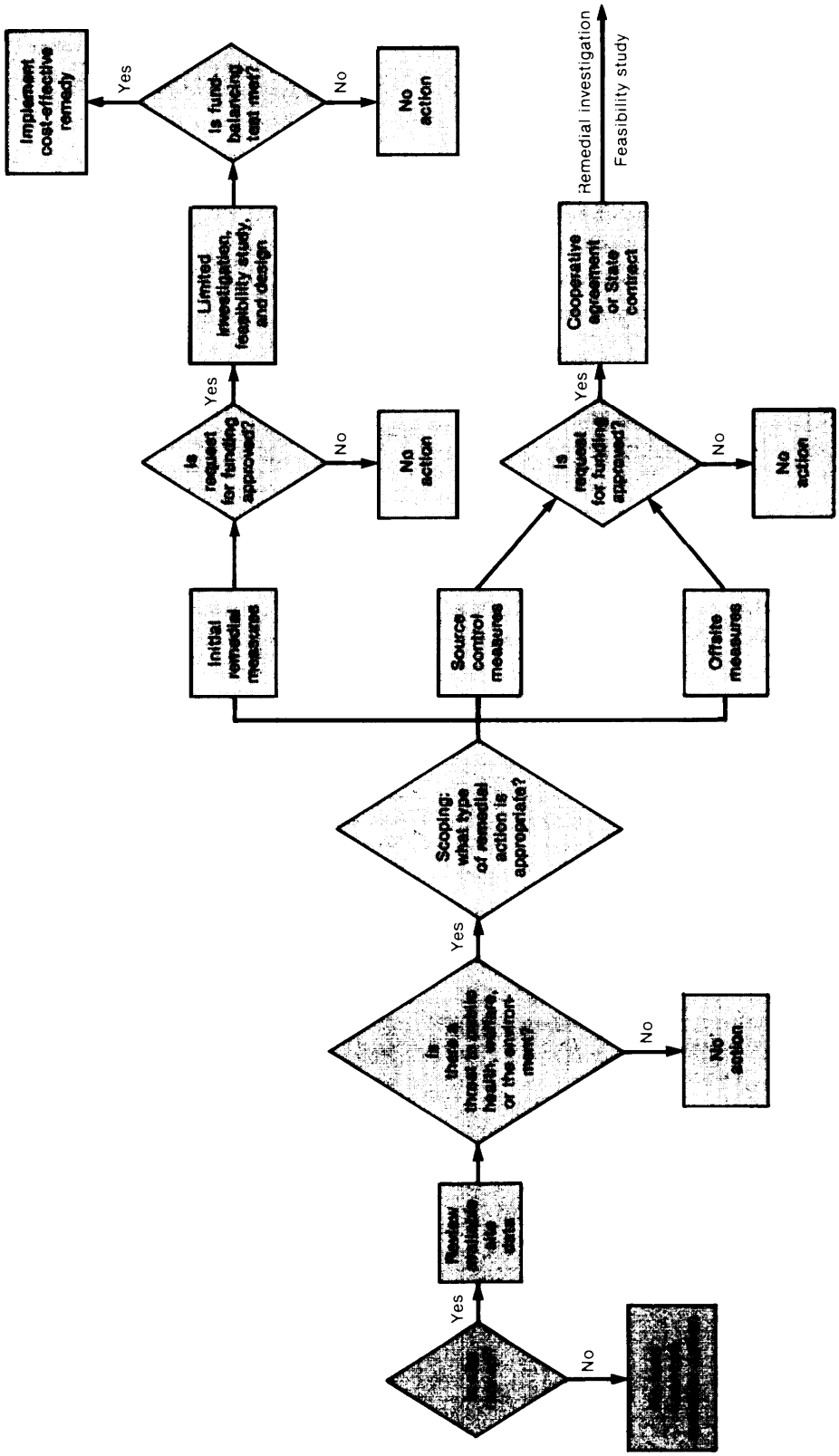
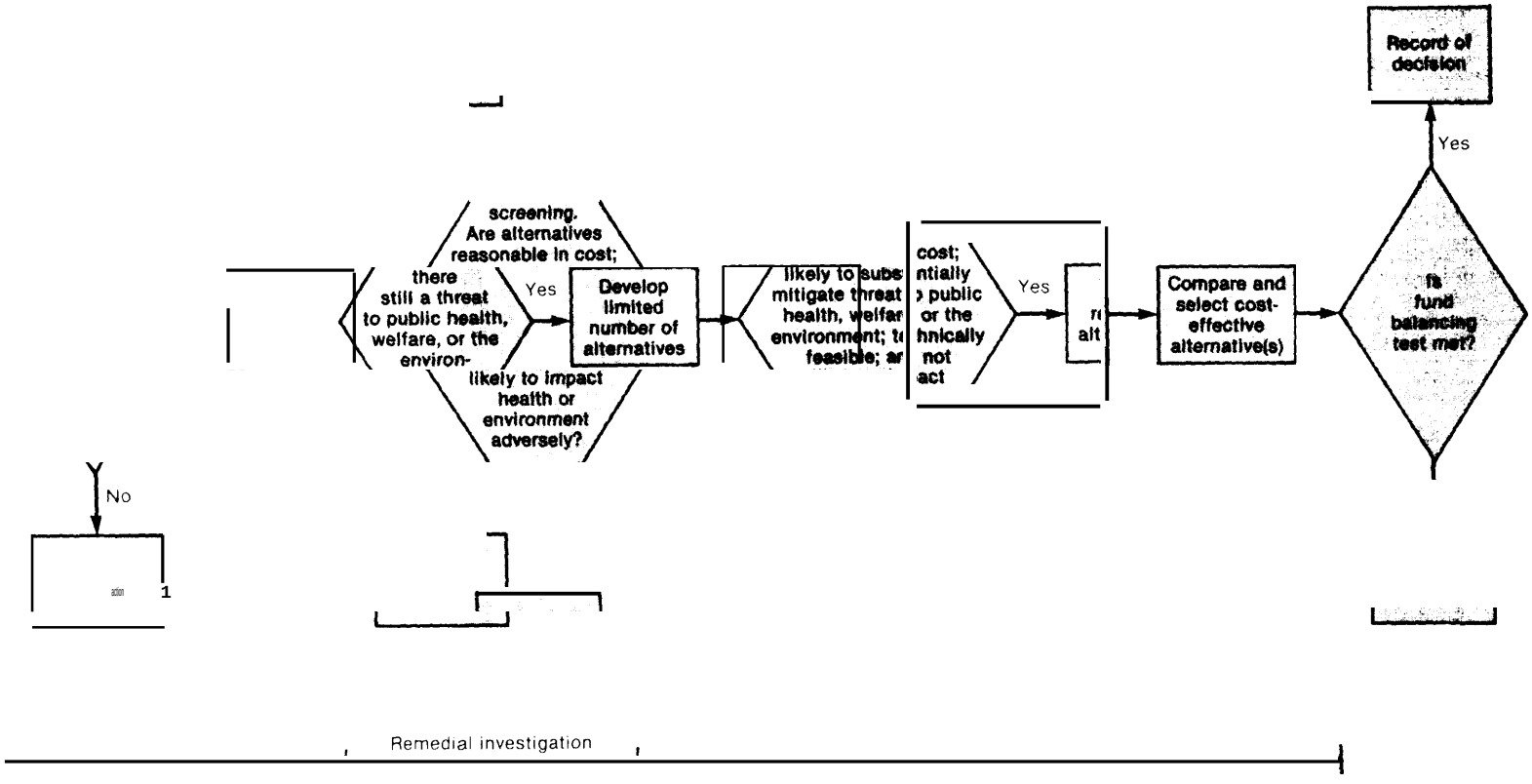


Figure 22.—Remedial Action Process Under the ational Contingency Plan

Figure 22.- Remedial Action Process Under the National Contingency Plan-Continued



SOURCE" Environmental Protection Agency, Off Ice of Emergency and Remedial Response, November 1982

and to what extent the site will be cleaned up. Because appropriate remedial action measures under the NCP can consist of temporary or "band-aid" approaches to stabilize sites that pose a threat while leaving the hazardous substances at the location, some choices of remedy may be controversial. The discretionary aspect of the remedial action decision under CERCLA and the requirement to balance the need for cleanup or action at one site against present or future needs to act at other sites creates an internal tension in carrying out the cleanup mandate of CERCLA. This dilemma between protecting the fund and removing risks to the public and the environment is frequently referred to as the "How clean is clean?" issue. Superfund cleanups under the NCP'S flexible standard of protection may not result in removal of toxic substances from the site. Contaminated soils and ground waters need not be restored to their original uncontaminated condition, but only to a level that does not pose a substantial threat. In some cases, the NCP provides that a "no action" alternative could be an appropriate remedy for an abandoned chemical dump site. Each decision will be made on an ad hoc basis; each site will be treated as unique.

Phase V1I–Cost Recovery .—The final stage of response action under the NCP is documentation and cost recovery. All documentation on the extent of the release and remedial action, the circumstances leading to the release, and the identity of any potentially responsible parties plus an accurate accounting of all Federal costs incurred and impacts on public health, welfare, or the environment are forwarded to the regional response team, to the national response team, and to others as appropriate. Claims for response costs against Superfund must first be presented to the owner or operator of the facility or to other potentially liable parties. If these parties cannot be identified, or cannot, or will not, pay for the response, then a claim can be made against the Response Trust Fund.

Cleanup by Responsible Private Parties

In many instances, EPA anticipates that instead of, or in addition to, fund-financed remedial action, private parties who are responsible for the release will initiate action to clean up the site and to mitigate any threat to the public or the environment. The participation of responsible parties maybe through voluntary agreement or as a result of administrative or judicial actions. Because sites considered for remedial action on the NPL have been found to be a significant threat to public health and the environment, the lead agency will usually review the cleanup proposals submitted by the responsible private parties. EPA may be asked to specify the level of cleanup to be required through enfc~rcement action. In judging whether proposed private cleanup actions will effectively reduce or remove the threat, EPA will apply the same criteria used in assessing fund-financed remedial actions. The cost-balancing considerations required under section 104(c) of CEIRCLA are not applicable to determining the appropriate extent of responsible party cleanup.

Private cleanup may offer some significant cost advantages over fund-financed action. For example, in the Seymour Recycling settlement, a group of 24 settling respsonsible parties estimated that surface cleanup costs (removal and decontamination) were significantly less than Government estimates ($7.7 million v. $15 million). The difference in part was because some of the responsible parties would do work themselves. It remains to be seen whether the parties will be successful in meeting their advance estimates of cleanup costs. In any event, in addition to the commitment of $7.7 million in estimated cleanup costs, the Department of Justice also required as a condition of the settlement a $15 million performance bond and a judicially enforceable guarantee that the site surface cleanup would meet specified standards without regard to the estimated costs or performance bond limits. Thus, the total com-

mitment could be in excess of $22 million. The Seymour settlement left nonsettling parties responsible for less than half the wastes at the site and potentially liable for remaining ground water cleanup (estimated at $15 million) .79 A second group of 171 settling parties agreed to pay $3.5 million for soil and ground water cleanup .80

Standard of Cleanup in Superfund Actions

NCP provisions for determining the appropriate extent of remedial action at Superfund sites has been criticized by several States and environmental groups because it does not establish any specific environmental standard for the level of cleanup to be achieved, such as maximum acceptable levels of contamination. EPA's flexible approach calls for the least costly technologically feasible alternative that "effectively mitigates and minimizes damages to and provides adequate protection of public health, welfare, or the environment. "[81] The NCP does not further define how the effectiveness of the alternative is to be measured or what level of protection of the public and the environment is "adequate. "

EPA responded to criticisms of the NCP for not explicitly requiring that environmental standards be used in determining the appropriate extent of remedy by noting that "environmental effects and welfare concerns" are included among the criteria to be considered, Moreover, as EPA observed in the preamble to the NCP:

> In some cases, this would allow EPA to consider applicable standards in selecting the appropriate remedy. It must be noted, however, that circumstances will frequently arise in which there are no clearly applicable standards. For instance, acceptable levels of hazardous substances in soil are not established, and there are no generally acceptable levels for many other hazardous substances in other media , . ,
>
> EPA cannot develop new standards for the hundreds of substances it will be confronted with in response actions. Not only is the requisite legal authority lacking in CERCLA, but such a task would also be enormous, costly, and time-consuming, and would unduly hamper the cleanup of releases, which is CERCLA'S primary mandate.[82]

EPA is correct in stating that there are no established acceptable concentration levels for hundreds (if not thousands) of hazardous substances that may be found at uncontrolled hazardous waste dump sites. EPA faces a similar difficulty in setting the contaminant levels for its ground water protection strategy under the July 1982 land disposal regulations. Nevertheless, EPA has decided to use the existing maximum concentration levels for contaminants set under the Safe Drinking Water Act regulations and, where appropriate, the background contaminant levels for other substances for compliance monitoring and corrective action purposes for permitting new and existing land disposal facilities. Under NCP, existence of contaminant levels that would require corrective action at permitted land disposal facilities under RCRA regulations could, conceivably, be allowed to continue after remedial response actions or without any remedial action being taken.

EPA's selection of an appropriate remedy also has implications for State actions, States are required to pay a share of the costs to qualify for Superfund-financed cleanups, and the States must provide for operations and maintenance at the site for the life of the remedial action. The NCP does not specify the period of time over which a response action must be effective for controlling threats to human health or the environment from a release of hazardous substances, Several States have expressed concern that EPA may select less expensive, incomplete remedial actions that leave the States open to substantially greater costs in the long term, instead of a more ex-

[79] Carol Dinkins, Assistant Attorney General, Land and Natural Resources Division, hefore ALI-ABA conference on Hazardous Waste, Superfund and Toxic Substances, Washington, D. C., Nov. 5, 1982.

[80] *Hazardous Waste Report*, vol, 4, Jan. 10, 1983, at 14.

[81] Preamble to the NCP, 47 F. R. 31,182, July 16, 1982.

[82] 47 F, R. 31,185, July 16, 1982.

pensive permanent remedy that removes or completely cleans up the problem caused by the hazardous substances. EPA policy statements have indicated that when the State prefers a more costly alternative, EPA will contribute only 90 percent of the total cost for the least costly alternative; the State would then pay the remaining cost of the more expensive alternative .83

An additional criticism raised by the States is that the NCP and the HRS do not allow States to determine which, if any, of their recommended priority sites will qualify for fund-financed remedial action. This uncertainty makes it difficult for States to plan for their own cleanup activities and to arrange for the required State contribution for Superfund actions. According to EPA officials, remedial actions at a number of priority list sites (about one-third of the initial 160 priority sites) have not been taken because States could not provide the required 10 percent contribution. It has been estimated that as many as 42 out of 50 States may not have adequate resources for the 10 percent share of Superfund clean-up.

The Hazardous Substance Response Trust Fund–"Superfund"

Section 221 of CERCLA established the Hazardous Substance Response Trust Fund, or Superfund.[85] This fund is to be used to pay for response actions for releases of hazardous substances. Superfund will receive up to $1.38 billion from oil and chemical taxes and $220 million in appropriations authorized ($44 million in fiscal years 1981-85) to be paid in full by the end of fiscal year 1985. Additionally, the fund will receive any amounts received as reimbursements in section 107 cost-recovery actions, and any penalties or punitive damages imposed under section 107 of CERCLA. One-half of remaining funds in the trust fund established under section 311 of CWA also were transferred to the Superfund.

According to the Department of the Treasury, as of August 31, 1982, the fund had a balance of $327.4 million. Generator payments during the month were $12.6 million. Total EPA obligations from the fund from December 1980 to September 30, 1982, were $221 million.[88]

Superfund Taxes.–Title II of CERCLA, the Hazardous Substance Response Revenue Act of 1980, imposes new excise taxes on petroleum and certain chemicals. Proceeds from these taxes are deposited to the Hazardous Substance Response Trust Fund to finance response and cleanup actions. These taxes took effect on April 1, 1981, and are to continue until September 30, 1985, or until the amounts collected reach $1.38 billion, whichever occurs first .87

A tax of 0.79 cent per barrel is levied on crude oil received at U.S. refineries and on imported petroleum products. Exports of U.S. crude oil and domestic use of crude oil (except that used onsite for oil and gas extraction) are also subject to the tax.

A tax ranging from $0.2:2 to $4.87 per ton is imposed on 42 listed chemicals manufactured or produced in the United States or imported for consumption, use, or warehousing. (See table 58 for the schedule of chemical taxes.) The tax is imposed when the chemical is sold initially or used by the manufacturer, producer, or importer. Limited exclusions are provided for methane and butane burned as fuel, for certain chemicals used in fertilizer production, for sulfuric acid generated as a byproduct of air pollution control processes, and on chemicals derived from coal.

Collection of the oil and chemical taxes can be suspended if the unobligated balance in the trust funds reaches $900 million on either September 30, 1983, or September 30, 1984, and if the Secretary of the Treasury determines

[83] 47 F.R. 31,217, July 16, 1982; 40 CFR 300.68(j).
[84] Remarks of William N. Hedeman, Director, EPA Office of Emergency and Remedial Response, Before the Senate Committee on Environment and Public Works, Feb. 15, 1983.
[85] 94 Stat. 2801, 42 U.S.C. 9631.
[86] *Hazardous Waste Report, vol. 4,* Jan. 10, 1983, at 4.
[87] See 94 Stat. 2796-99, 26 U.S. C. 2611 and 26 U.S. C. 4661; and 94 Stat. 2808, 42 U.S.C. 9653.

Table 58.—Chemical Taxes Under Superfund

In the case of:	Tax per ton
Acetylène	$4.87
Benzene	4.87
Butane	4.87
Butylene	4.87
Butadiene	4.87
Ethylene	4.87
Methane	3.44
Naphthalene	4.87
Propylene	4,87
Toluene	4.87
Xylene	4.87
Ammonia	2.64
Antimony	4.45
Antimony trioxide	3.75
Arsenic	4.45
Arsenic trioxide	3.41
Barium sulfide	2.30
Bromine	4.45
Cadmium	4.45
Chlorine	2.70
Chromium	4.45
Chromate	1,52
Potassium bichromate	1.69
Sodium bichromate	1.87
Cobalt	4.45
Cupric sulfate	1.87
Cupric oxide	3.59
Cuprous oxide	3.97
Hydrochloric acid	0.29
Hydrogen fluoride	4.23
Lead oxide	4,14
Mercury	4.45
Nickel	4.45
Phosphorus	4.45
Stannous chloride	2.85
Stannic chloride	2.12
Zinc chloride	2.22
Zinc sulfate	1,90
Potassium hydroxide	0.22
Sodium hydroxide	0,28
Sulfuric acid	0.26
Nitric acid	0.24

SOURCE Public Law 96.510, 94 Stat 2799, Dec ?0, 1980

that the remaining unobligated balance in the fund will exceed $50 million on September 300 of thefollowingy ear without collection of further Superfund taxes.

Use of the Fund.–Superfund can be used to pay for Government response costs under section 104 and the NCP. The range of authorized actions and expenditures is extremely broad and includes not only activity at the site to remove or abate the danger caused by the presence of hazardous substances but also the cost of necessary investigations, testing, monitoring, engineering and design studies, and plans required to define and implement a cost effective and adequate response, The costs of pursuing cost recovery and enforcement actions against potentially responsible parties also can be paid out of the fund. Section ill(a) provides that the fund can be used to pay the necessary response costs incurred by other persons in carrying out NCP, to pay for claims approved under the review procedures of section 112, and for certain claims arising under section 304 of CWA. Additionally, the fund is specifically authorized to pay for:[88]

- the costs of assessing the amount of injury or destruction to natural resources and of the governmental effort to restore or replace natural resources injured or destroyed because of releases of hazardous substances;
- epidemiologic studies, the development and maintenance of the national registry of persons exposed to the release of hazardous substances in the environment, and diagnostic services not otherwise available to determine whether any of the exposed population are suffering from long latency diseases; and
- subject to limitations in the appropriations bills, costs of a program for-enforcement and abatement action against releases, the costs of equipping, supplying, and maintaining damage assessment and response capability for strike forces and emergency response teams under NCP, and the cost of a program to protect the health and safety of workers involved in response actions.

Administrative costs or expenses that are reasonably necessary and incidental to the implementation of Superfund also maybe paid out of the fund,

Liability of Responsible Parties Under CERCLA

Section 107 of CERCLA imposes far-reaching liability for response costs and damages to natural resources from releases of hazardous substances.[89] This liability applies not with-

[88] 94 Stat. 2789; 42 U.S.C. 9611(c).
[89] 94 Stat. 2781; 42 U.S.C. 9607(a).

standing any other provisions or rules of law and is subject only to the defenses in CERCLA. Prior agreements or arrangements or common law defenses that might otherwise shield a generator or facility operator from liability for releases in lawsuits by private parties may not be asserted against the Government in CERCLA cost-recovery actions.

whenever there are response costs due to a release or threatened release of a hazardous substance from a vessel or facility, responsible parties may be held liable for:

- all the costs of removal or remedial action incurred by the Federal or State Government not inconsistent with the NCP;
- any other necessary costs of response incurred by any other person not inconsistent with the NCP; and
- damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such harm resulting from the release.

Section 107 also defines the persons who can be held liable under CERCLA. These responsible parties may include: the owner or operator of the facility from which there is a release or threatened release, the persons who owned or operated the facility at the time of disposal, any person who contracted or arranged with another person for disposal or treatment of hazardous substances (i.e., generators), and any person who accepted hazardous substances for transport and selected the disposal or treatment facility. Under section 107, the Government may proceed against any responsible party for the full costs incurred for response and for damages to natural resources. The extent to which one responsible party may make other responsible parties defendants in a cost-recovery action or seek contribution from them is not yet settled. The Federal Government has maintained that joint and several liability is available under CERCLA and has proceeded under this theory in several cases. Representatives of the chemical industry and other major generators, frequently targets of CERCLA cost-recovery actions for abandoned sites containing their wastes, maintain that the availability of joint and several liability under CERCLA was expressly left to the courts by Congress and has not yet been established.

Defenses .-CERCLA allows only several very narrow defenses to be raised by a responsible party who would otherwise be liable for response costs or natural resource damages. A responsible party may escape liability if it is shown by the preponderance of evidence that the release was caused solely by: 1) an act of God, 2) an act of war, 3) the act or omission of a third party, or 4) any combination of the previous three defenses. [n raising the third party defense, the defendant must show that the third party was not his employee or agent or under a contractual relationship with the defendant. The defendant must also show that he "exercised due care" with respect to the hazardous substance involved and that he took precautions against foreseeable action or omissions of any such third party and the consequences that could foreseeable result from such acts or omissions.

A person who failed to notify EPA of the existence of an inactive hazardous waste site as required in section 103(c) of CERCLA may not raise any of the statutory defenses or limitations on liability in a cost recovery action.

Liability Limitations.—CERCLA limits the amount of liability that can be imposed in the event of releases of hazardous substances requiring response actions. Liability for motor vehicles, aircraft, pipelines, or rolling stock may not exceed $50 million per release or any lesser limit established by regulation, but not less than $5 million per release. (Liability for releases into navigable waters is, however, set at not more than $8 million,) For facilities (other than the classes of transportation facilities previously mentioned), the liability limit per release is set at the total of all response costs, plus $50 million for damages to natural resources.

The responsible party can be required to pay the full and total costs of response actions and damages to natural resources without any liability limitations if the:

- release was due to willful misconduct or willful negligence within the privity or knowledge of the responsible party;
- primary cause of the release was the violation (within the privity or knowledge of the responsible party) of applicable safety, construction, or operating standards or regulations;
- party fails or refuses to provide reasonable cooperation or assistance requested by a responsible public official in connection with response activities under the NCP; or
- party failed to notify EPA that hazardous substances had been disposed of at the facility as required by section 103(c) of CERCLA.

Punitive damages of up to three times the costs incurred by the Response Trust Fund can be assessed against a responsible party who, without sufficient cause, has failed or refused to take proper removal or remedial action in response to an administrative order under section 104 or 106 of CERCLA. These punitive damages are in addition to recovery of the response costs, A responsible party, who fails to cooperate with response actions or to comply with an abatement order, could potentially end up paying four times the original response costs.

Insurance and Contribution .—CERCLA further provides that "no indemnification, hold harmless, or similar agreement or conveyance shall be effective" to transfer liability from a potentially responsible party to another person.[90] The act, however, does not bar any agreements to ensure, hold harmless, or indemnify a party to such an agreement against any liability under section 107. A responsible party could not, therefore, escape liability, but could later invoke the benefit of an agreement to compensate him for any liability incurred, CERCLA also provides that an owner or operator or other person subject to liability under section 107 retains any cause of action for subrogation or otherwise as a result of such liability or release.

Recovery for Natural Resources Damage .—Section 107(f) provides that the United States or any State may sue to recover for injury or destruction of natural resources. Natural resources include land, air, water, fish, wildlife, and biota owned, controlled, managed, held in trust by, or appertaining to the United States, a State, local government, or a foreign government. The President (or a State), acting as trustee for the natural resources, can sue to recover damages in the amount necessary to restore or replace such resources, Damages for harm to natural resources cannot be recovered if the injury occurred before enactment of CERCLA or if: "l) the harm suffered is shown to be an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable analysis; 2) such impact was authorized in the decision to grant the permit or license; and 3) the facility operated in compliance with that permit or license. "[91]

The Post-Closure Liability Trust Fund

Under section 107(k) of CERCLA, the liability of an owner or operator of a qualified hazardous waste facility that has been permitted under section 3005 for response costs and damages under section 107 cost-recovery action is transferred to the Post-Closure Liability Trust Fund. Liability is transferred if the owner or operator demonstrates that:

- the facility and the owner/operator has compiled with RCRA provisions and regulations regarding performance of the facility after closure; and
- the facility has been closed in compliance with the regulations and permit conditions and the facility and the surrounding area have been monitored for a period not exceeding 5 years after closure to demonstrate that there is not a substantial likelihood that any migration or release from confinement of any hazardous substance or other risk to public health or the environment will occur.[92]

[90] 94 Stat. 2783; 42 U.S.C. 9607(e).

[91] 94 Stat. 2783; 42 U.S. C. 9607 (f).

[92] 94 Stat. 2784; 42 U.S.C. 9607(k).

The transfer of liability becomes effective 90 days after the facility owner or operator notifies EPA (and the State with an approved program) that it has met the requirements for transfer, unless within that time EPA (or the State) decides that the facility has not demonstrated compliance, or has submitted insufficient information.

After transfer of liability, the post-closure trust fund will assume the liability of the owner or operator under section 107 cost-recovery actions for response costs incurred and natural resource damage. Additionally, the fund may pay the costs of monitoring, care, and maintenance of a site incurred by other persons after the monitoring period required under RCRA regulations for facility closure and post-closure has expired. (For landfills, the post-closure period is 30 years.) Regulations for transfer of liability to the Post-Closure Liability Trust Fund have not yet been promulgated.

The Post-Closure Liability Trust Fund can be used for any of the same purposes as expenditures from Superfund. Additionally, the post-closure fund may be used to pay for any other claim or appropriate request for the costs of response, damage, or any other compensation for injury or loss under section 107(k) of CERCLA or any other State or Federal law resulting from a release of a hazardous substance at such a facility. The Post-Closure Liability Trust Fund, therefore, is potentially available to meet a broader type of claim than Superfund because of the qualification of claims payments under any other Federal or State law. Presumably this could compensate third parties for personal injuries or property damage from leaks at closed hazardous waste dump sites. In contrast, Superfund does not compensate for personal injury or property damage suffered by third parties.

Hazardous Waste Tax.–The Post-Closure Liability Trust Fund is to be financed by a tax of $2.13 per dry weight ton of hazardous wastes received at a disposal facility that is permitted or has interim status under section 3005 of RCRA. The taxis payable by the facility owner or operator. No tax is paid on any hazardous waste that will not remain at the facility after it is closed. The tax primarily affects land disposal facilities and provides an economic incentive of sorts to reduce the amount of hazardous waste sent to landfills.

Collection of the tax will begin on April 1, 1983, but will be suspended in any calendar year if, on September 30 of the preceding year, the unobligated balance in the fund exceeds $200 million. Section 303 of CERCLA provides that the authorization to collect taxes under CERCLA will expire on September 30, 1985, or whenever the total collected under the oil and chemical tax provisions reaches $1.38 billion, whichever is sooner.

Over the long term, the Post-Closure Liability Trust Fund could face substantial claims for response actions if the standards for landfills and other land disposal facilities under RCRA are not more stringent. As EPA has frequently acknowledged, all containment will eventually leak, and contaminants could reach the environment. Land disposal facilities, even with liners, final covers, and leachate collection systems, could be closed and maintain their integrity over the required 5-year monitoring period to qualify for liability transfer, and when they later begin to leak, the fund could bear the substantial response and long-term care costs. one means of preventing this is to apply a very stringent standard of proof for the required demonstration that there is no substantial likelihood of migration or release, so that few existing facilities that did not upgrade beyond minimum standards could qualify for the liability transfer.

Alternative Insurance Coverage.–Section 107(k)(4) calls for a study of the feasibility of allowing private insurance coverage as an alternative to the Post-Closure Liability Trust Fund. The Treasury was to study the feasibility and the necessary actions to make private insurance a practical and effective option to the financing arrangements in the post-closure trust fund. This study was completed in March 1982.[93] After a public hearing, the President (through

[93] U.S. Department of the Treasury, *Hazardous Substance Liability Insurance, A Report in Compliance With* ***Section 301(b) and Section 10 7(k)(4) of Public Law 9&510,*** March 1982.

EPA) is to decide first whether such an alternative is feasible, and then to prescribe minimum requirements for such private coverage in lieu of participation in the Post-Closure Liability Trust Fund. If a private plan qualifies as a practical and effective alternative under the rules established, facilities enrolled in and complying with the terms of the plan will be exempt from payment of the facility tax and excluded from the liability transfer under section 107(k).

Other Federal Environmental Laws and Hazardous Waste

In enacting RCRA, Congress declared that it was closing "the last remaining loophole in environmental law, that of unregulated land disposal of discarded materials and hazardous wastes."= Congress further recognized that "as a result of the Clean Air Act, Water Pollution Control Act, and other Federal and State laws respecting public health and the environment, greater amounts of solid waste (in the form of sludge and other pollution treatment residues) have been created.''" Before passage of RCRA, hazardous wastes were subject to Federal regulation only to the extent that their improper management might cause violations of other laws, such as those governing protection of public health, air quality and water quality, or those controlling the products from which the wastes were derived.

Passage of RCRA unavoidably established overlapping coverage between regulation of hazardous waste management under RCRA and regulation of environmental pollution and control of hazardous materials under other Federal laws. This potential problem of concurrent jurisdiction was recognized in RCRA section 1006(b) which requires the EPA Administrator to "integrate all provisions of this Act for purposes of administration and enforcement and to avoid duplication, to the maximum extent practicable, with the appropriate provisions of . . . (other related Legislation).ge However, implementation of these environmental laws has resulted in very little overlap or duplicative regulatory requirements; in fact, implementation has left significant gaps in protection from the adverse effects of hazardous substances in the environment.

RCRA–Subtitle D–Regulation of Solid Waste Management

The objectives of subtitle D of RCRA are to assist in developing and encouraging methods for solid waste disposal that are environmentally sound and maximize the utilization of recovered resources, and to encourage resource conservation. These objectives are to be accomplished through State solid waste management plans prepared in accordance with guidelines published by EPA. Among other things, such a plan must describe how the State will meet the requirements of subtitle C governing hazardous waste management. States with an approved solid waste management plan are eligible for Federal technical and financial assistance. The variety of Federal technical and financial assistance mechanisms for State solid and hazardous waste management activities authorized under RCRA are discussed later in this chapter,

Section 4005(a)" of subtitle D prohibits "open dumping" of solid waste." To gain approval of its solid waste management plan, a State must, with EPA financial and technical assistance, conduct a survey of solid waste facilities and develop an inventory of those judged to be open dumps according to EPA-promulgated criteria (under sec. 4004(a)) that distinguish open dumps from sanitary Iandfills.[98] The State plan must provide for the closing or upgrading of all existing open dumps within a period not to exceed 5 years from the date of promulgation of the section 1008(a)(3) criteria. The plan must also demonstrate the State's authority to

'House Report 94-1491, 94th Cong., 2d sess. (1976), p. 4.
[95]RCRA, sec. 1002@)(3), 90 Stat. 2797; 42 U.S. C. 6901(b)(3).

[96]42 U.S. C. 6905. The acts are the Clean Air Act, the Clean Water Act, the Federal Insecticide, Fungicide and Rodenticide Act, the Safe Drinking Water Act, and the Marine Protection, Research, and Sanctuaries Act.
[97]42 U.S. C. 6945.
[98]40 CFR Part 257 (1982).

prevent the recurrence of open dumping by means of a permit program for new facilities and adequate surveillance and enforcement capabilities.

Enforcement of the ban on open dumping is largely in the hands of each State. However, solid waste activities are covered by the section 7002 citizen suit provision and section 7003 imminent hazard authority of RCRA.

Many existing "open dumps" and approved sanitary or municipal landfills contain hazardous wastes that were deposited there either before the subtitle C regulations took effect or because the wastes were not regulated under the subtitle C regulatory program (e.g., hazardous wastes produced by small-quantity generators).

In practice, implementation of the subtitle D provisions has been incomplete, Most, but not all, States have prepared a first round of solid waste management plans, many of which have received EPA approval. Partial inventories of open dumps have been prepared by the States and published in the Federal Register. Virtually all Federal financial and technical assistance under subtitle D for State solid waste plans has been terminated. The fiscal year 1983 appropriations, however, include funds to support the site inventory needed to complement efforts under the hazardous waste and Superfund programs.

Hazardous Materials Transportation Act (HMTA)[99]

HMTA authorizes DOT to establish regulations governing the transport of hazardous materials, including wastes. Under HMTA "hazardous materials" are those that the Secretary determines may pose an unreasonable risk to health and safety or property when transported in commerce. DOT regulations provide for the classification of hazardous materials, disclosure requirements, shipping container requirements, labeling and placarding standards, handling procedures for various modes of transport, and reporting of accidents.[100]

In carrying out its responsibilities under RCRA Subtitle C, EPA has adopted these same regulations to ensure consistency between the requirements of the two agencies as required by section 3003(b) of RCRA. The section also authorizes the EPA Administrator to make recommendations to the Secretary of Transportation on hazardous waste regulations under HMTA and on the addition of materials to be covered by that act.

Although RCRA requires maximum consistency between the regulations of DOT and EPA, each agency still retains separate authority to promulgate and enforce its own regulations.

Toxic Substances Control Act (TSCA)[101]

TSCA directs EPA to inventory all chemical substances in commerce, to require premanufacture notice of all new chemical substances, to gather available information about the toxicities of particular chemicals and exposures, to require industry testing under certain circumstances where data are insufficient, and to assess whether unreasonable risks to human health or the environment are involved. In determining whether a substance poses an unreasonable risk, EPA must consider such factors as: type of effect (e.g., chronic or acute, reversible or irreversible); degree of risk; characteristics and numbers of humans, plants, animals, or ecosystems at risk; amount of knowledge about the effects; availability of alternative substances and their expected effects; magnitude of the social and economic costs and benefits of possible control actions; and appropriateness and effectiveness of TSCA as the legal instrument for controlling the risk.

EPA may prohibit, limit, or control the manufacture, processing, distribution through commerce, use, and disposal of substances posing an unreasonable risk. These measures can range from requiring hazard-warning labels to banning the manufacture or use of an especially hazardous substance.[102]

[99] 49 U.S.C. 1801 et seq.
[100] 49 CFR Parts 171-179 (1982).

[101] Public Law 94-469, 90 Stat. 2003 (1976); 15 U.S.C. 2601 et seq.
[102] TSCA, sec. 6, 90 Stat. 2020; 15 U.S. C, 2605.

Regulations under TSCA have been issued for two groups of chemicals: polychlorinated biphenyls (PCBS) and certain chlorofluorocarbons (CFCS). The manufacture of PCBS has been prohibited, except as allowed by EPA. Rules governing the use and disposal of PCBS in a variety of applications have been established. However, the disposal of about 40 percent of the PCBS still in use (largely contained in small appliances and capacitors) has not been regulated under TSCA. Some, but not all, uses of CFCS have been prohibited. In general, the standards for treatment and disposal of PCBS under TSCA are more stringent than the standards for hazardous waste under RCRA. For example, under TSCA rules, incinerators burning liquid PCBS must attain a 99.9999 percent destruction level; RCRA standards are only 99.99 percent.[103]

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[104]

FIFRA requires that all pesticides be registered with EPA on the basis of submitted safety data, and prohibits the sale, distribution, and use of pesticides except in accordance with registered labels. To obtain registration, it must be demonstrated, among other things, that a pesticide, when used in accordance with widespread and commonly recognized practice, will not generally cause "unreasonable adverse effects on the environment. " The EPA Administrator is required, after consultation with other interested Federal agencies, to establish procedures and regulations for the disposal or storage of packages and containers of pesticides.

Subject to trade secret exclusions, the EPA Administrator must make public the data called for in the registration statement of a pesticide. Information obtained through FIFRA reporting and testing programs maybe useful in establishing whether a discarded pesticide should be classified as an RCRA hazardous waste.

Clean Water Act (CWA)[105]

The overall objective of CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. " Among the goals and policies used to promote this objective are those of eliminating the discharge of pollutants into navigable waters by 1985 and prohibiting the discharge of toxic pollutants in toxic amounts.

Section 301(a) prohibits the discharge of any pollutant from a point source without a permit under section 402 (which establishes the National Pollutant Discharge Elimination System (NPDES)), and except in conformance with technology-based effluent limitations under section 301, water quality-related effluent limitations under section 302, new source performance standards under section 306, and toxic and pretreatment effluent standards under section 307.[106]

Technology-based limitations are tied to three categories of discharges—municipal, industrial, and toxic. Industrial discharges have been subdivided into conventional pollutants (biological oxygen demand, suspended solids, fecal coliform, pH, oil and grease), toxic (included on a list of toxic substances), and nonconventional pollutants (other than conventional or toxic).

The 1972 amendments provided for the listing of toxic pollutants based on factors such as toxicity, persistence, degradability, potential for exposure of organisms, etc. Toxic pollutant effluent standards providing an "ample margin of safety" were to be promulgated on a pollutant-by-pollutant basis.[107] Because of difficulties and delays in the implementation of this provision, and prompted by a court settlement, the 1977 amendments call for EPA to develop and issue "best available technology" effluent limitation guidelines, pretreatment standards, and new source performance standards for 21 major industries covering 65 serious pollutants or groups of pollutants (see table 59).

10340 CFR 761.70. TSCA, sec. 6(e), directs EPA to prescribe methods for the disposal of PCBs, 15 U.S.C. 2605(e).
1047 U.S. C. 135 et seq.
10533 U.S.C. 1251 et seq.
10633 U.S. C. 1311.
10733 U.S.C. 1317(a](4).

Table 59.—Toxic Water Pollutants Under Section 307 of the Clean Water Act

Classes of toxic pollutants for which EPA must issue water quality criteria

1. Acenaphthene
2. Acrolein
3. Acrylonitrile
4. Aldrinidieldrin
5. Antimony and compounds
6. Arsenic and compounds
7. Asbestos
8. Benzene
9. Benzidine
10. Beryllium and compounds
11. Cadmium and compounds
12. Carbon tetrachloride
13. Chlordane (technical mixture and metabolizes)
14. Chlorinated benzenes (other than dichlorobenzenes)
15. Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane, and hexachloroethane)
16. Chloroalkyl ethers (chloromethyl, and mixed ethers)
17. Chlorinated naphthalene
18. Chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols)
19. Chloroform
20. 2-Chlorophenol
21. Chromium and compounds
22. Copper and compounds
23. Cyanides
24. DDT and metabolizes
25. Dichlorobenzenes (1,2-, 1,3-, and 1,4-dichlorobenzenes
26. Dichlorobenzidine
27. Dichloroethylenes (1 ,1- and 1,2-dichloroethylene)
28. 2,4- Dichlorophenol
29. Dichloropropane and dichloropropene
30. 2,4-Dimethylphenol
31. Dinitrotoiuene
32. Diphenylhydrazine
33. Endosulfan and metabolizes
34. Endrin and metabolizes
35. Ethylbenzene
36. Fluoranthene
37. Haloethers (other than those listed elsewhere; includes chlorophenylphenyl esters, bromophenylphenyl ether, bis(dichloroisopropyl) ether, bis(chloroethoxy) methane, and polychlorinated diphenyl ethers)
38. Halomethanes (other than those listed elsewhere; includes methylene chloride, methyl chloride, methyl bromide, bromoform, dichlorobromornethane, trichlorofluoromethane, dichlorodifluoromethane)
39. Heptachlor and metabolizes
40. Hexachlorobutadiene
41. Hexachlorocyclohexane (all isomers)
42. Hexachlorocyclopentadiene
43. Isophorone
44. Lead and compounds
45. Mercury and compounds
46. Naphthalene
47. Nickel and compounds
48. Nitrobenzene
49. Nitrophenols (including 2,4-dinitrophenol, dinitrocresol)
50. Nitrosamines
51. Pentachlorophenol
52. Phenol
53. Phthalate esters
54. Polychlorinated biphenyls (PCBs)
55. Polynuclear aromatic hydrocarbons (including benzanthracenes, benzopyrenes, benzofluoranthene, chrysenes, dibenzanthracenes and indenopyrenes)
56. Selenium and compounds
57. Silver and compounds
58. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
59. Tetrachloroethylene
60. Thallium and compounds
61. Toluene
62. Toxaphene
63. Trichloroethylene
64. Vinyl chloride
65. Zinc and compounds

SOURCE. 43 F. R. 4108, Jan 31, 1978

The list of industries, however, is not identical to the list of generators under RCRA, and the range of pollutants of concern under RCRA is much broader. The EPA Administrator has some discretion in adding to or removing pollutants from the list of pollutants, taking into account the same factors used in preparing the list initially. The Administrator may also issue a more stringent toxic pollutant effluent standard if appropriate.

In relation to toxic and hazardous materials that might enter the environment other than through effluent discharge, EPA is authorized to establish "best management practices" to be implemented as provisions of NPDES permits, for control of plant site runoff, leaks, spills, sludge, waste disposal, and drainage from raw material storage sites.

CWA requires promulgation of standards for the pretreatment of industrial pollutants discharged to publicly owned treatment works (POTWS) that might create problems in sewers (fire, corrosion, explosion), inhibit municipal sewage treatment processes, or pass untreated into waterways or the POTWS sludge, thereby rendering it unfit for beneficial use or disposal.[108] However, subject to State and EPA approval, a municipality may provide at least par-

10033 U.S.C. 1317@).

tial treatment for industrial toxic wastes in a way which allows the industry to reduce its pretreatment costs. (Hazardous waste discharged into a POTW is currently excluded from the definition of hazardous waste and regulation under RCRA because of the CWA pretreatment provision.)

Implementation of the pretreatment requirements has been subject to some delay. Amendments to the general regulations (originally promulgated in 1978) were promulgated in 1981, then suspended by the Reagan administration pending regulatory impact analysis, and later made partially effective following court action. Certain provisions remain suspended. EPA is currently considering further changes, generally involving greater local control and responsibility for pretreatment requirements, as well as a decreased emphasis on mandatory national technology-based categorical standards.[109]

EPA has ruled that any non-domestic waste mixed with domestic waste in a sewer system leading to a POTW is not a solid waste. If this non-domestic waste is not treated because of the lack of pretreatment standards or because the generator is not regulated under CWA, the discharge into the POTW could be regulated under subtitle C as a hazardous waste activity if a hazardous waste (as defined in RCRA) is involved. Furthermore, although a point source discharge covered by a NPDES permit is not subject to subtitle C regulation, any waste management activity occurring before the flow reaches the point of discharge may be subject to subtitle C regulation if a hazardous waste is involved,

Section 311 establishes procedures by which EPA can act to prevent or respond to spills and other nonroutine releases of oil and hazardous substances into U.S. waters and can recover the mitigation costs from the discharger. EPA was required to prepare a national contingency plan (NCP) for oil and chemical and to establish a special fund for emergency assistance to persons and communities in cases of pollutant and contaminant discharges. The program is not limited to water pollution emergencies, but covers "all releases to the environment. " The NCP established under CWA was expanded by CERCLA to include a comprehensive national hazardous substance response plan to deal with chemical spills and releases of hazardous substances into the environment.

Safe Drinking Water Act (SDWA)[110]

SDWA provides for EPA to establish national primary drinking water quality standards and, as needed, to require application of specific water treatment technologies. The act regulates both public and private water utilities serving from a few dozen to millions of people. The primary standards, or "maximum contaminant levels," are intended to protect human health. EPA may also recommend secondary standards for substances that do not threaten public health but that cause aesthetic problems with the odor, or appearance affecting the usability of water. The SDWA gives the main responsibility for enforcing the standards to the States. Each State must adopt standards at least as strict as the national standards, and must be able to monitor and enforce compliance with the standards by individual supply systems. If a State cannot or does not carry out these responsibilites, EPA can conduct the program itself.

Maximum contaminant levels (MCLS) have been established to date for 10 inorganic chemicals (arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, and silver), 6 pesticides (toxaphene, methoxychlor, endrin, lindane, 2,4-D, and 2,4,5-T), and trihalomethanes (which result primarily from reactions between natural organic chemicals present in raw water and the chlorine typically used as a disinfectant). Maximum levels for bacterial contamination, radioactivity, and turbidity have also been established (see table 60).[111] For a few compounds, interim nonbinding guidelines (Suggested No Adverse Response Level—''SNARL" documents have

[109] See 47 F.R. 4,518, Feb. 1, 1982, 40 CFR Part 403, originally published at 46 F.R. 9,404, Jan. 28, 1981.

[110] 42 U.S.C. 300 f-300j.

[111] 40 CFR 141, subpart B (1982).

Table 60.—National Interim Primary Drinking Water Standards

Constituent	Maximum concentration (in mg/l unless specified)
Inorganic chemicals	0.05
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05
Fluoride	1.4-2.4
Turbidity	1 tu upto5tu
Coliform bacteria	I/1OOm-(mean)
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-D	0.1
2,4,5-TP Silver	0.01
Total trihalomethanes	0.1
Radionuclides:	
Radium 226 and 228 (combined	5pCi/1
Gross alpha particle activity	15pCi/1
Gross beta particle activity	4mrem/year

SOURCE: 40 C.F.R. 141(1982)

been prepared for use by States and municipalities on a case-by-case advisory basis. MCLs established under SDWA will provide part of the basis for the ground water protection strategy adopted in the July 1982 land disposal standards under RCRA.

SDWA also provides for a program regulating the underground injection of wastes and other materials. Injection wells are a widely used method of industrial waste disposal. EPA is required to list States that are thought to require underground injection control (UIC) programs and to set minimum national requirements for such programs. EPA must approve the adequacy of each proposal UIC program, although the agency is specifically instructed not to disrupt unnecessarily any State programs already being effectively enforced. Where an adequate program is not being carried out by a State, however, EPA will administer the program.

Regulations promulgated by EPA in 1980 distinguish five different kinds of wells: deep waste-disposal wells (or those below usable aquifers), wells related to oil and gas production, wells for special processes such as solution mining and geothermal energy, shallow wells (or those injecting into usable aquifers) for hazardous waste disposal, and all others. Following the settlement of legal challenges to these regulations, EPA promulgated revised regulations in February 1982.[112] Standards have not yet been promulgated for wells in which waste is injected above underground sources of drinking water (see ch. 5), nor have standards been implemented in many jurisdictions in which waste is injected directly into underground sources of drinking water.

SDWA provides for controls over the underground injection of wastes. RCRA also authorizes regulation of hazardous waste disposal by injection into or onto the land or waters so that wastes might enter the environment. Because of this overlapping jurisdiction, EPA has promulgated a permit-by-rule approach for injection wells in the RCRA subtitle C program. The owner or operator of an injection well disposing of hazardous waste will be deemed to have a RCRA permit if he: 1) obtains and complies with UIC permit, and 2) complies with special requirements under SDWA for wells injecting hazardous waste.

In general, the UIC program requires that high-risk types of wells must be authorized by permits before they may be operated, while lower-risk wells may be operated without individual permits under general rules. Where needed, UIC permits impose both technological and administrative requirements on well operators. UIC permit conditions generally cover construction, operation, monitoring, reporting, special corrective actions, well abandonment, Government access to operator records and facilities, and provisions for permit review, modification, and termination.

SDWA also contains an important provision for protection of aquifers that supply drinking water. SDWA prevents the use of Federal assistance for purposes that could endanger irreplaceable drinking water supplies. It applies

[112] 47 F.R. 4,992, Feb. 3, 1982; to be codified at 40 CFR part 146.

where EPA (on its own initiative or on receiving a petition from the affected community) determines that an area has an aquifer which is its sole or principal drinking water source .113 If contamination of such an aquifer will cause a significant health hazard, EPA may delay or stop commitment of Federal assistance for any projects or activities that could cause such contamination. By 1980, seven "sole source aquifers" had been designated.

Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA)[114]

Enacted to implement international treaty obligations restricting ocean dumping, MPRSA has the purpose of preventing or severely limiting the ocean dumping of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological system, or economic potentialities. Practically, the act requires stopping all "harmful dumping" in the oceans by 1981. The critical phrase "harmful dumping" is defined as the dumping of wastes that do not meet certain environmental impact criteria;[115] such wastes are likely to include all hazardous wastes as defined under RCRA. A 1977 amendment to the act specifies that the ocean dumping of sewage sludge must cease by 1981.

MPRSA directs EPA and the U.S. Army Corps of Engineers (subject to EPA review) to administer permit systems to control dumping. The permit responsibilities of the Corps are limited to dumping of dredged materials.

The ocean dumping of municipal sewage sludge increased between 1973 and 1978, possibly reflecting implementation of CWA and the resulting growth in the generation of sludge. Ocean dumping of industrial wastes declined during the same period, but increased pressure to allow more such dumping might be expected following implementation of the full RCRA regulatory scheme. (See discussion of ocean dumping in ch. 5.)

Clean Air Act (CAA)[116]

CAA requires EPA to establish national ambient air quality goals designed to protect public health and welfare, and to take action (if State and local governments will not) to see that the goals are met. For the major pollutants (currently including sulfur dioxide, carbon monoxide, nitrogen oxides, nonmethane hydrocarbons, particulate, ozone, and lead), the EPA has set primary and secondary National Ambient Air Quality Standards (NAAQS). The primary standards are designed to protect public health (with an adequate margin of safety from adverse health effects). Secondary standards designed to protect public welfare such as protection of plants and animals, buildings and materials, and visibility from the adverse affects of pollutants have also been established. The States are required to submit State implementation plans with emission limitations and other measures necessary to achieve and maintain the NAAQS within the deadlines established by Congress. If a State either does not submit a plan or does not receive EPA's approval of its plan, EPA itself is required to take the necessary actions to attain and maintain the standards in that State.

CAA provides for the establishment of national emission standards applicable to certain major new and modified industrial sources. The States are required to establish emission standards applicable to existing industrial sources. In areas that do not meet one or more of the NAAQS (nonattainment areas), and in areas subject to nondegradation controls, major stationary sources must obtain a permit and must meet stringent new source performance standards.

Section 112 of the act provides for the establishment of national emission standards for "hazardous air pollutants" for which there is no applicable ambient air quality standard.[117] EPA may designate as "hazardous" any pollutant which "may cause, or contribute to, an increase in mortality or serious irreversible, or

[113] 42 U.S.C. 300h-3. Regulations are found at 40 CFR 1464 (1982).
[114] 33 U.S.C. 1401 et seq.
[115] 40 CFR 227, subpart B (1982).
[116] 42 U. S.C. 7401 et seq.
[117] 42 U.S. C. 7412.

incapacitating reversible, illness. " Within 1 year of listing a hazardous pollutant, EPA is to issue standards for controlling hazardous pollutant emissions. The resulting standards must provide an "ample margin of safety to protect the public health. " Where an emission standard is not feasible, EPA may prescribe a design, equipment, work practice, or operational standard.

For stationary sources about to be built or modified, hazardous pollutant standards become effective immediately upon proposal. EPA has the authority to prohibit the construction or modification of any source that will not comply with promulgated standards. Existing sources must comply within 90 days of promulgation of final standards unless a waiver is granted.

To date, EPA has listed and set final standards under section 112 for four substances: beryllium, mercury, asbestos, and vinyl chloride (see table 61).[116] Three other substances have been listed as hazardous, but final standards have not yet been issued: for benzene, standards have been proposed; for arsenic, they are under development; and for radionuclides they are under consideration. EPA has been sued for its failure to meet the l-year deadline for promulgating standards for these substances. Among other pollutants that have been considered for listing under section 112 are: coke oven emissions, polycyclic organic matter, cadmium, ethylene dichloride, perchloroethylene, acrylonitrile, methylene chloride, methyl chloroform, toluene, and trichloroethylene.[119]

Table 61.—Hazardous Air Pollutants Under Section 112 of the Clean Air Act

Listed pollutants	Major source categories	Regulation status
Status of toxic air pollutants regulation		
Asbestos	Mills, manufacturing, demolition	Promulgated
Beryllium	Extraction plants, foundries, machine shops	Promulgated
Mercury	Smelters, chlor.alkali, sludge incineration	Promulgated
Vinyl chloride	Manufacture, polymerization	Promulgated
Benzene[a]	Chemicals and petroleum	Proposed
Arsenic[b]	Copper smelter	Under development
Radionuclides[c]	Uranium mines, phosphoric acid plants	Under consideration[d]
Chemicals under assessment		
Acetaldehyde	Hexachlorocyc opentadiene	
Acrolein	Maleic anhydride	
Acrylonitrile	Manganese	
Allyl chloride	Methyl chloroform	
Benzyl chloride	(1,1,1 trichloroethane)	
Beryllium	Methylene chlcride	
Cadmium	(dichloronmethane)	
Carbon tetrachloride	Nickel	
Chlorobenzene	Nitrobenzene	
Chloroform	Nitrosomorpholine	
Chloroprene	Perchloroethylone	
Coke oven emissions	Phenol	
o-, m-, p- cresol	Phosgene	
p-Dichlorobenzene	Polychlorinatecl biphenyls	
Dimethyl nitrosamine	Proplyene oxide	
Dioxin	Toluene	
Epichlorohydrin	Trichloroethylene	
Ethylene dichloride	Vinylidene chloride	
Ethylene oxide	o-, m-, p-xylene	
Formaldehyde		

[a] No standards yet issued.
[b] No standards yet issued. EPA has been sued for failure to promulgate standards within statutory deadline, Settlement in negotiation.
[c] No standards yet issued. EPA was sued by the Sierra Club (and others) for failure to promulgate standards within statutory period EPA now under court order to issue proposed rules
[d] Sources to be regulated not Yet determined.

SOURCE: *Hearings orr Oversight on the* C/can *Air* Act, Senate Committee on Environment and Public Works, 97th Cong., 1st sess., June 1981, pp 580-581

Air pollutants from hazardous waste facilities—or from the burning of hazardous waste for energy recovery-might in principle be controlled under either section 112 of CAA or subtitle C of RCRA. However, the pollutant-by-pollutant approach under CAA is cumbersome. Only a few pollutants have been listed and standards have been established for only a very narrow group of facilities. The RCRA program is better suited for the control of pollutants from hazardous waste TSDFS, while other specific airborne hazardous pollutants generated in a range of industrial processes might be more readily controlled using section 112 standards.

Air pollution controls have themselves resulted in some increase in the generation of

[118] 40 CFR Part 61.

[119] In 1979, EPA proposed a general methodology which was intended for use in identifying, assessing, and regulating suspected carcinogens that are emitted from stationary sources. The proposal includes the listing under section 112 of any air pollutant determined to present a significant carcinogenic risk to human health as the result of emissions from one or more categories of stationary sources. This listing would be accompanied, when applicable, by the proposing of generic emission standards for source categories producing or handling significant quantities of the substance. Final standards would, at a minimum, require sources to use best available technology to reduce emissions, as well as additional measures (including the closure of certain sources) as necessary to reduce any remaining risk deemed to be unreasonable. Further action on the airborne carcinogen policy has been deferred by EPA. 44 F.R. 58,642, Oct. 10, 1979.

hazardous waste. However, as mentioned elsewhere, fly ash waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels have temporarily been excluded from regulation under subtitle C of RCRA, pending completion of studies required by 1980 RCRA amendments.

Surface Mining Control and Reclamation Act of 1977 (S MC RA)[120]

SMCRA establishes a nationwide program to protect society and the environment from the adverse effects of coal mining. Regulations issued under the act by the Department of the Interior cover three major areas:

- performance standards for protection of the environment and public health and safety, permit applications, and bonding requirements for surface coal mining and reclamation operations;
- procedures for preparation, submission, and approval of State programs to control mining and reclamation; and
- development and implementation of a Federal program for any State that does not develop an acceptable program.

The surface mining regulatory program includes standards and requirements for protection of surface and ground waters from contamination from mining wastes and overburden. Section 1OO6(C) of RCRA provides for integration between RCRA and SMCRA in controlling solid and hazardous wastes and requires consultation between EPA and the Department of the Interior on the adequacy of these rules.[121] The Secretary of the Interior is given exclusive responsibility for carrying out the requirements of RCRA subtitle C with respect to coal mining wastes or overburden for which a permit under SMCRA has been issued or approved. Section 3005(f) of RCRA states that a permit issued or approved under SMCRA covering any coal mining wastes or overburden shall be deemed to be a treatment, storage, and disposal permit issued under RCRA.[122] Subtitle C regulations are not be applicable to the treatment, storage, or disposal of coal mining wastes and overburden covered by such a permit.

Nonregulatory Approaches and Technical Support

RCRA and other laws contain nonregulatory provisions (i. e., which do not directly require compliance with standards or controls) that are intended to influence hazardous waste management activities by State and local governments and the private sector. These provisions include direct or indirect incentives to adopt State programs or to develop alternative hazardous waste management practices. Among the existing provisions are those that provide for financial and technical assistance to States, information distribution, research and development activities, and interstate cooperation. Although, RCRA authorizes a broad range of non-regulatory activities that could promote the adoption of better waste management strategies by State and private industry, these measures have been largeley ineffective due to lack of adequate funding and/or failure of implementation by Executive agencies.

Interstate Cooperation .—Section 1005 of RCRA[123] allows two or more States to establish agreements or compacts, not in conflict with any U.S. law or treaty, for cooperative effort and mutual assistance in the management of solids and/or hazardous waste. These regional compacts allow States to plan for regional waste needs and develop consistent regulatory policies.

Guidelines for Solid Waste Management.–Section 1008[124] of RCRA requires the EPA Administrator to develop and publish suggested guidelines for solid waste management which will establish criteria for defining solid waste and will provide a technical and economic description of the level of performance in protecting health

[120] Public Law 95-87, 91 Stat. 445, Aug. 3, 1977; 30 U.S. C. 1201 et seq.

[121] 42 U.S.C. 9605, as amended by the Solid Waste Disposal Act Amendments of 1980, Public Law 96-482, sec. 2, 94 Stat. 2334.

[122] 42 U.S. C. 9625(f), as amended by Public Law 96-482, sec. 11, 94 Stat. 2338.

[123] 42 U.S. C. 6904.

[124] 42 U.S.C. 6907.

and the environment attainable by available solid waste management practices.

Where appropriate, the guidelines are also to include information for use in deciding the adequate location, design, and construction of solid waste management facilities, including consideration of regional, geographic, demographic, and climatic factors.

Several solid waste guidelines were issued by EPA under section 209 of SWDA before passage of RCRA.[125] Since then, EPA's guideline-writing under RCRA section 1008 has been minimal. The minimum criteria for use in defining practices that constitute open dumping were issued not as a separate guideline document but rather in combination with criteria for classifying facilities as sanitary landfills or open dumps, required by section 4004(a)" of RCRA.[126]

Section 6004 of RCRA provides that any guidelines issued under section 1008 are binding on executive agencies and units of the legislative branch of the Federal Government.[127]

Financial Assistance.–Section 3011 of RCRA authorizes Federal grants to assist the States in the development and implementation of hazardous waste management programs.[128] EPA has determined that these grants are also available for States with partial authorization or cooperative arrangements. Hazardous waste grants have steadily increased as shown in table 7 in the following section. Because the subtitle C hazardous waste regulatory program has only recently been promulgated in reasonably complete and final form, and because the development, final authorization, and implementation of State hazardous waste programs entail a major effort yet to be completed, EPA has been widely criticized for failing to request or provide sufficient financial assistance to the States at a time when their regulatory responsibilities under RCRA will increase dramatically. EPA has recently suggested that the State grants program be phased out and that States finance their regulatory programs through increased fees and State appropriations.[129]

Under section 3012,[129] grants may be made to the States for a continuing program to inventory active and inactive hazardous waste sites. In fiscal year 1983, Congress appropriated $10 million from Superfund to carry out this program. EPA had not previously requested such funds.

Under subtitle D, section 2007, 4007, and 4008 of RCRA provide for EPA to grant financial assistance to States and sub-State agencies for the purpose of developing and implementing their solid waste plans.[130]

Under section 4008(a)(2)(A), financial assistance may be provided for facility planning and feasibility studies; expert consultation; technology assessments; legal expenses; construction feasibility studies; and fiscal or economic investigations or studies, but it may not include construction or land aquisition.[131] Applicants for such assistance must agree to comply (with respect to the project or program assisted) with the requirement under section 4005 for the closing or upgrading of open dumps and with the requirements of the subtitle C hazardous waste program, as well as agreeing to apply practices, methods, and levels of control consistent with any guidelines issued under section 1008.[132]

Provisions for financial assistance under subtitle D generally emphasize support for resource conservation and recovery; indeed, assistance provided under section 4008(a)(3) is restricted to uses related to energy and mate-

[125] Public Law 89-272, 79 Stat. 997 (1965].
[126] 42 U.S.C. 6944,
[127] 42 U.S. C, 6931,
[128] 42 U.S.C. 6931.

[129] 42 U.S. C. 6933, as amended by Public Law 96482, sec. 17, 94 Stat. 2344 (1980).
[130] Section 2007, as amended, provides for general authorizations for appropriations for RCRA implementation and provides that specified shares are to be allocated to the Resource Recovery and Conservation Panels, (20 percent or $5 million), to the Hazardous Waste Regulatory Program (:30 percent, excluding sec. 3011 grants to States); and to sec. 4008 programs for State, local, and regional agencies resource and material conservation and recovery programs and State solid waste plans (25 percent of total appropriated for sec. 4008 programs).
[131] 42 U.S.C. 6848.
[132] 42 U.S.C. 6945.

rials conservation and recovery as described in section 4003(b) (1).133 The primary emphasis is on conservation and recovery in relation to municipal waste, but section 4003(b)(2) refers also to "other sources of solid waste from which energy and materials may be recovered or minimized" which could, in principle, include hazardous waste.

In practice, EPA provided grants under subtitle D (including grants specifically in support of resource recovery) totaling $27,910,000 in fiscal year 1980 and $12,936,000 in fiscal year 1981. However, these grants were phased out at the end of fiscal year 1981, although recipients were permitted to spend in fiscal year 1982 any money that previously had been allocated but remained unspent. The phaseout left States without Federal support for, among other things, continued solid waste planning and continued preparation of the inventory of open dumps, as well as for plan implementation.

Technical Assistance .—Under subtitle D, section 4008(d) authorizes EPA to provide technical assistance to State and local governments for developing and implementing State plans.[134] Technical assistance on resource conservation and recovery (in practice, largely applied to municipal waste) may be provided through "Resource Recovery and Conservation Panels. " These are teams of personnel, including Federal, State, and local employees or contractors who supply assistance at no charge to States and local governments.[135]

The delivery of technical assistance was funded at the level of $4,304,000 in fiscal year 1980 and $3,198,000 in fiscal year 1981 but was eliminated in fiscal year 1982 EPA budget.

RCRA also directed the Department of Commerce to provide technical support to encourage the commercialization of proven technologies for resource conservation and recovery. The National Bureau of Standards was directed to publish guidelines for specifications for classifying materials recovered from wastes. The Department of Energy was given the responsibility for R&D programs for recovery of synthetic fuels from solid wastes. EPA was directed to coordinate and consult with DOE on other energy related solid waste programs.

Research and Development.—Subtitle H, section 8001, of RCRA authorizes EPA to conduct or assist others in conducting research, investigations, experiments, training, demonstrations, surveys, public education programs, and studies on various aspects of solid and hazardous waste management.[136] Among the possible areas for research and development activities authorized under this section are: adverse health and environmental effects of solid and hazardous waste, financing and operation of waste management programs, development of solid and hazardous waste management technologies, resource conservation and recycling technologies, and waste reduction techniques,

Section 8002 directs the EPA Administrator to carry out a number of special studies including an assessment of the adverse environmental effects of solid waste from surface and underground mines and the generation and management of sludge,[137] Section 8002 also describes the study required under the 1980 amendments to section 3001 for an assessment of environmental and health effects of disposal of hazardous waste from oil, gas, and geothermal energy expiration, development and production, from burning of coal and fossil fuels, from mining and processing of ores and minerals, and from cement kiln dust.

Other agencies also carry out related R&D activities, such as the National Institute of Health (screening and testing of carcinogenic, mutagenic, terotogenic effects of chemicals), the Occupational Safety and Health Administration and National Institute for Occupational Safety and Health (protection of health and safety of employees working in both industrial and cleanup environments). The National Science Foundation has in the past funded major R&D projects related to toxic chemicals and hazardous waste management.

133 42 U.S. C. 6943(%)(1).
134 3442 U.S. C. 6948(d).
135 42 U.S.C. 6913.
136 42 U.S.C. 6981.
137 42 U.S. C. 6982.

EPA Research Activities in Hazardous Waste

All research activities within EPA are the responsibility of the Office of Research and Development (ORD).[138] ORD has defined the following five objectives to provide support to the RCRA hazardous waste program:

1. Waste analysis and characterization: development of analytical methods and procedures for the detection and identification of substances, development of monitoring guidelines, and a quality assurance program for development and enforcement of regulations.
2. Control technology: assessment of disposal and treatment technologies, development and evaluation of technologies for remedial actions, and assistance of the Office of Solid Waste in reviewing permit applications.
3. Risk assessment: development of data and methodologies for determining risks to human health and environment.
4. Spills response: development of methods and guidelines to provide quick response to emergency spills,
5. Long-term research: investigation of advanced technologies.

Since 1981, there has been a significant shift of emphasis within ORD from longer term research projects (e. g., studies of the effects of chemicals and new process developments) to programs which directly support the promulgation of regulations. Some 15 to 20 percent of ORD'S total budget is set aside for exploratory research projects; however, little of a truly exploratory or long-range nature is being done even in this portion of the program.

OTA has reviewed current research projects planned for completion by 1986 (see table 62). Major emphasis has been placed on risk assessments and analytical methods for detection and measurement of specific chemicals. The control technologies emphasized are landfills and land treatments. Research plans for incineration focus on the development of performance standards for hazardous waste incinerators, not the improvement in incinerator technology. The investigation of new treatment technologies has been omitted even in the long-term research strategy planning.

ORD'S research in support of the toxic substances program under TSCA and the Superfund program under CERCLA may also contribute to the management of' hazardous waste, Again, the emphasis appears to have shifted toward relatively short-term research directed at problems of immediate regulatory concern.

Collection and Dissemination of Information.– Under subtitle H, section 8003 of RCRA directs the EPA Administrator to develop, collect, evaluate, and coordinate information on a variety of aspects of solid and hazardous waste management.[139] A program for the rapid dissemination of information on solid waste management, hazardous waste management, resource conservation, and methods of resource recovery from solid waste is to be implemented.

The Administrator is also directed to establish and maintain a central reference library. Information in this library, to the extent practicable, is to be collated, analyzed, verified, and published, and made available to State and local governments and other persons. Additionally, the Administrator is to develop and publish a model cost and revenue accounting system, and to recommend model codes, ordinances, and statutes providing for sound solid waste management,

Until 1981, EPA maintained a solid waste technical information service in Cincinnati, Ohio, which distributed free copies of EPA solid waste reports. Relatively technical documents (e. g., EPA contractors' reports) were frequently omitted from this collection but could be obtained for a charge from the National Technical Information Service (NTIS). The service in Cincinnati has been discontinued, and only a very small number of copies of EPA reports are typically made available by

[138] Information on research activities of EPA/ORD was obtained by OTA from ORD in spring-summer of 1982 and from EPA's fiscal year 1983 Budget Justification.

[139] 42 U.S.C. 6983,

Table 62.—Research Projects Planned by ORD in Support of Hazardous Waste Management Program

Risk assessment	Control technology	Waste analysis	Long-term research	Spills response
• Integrate existind risk assessment methods into guidelines • Develop predictive methods for assessing health and environmental impacts of specific chemicals • Develop biological methods for predicting health impacts • Develop and standardize bioassay methods for predicting impacts of waste • Develop processes for listing/delisting waste and mixtures using health impacts, environmental impacts, and mobility data • Develop models for screenIng chemicals for predicting human exposure • Develop data and methodology for estimating health and environmental impacts resulting from exposure to levels of hazardous waste • Develop methods for predicting ground water impacts of pollutants released from landfills • Develop data and methodology for determining likelihood of harm resulting from existing landfill facility • Develop predictive methods for assessing effects of technologies, environments, and waste streams . Develop data and methodology for estimating impacts from ocean disposal . Develop methods for site selection of ocean disposal • Assess hazards for specific chemicals for use by permitting programs . Assess health effects and risks of specific sites in support of permits • Develop guidelines for site evaluation based on pollutant migration for use in permitting • Predict health effects for use i n regulatory impact analysis • Evaluate risk assessments for use in RIA for land disposal regulations • Develop data and methodology for estimating health impacts of exposure to various chemicals • Develop improved methods for predicting long-term environmental effects of landfills	• Develop desruction and control efficiency data for incineration, landfill, and land treatment Ž Develop data on integrity of liners • Identify and evaluate on cost basis technologies for controlling releases of waste from TSDFS • Identify technologies for ocean incineration • Develop data and methodology for land treatment • Prepare guidance manuals for design and performance standards for disposal or treatment • Develop guidance manuals for use by permitting agencies in control capabilities of disposal and treatment technologies • Develop models for estimating lifecycle costs of alternative disposal technologies	. Refining extraction procedures using waste for integration of effects and water quality data • Improve analytical methods for detection of chemicals • Improve dioxin detection methods • Standardize waste characteristic methods for impact analysis • Develop data base for waste mixtures • Provide quality control procedures for automated analytical systems for regulatory application • Develop monitoring and analysis methods for quality assurance of disposal facilities . Issue guidelines for post-closure monitoring of land disposal sites • Complete economic analysis of alternatives to ground water monitoring for land disposal • Develop procedures for determining when Superfund should be used for monitoring and maintenance . Prepare manuals for long-term monitoring of disposal sites • Develop criteria for qualification of sites for Superfund • Develop methodologies for screening waste for enforcement actions • Develop biological methods for demonstrating releases from disposal facilities • Develop methods for estimating costs of long-term monitoring of disposal facilities	• Focus on waste stream mixtures: —determine environmental and health impacts and —treatment and monitoring techniques • Develop new detecting methods, particularly subsurface pollutants • Destruction and recovery of organics Ž Impacts of reactive and corrosive waste in land treatment facilities • Definition of characteristics which are vulnerable to irreversible damage as result of exposure to chemicals • Focus on persistence and fate of chemicals i n environ merit —biodegradation rates of waste to form basis of monitoring guidelines	• Develop procedures to determine health and environmental effects due to spills of chemicals • Document impacts of chemicals used in treatment of spills, such as neutralizing agents • Develop methods to measure effects of spills on crops and animals • Develop data to correlate responses of aquatic organisms to toxic substances with human health effect data • Develop computer model for predicting toxicity of mixtures • Develop computer model to predict environmental impacts of spills • Develop environmental tests for estimating hazards of spilled materials • Prepare prevention, control, and compliance studies of new techniques for handling spills · Maintain emergency response capability for sampling, analysis, and remote monitoring • Develop manuals for response teams

SOURCE Office of Technology Assessment

the agency itself. The apparent intention is for most reports to be distributed in the future through NTIS which, for some users, represents a significant increase in acquisition cost and a considerable reduction in convenience and ease of access to the reports.

Full-Scale Demonstration Facilities.—Under subtitle H, section 8004 of RCRA authorizes the EPA Administrator to enter into contracts or provide financial support for the construction of full-scale demonstration facilities where certain conditions are met (e.g., that the facility will demonstrate a significant improvement in a technology or process, and that it would not receive adequate support from other sources).[140] No use has yet been made of this provision for the construction of demonstration facilities for hazardous waste management technologies.

Federal, State, and Private Compliance Cost for the Current Hazardous Waste Management Program

Introduction

The Resource Conservation and Recovery Act, which establishes a comprehensive hazardous waste management program, reflects the congressional belief that the benefits of the program will exceed the costs of implementation. RCRA does not call for **a** balancing of **costs** and benefits in regulatory decisions involving hazardous wastes. Quantitative estimates of the expected benefits, resulting from the increased level of protection of human health and the environment from damages due to the mismanagement of hazardous wastes, are not available. However, some information is available on the costs, and this chapter provides a summary of the estimates that have been made, EPA estimates focus on the potential incremental costs (i.e., those directly attributable to compliance with RCRA regulations) as opposed to those attributable to independent or pre-RCRA efforts. (There are also costs incurred for the CERCLA program; however, these are not generally considered as "regulatory" compliance costs,) Estimates of industrial compliance costs and Federal and State administrative costs are summarized in the following sections. A final section presents total national costs associated with all hazardous waste activities.

Industrial Compliance Costs

The Hazardous Waste Services Industry .—One measure of the impact of complying with government regulations is the amount of money spent by the private sector to manage hazardous wastes. This can be roughly estimated by a two-step analysis. First, the sales are obtained for those firms providing treatment, storage, and disposal services at offsite, commercial facilities. Second, the ratio of offsite to onsite (i.e., generator) management of hazardous waste is estimated. Using this ratio and assuming that noncommercial facilities have approximately the same level of costs per tonne of waste, the onsite or generator management costs are derived. Total costs to waste generators are then estimated by combining commercial and noncommercial waste management costs,

Two studies are available for obtaining the sales of the commercial waste management industry. The summary data from these studies, including projections to 1990, are given in table 63.

The analysis by A. D. Little was based on 1981 revenues from hazardous waste activities for three categories of firms: 1) 9 full service, nationally oriented firms with a subtotal of

Table 63.—Characteristics of the Commercial Off site Hazardous Waste Management Industry

	A, D, Little[a]		Frost & Sullivan[b]	
	1981	1990	1980	1990
Total hazardous waste generated (millions of metric tons)	43[c]	56	60	85
Proportion of waste managed off site (percent)	20	80	15	15-25
Average treatment/disposal price (1981 dollars/metric ton)	$100	$200	–	–
Estimated industry revenues (billions of 1981 or 1980 dollars)	$0.9	$9	$0.5	$2.5

SOURCES: [a]Joan B. Berkowitz, "Outlook for the Hazardous Waste Management Services Industry," September 1982, draft from A.D. Little.
[b]Frost & Sullivan, "Hazardous Waste Market—Handling, storage and Disposal," February 1981.
[c]From EPA, December 1980.

[140] 42 U.S.C. 6984.

$301 million; 2) 222 regionally or locally oriented firms usually specializing in a limited range of services with a subtotal of $179 million to $277 million; and 3)''unpermitted" firms* with a subtotal of $3oo million to $4oo million, A. D. Little's projections from 1981 to 1990 are based on an assumed annual growth rate of 3 percent for hazardous waste generation (noting that the EPA estimate for 1981 may be low), which is acknowledged to be conservative. Offsite management is assumed to change from 20 percent at present to 80 percent of the total amount of waste in 1990; it is acknowledged that this projection may be high. The average price is assumed to double from about $100/tonne in 1981 as landfill capacities decline and regulatory actions force the use of more costly options such as incineration and chemical treatment. The increase in total sales from $900 million in 1981 to $9 billion in 1990 corresponds to an average annual growth rate of 29 percent.

The second study by Frost and Sullivan analyzes the 1980 revenues of seven large national-type firms and presents an extrapolation to all of the commercial waste management firms, a projection to 1990 assuming a growth rate of 20—25 percent per year in revenues, an estimate for waste generation in both 1980 and 1990, and a modest increase in the fraction of waste managed off site.

The results of both studies for current spending for offsite, commercial hazardous waste management are in relatively good agreement. They indicate that the total amount spent in 1980 and 1981 for both onsite and offsite hazardous waste management was probably in the range of $4 billion to $5 billion annually (in current dollars). * * These figures, although approximate, are probably low for two reasons. Significant funds are also spent by the private sector on technical consulting and analytical services, but exact figures for these costs are not available. Also, spending on transportation services have not been determined exactly. However, exclusion of these two cost areas may balance the potential for overestimating in the procedure used here. Assuming that onsite management costs are equal to offsite costs probably overestimates total costs, as onsite management is generally understood to be less costly. This results from two factors: 1) onsite efforts generally manage wastes requiring the least costs; and 2) there are more economy-of-scale savings for large onsite activities which often deal with fewer wastes than offsite facilities.

The projections to 1990 with regard to the fraction of the total amount of waste managed offsite are also subject to some uncertainty. However, both studies indicate a similar level of total spending for offsite and onsite hazardous waste management in 1990. The A. D. Little study indicates $11 billion and the Frost and Sullivan indicates $12.5 billion (not adjusting for inflation).

To put these total present and projected levels of industry spending into some perspective, hazardous waste management costs represent about 1 to 2 percent of total annual sales for the chemical and allied products industry, assuming that about 50 percent of all hazardous wastes are generated by this industry, which has generally been found to be the case. Naturally, this percentage will vary significantly among different industries.

EPA Estimates.—This section provides available estimates of the costs to the private sector of complying with the RCRA Subtitle C regulations, based on analyses prepared for EPA in support of the promulgation of these regulations. The analyses cover the expected costs of compliance with the interim status standards, with the interim final design and operation standards for land disposal facilities, and with the financial responsibility requirements for hazardous waste facilities. Cost estimates are not yet available for some of the facility permit standards either because they have not yet been promulgated or because cost analyses have not been completed. Consequently, published data are necessarily incomplete and do

•It is presumed that these unpermitted firms include a large number of facilities that are generally exempted from RCRA regulation such as recycling operations.

••● The A. D. Little study indicates $4.5 billion for 1981, and the Frost-Sullivan study indicates $3 billion for 1980, using their figures for revenues and their fractions of offsite management of 0.2 and 0.15, respectively.

not reflect the total compliance costs for the RCRA regulations.

Although OTA attempted to locate alternative (non-EPA) estimates for purposes of comparison and validation, these efforts proved unsuccessful. An examination of three of the best known annual surveys of industrial expenditures on pollution control (conducted by McGraw-Hill, the Bureau of Economic Analysis, and the Bureau of the Census) did not yield useful comparisons because some unknown portion of the reported expenditures are attributable to solid waste activities and not to hazardous waste regulatory compliance costs.

It is important to emphasize that the absence of data comparable to the EPA cost analyses inhibits any direct empirical validation of the EPA results.

The costs of complying with the subtitle C regulations will be incurred at various times during the remaining lifetime of the facilities involved and, in some cases, after closure. To simplify comparisons, EPA has "annualized" its cost estimates by presenting them in the form of "annual revenue requirements, " signifying the annual revenues that facilities would have to obtain in equal installments over a 20-year period to offset the costs of compliance. For annualizing each facility is assumed to have a remaining life of 20 years, although costs associated with the financial requirements are taken into account over a 50-year period.

Table 64 provides a summary of EPA's estimates of total annualized compliance costs for implementation of the various sections of RCRA. As mentioned above, these estimates are incomplete since they do not cover all of the anticipated Phase II regulations. Nevertheless, it can be seen from the table that the costs of complying with the performance standards for the owners and operators of treatment, storage, and disposal facilities (under RCRA sec. 3004) are expected to be significantly greater than the costs associated with other RCRA sections. These other sections (providing mostly for general operations such as manifest preparation, waste analysis, recordkeeping, etc.) are

Table 64.—EPA Estimates of Annualized RCRA Compliance Costs by Subtitle C Section (in millions of 1981 dollars)

Section	Annualized cost
3001-identification and listing	$68.6
3002-generator standards	58.5
3003-transporter standards	0.6
3004 -TSDF owners and operators	916.2 -1,832.7
3005-permit requirement	1.8
Total	$1,045 .8-$1,962.3

SOURCES: Environmental Law Institute, "Costs of Implementing Subtitle C of the Resource Conservation and Recovery Act," OTA Working Paper, October 1982; and A. D Little, *Economic Impact Analysis of RCRA Interim Status Standards,* 1981.

a relatively minor portion of the total costs of compliance. EPA analyses indicated that the most significant cost impacts of the ISS regulations for land disposal facilities were for the installation of ground water monitoring systems (an average of $23,000) and for closure and post-closure costs, Only ground water monitoring involves substantial immediate expenditures for existing facilities.

Compliance Costs for Land Disposal Facilities

The **costs** of complying with RCRA section 3004 requirements can be subdivided into the costs associated with the interim status standards and those associated with the final (Phase II) standards. Table 65 summarizes EPA's estimates of the total incremental annualized costs of meeting the Phase II requirements for land disposal facilities. The estimates compare Phase II incremental compliance costs with baseline pre-ISS costs for landfills and surface impoundments (e.g., land acquisition, excavation, and infrastructure costs) and ISS costs for all land disposal facilities. The table includes low and high estimates for the Phase II incremental costs, based on differing assumptions about the installation of liners, the occurrence of leaks, and the need for corrective action.

EPA estimated the total annualized incremental costs of complying with the interim status standards for land disposal facilities at $341 million. Implementation of the part 264 permitting standards would, according to EPA estimates, impose additional annual revenue requirements of $150 million to $1,145 million depending on the need for corrective action.

Table 65.—Total Annual Revenue Requirements for Part 264 Regulations (millions of current dollars)

Compliance requirements for existing facilities	Base line[a] (pre-ISS & ISS)	Incremental Part 264 Low estimate[b]	Incremental Part 264 High estimate[c]
Landfills (design and operating (D&O) requirements)	$301[d]	81	*159*
Surface impoundments D&O	534[e]	102	*401*
(Adjustment for landfilled materials)[f]	(190)	(57)	(118)
Waste piles D&O	169		12
(Adjustment for landfilled materials)[f]	(10	(3)	(6)
Land treatment D&O		20	20
Total D&O	702	150	468
Corrective action			677
Total	*702*	150	1,145

[a] Baseline costs Include pre-ISS costs such as land acquisition, excavation, and infrastructure expenses incurred in establishing a land disposal facility and ISS compliance costs Imposed under May 1980 regulations Including closure and post-closure care, ground water monitoring, and financial responsibility requirements Approximately 72 percent of the $341 million ISS costs included in the baseline are attributable to closure ($82 million), post. closure ($40 million), ground water monitoring ($42 million), and financial assurance ($82 million) requirements Baseline costs include estimated pre-ISS costs for landfills and surface Impoundments only

[b] Low estimate assumes installation of single synthetic liners at landfills and replacement of containment system for waste piles to avoid ground water monitoring requirements No facilities leak, therefore, no corrective action required

[c] High COstestimate assumes installation of double synthetic liners at landfills, closure of all existing surface Impoundments and replacement with new impoundment with double synthetic liner All facilities immediately begin to leak and require extensive counterpumping corrective action for 150 years

[d] Includes $181 million in pre-ISS costs for landfills

[e] Includes $180 million in pre-ISS for surface impoundments

[f] Some materials, sludges, and residues from surface impoundments and waste piles are eventually sent to land disposal facilities Adjustment to total is made to avoid double counting of compliance cost of landfilling of materials from these facilities

[g] Pre-ISS costs not available for waste Piles

[h] Pre-ISS costs not available for land treatment facilities

SOURCE 47 F R 32,338 July 26 1982

EPA analyses of compliance costs of RCRA regulations use a number of key assumptions that can significantly affect the results, including:

1. the use of unit cost data;
2. the annualizing process;
3. the ratio of onsite and offsite disposal;
4. the number of facilities incurring compliance costs;
5. the costs incurred by new facilities;
6. ground water protection and the need for corrective action; and
7. the rate of permitting and the timing of compliance.

1. The use of unit cost data.—EPA's analyses are based on unit "engineering" costs. Hazardous waste facilities differ widely depending on their particular characteristics. However, it is common in EPA cost analyses to use model plants that represent the average range of facilities in the relevant universe. Once these models have been specified, compliance costs for each are based on the costs of unit operations. This approach usually leads to an overestimate of actual costs since it fails to allow for technological changes and innovative regulatory responses that tend to lower average costs in practice.

2. The annualizing process.—The annualizing process assumes a 7-percent inflation rate in calculating future costs, and then uses a lo-percent discount rate in discounting these costs back to the present; thus, a "real" discount rate of 3 percent is used. No justification for this choice of discount rate has been offered, nor is any analysis presented on the sensitivity of resulting cost estimates to the discount rate selected.

3. The ratio of onsite to offsite disposal.—EPA's analyses make an arbitrary allocation between onsite and offsite disposal based on an estimate of the volumes below which it might be considered uneconomical to dispose onsite. For this purpose, an assumption about the cost of offsite disposal is necessary. This ratio does not reflect the influence of other, noneconomic considerations, such as liability, type of waste, or age of the facility, in the onsite/offsite deci-

sion, This assumption could tend to indicate higher total offsite disposal costs and lower total onsite disposal costs.

4. The number of facilities incurring compliance costs.—EPA calculated the design and operating compliance costs only for the 5,662 existing land disposal units that submitted part A applications including:

- 573 landfills with 12 million tonnes per year capacity;
- 4,240 surface impoundments with 11,169 acres surface area;
- 608 waste piles with 87 million cubic feet of waste;
- 241 land treatment units with 12,100 acres of operating area.

According to EPA, this will overstate the number of facilities that will actually incur compliance costs as some will close before permitting, and some facilities include several types of units within a single operation and will achieve some economies of scale in full-status standard requirements, EPA calculated corrective action costs only for 2,484 disposal facilities—the number of disposal facilities that submitted part A applications which is less than the total number of existing units because one facility can have several units. This could overestimate the number of disposal facilities, but could underestimate the number of corrective actions. EPA assumed that extensive corrective action would be taken for an entire facility, not separately for each unit in the facility. (See ch. 4 of this report for a more accurate estimate of existing facilities.)

5. The costs incurred by new facilities.—EPA did not calculate the incremental costs of complying with part 264 standards for new land disposal facilities because it was difficult to project the number of facilities affected and, moreover, cost estimates were not available for the part 267 temporary standards for new facilities. Exclusion of compliance costs for new facilities will tend to underestimate total costs,

6. Ground water protection and the need for corrective action.—EPA could not predict how the owners and operators of TSDFS will react to the liner and ground water monitoring requirements (i.e., whether they will install liners, monitoring systems, etc.). Nor did EPA attempt to predict the incidence of leakage, the need for corrective action, and the costs associated with corrective action. For the purpose of producing estimates, EPA made two extreme sets of assumptions: a low-cost case and a high-cost case. The low- cost case assumes that all landfills use single synthetic liners, all waste piles are replaced to avoid the need for ground water monitoring, no leakage occurs, and no corrective action is needed, The high-cost case assumes that all landfills have double synthetic liners, all waste piles monitor ground water, all surface impoundments are closed and replaced by new units with double liners, and, even with all these precautions, all facilities require immediate corrective action using an expensive counter-pumping strategy for over 150 years. The two cases are so extreme that it is difficult to estimate the costs of a probable intermediate scenario.

7. The rate of permitting and the timing of compliance.—EPA's analysis assumed that all facilities are permitted simultaneously and immediately so that compliance costs for all units are occurred at the same time. An earlier study for EPA of the costs of proposed final permitting standards found that the targetting and rate of permitting efforts by EPA (i. e., how quickly must meet permit standards and which industries are permitted first) were among the most important variables affecting annualized compliance costs that are under EPA's control. * Total annualized compliance costs are probably overstated as a result of this assumption. Existing facilities will continue to operate under interim status standards until permitting. EPA has estimated that initial permitting of over 2,100 existing land disposal facilities will not be completed until fiscal year 1988,

EPA's analysis concluded that the compliance costs for the land disposal regulations might lead to the closure of small onsite land-

*Development Planning Associates, Inc., Pope Reid Associates, inc., Putnam, Hayes and Bartlett, Inc., and Temple, Barker, and Sloane, Inc., *Final Impact Analysis of Proposed RCRA-FSS Regulations, 19801990,* November 1980, pp. 4-5.

fills an the closure and replacement of small onsite surface impoundments. EPA **estimates that** there are about 225 small landfills (500 tonnes/yr or less) representing about 44 percent of all landfills. The 2,760 small surface impoundments (one acre or less) represent about 65 percent of all surface impoundments. Compliance costs for these facilities are expected to be substantially higher on a per unit basis than for the larger commercial facilities.

EPA **estimated that** part 264 design and operating standards would add from $10 to $22 per tonne to disposal costs at a midsize landfill (l5,000 tonnes per year) depending on the type of liner installed. Corrective action costs would add an additional $2 to $21 per tonne in annual revenue requirements depending on the type and extent of remedial measures required, In contrast, a small (500 tonnes per year) landfill would require annual revenues of $62 to $104 per tonne to offset incremental compliance costs for design and operating requirements and additional annual revenues of $34 to $396 per tonne for potential corrective action costs.

EPA estimated that commercial landfill disposal charges in 1981 ranged from $55 to $240 per tonne depending on the type of wastes and excluding transportation costs. Compliance with interim status standards and Phase II permitting standards are not expected to increase these charges significantly for the larger facilities even if corrective action is needed.

EPA did not analyze the impact of the land disposal regulations on the use of alternative treatment technologies. However, a comparison of available information about charges at alternative treatment facilities and commercial landfills in California suggests that the economic impacts of complying with EPA's land disposal regulations will not result in any significant economic incentive to use alternative waste management technologies, * According to a California report, the charges for landfilling hazardous wastes range from $20-$200 per ton depending on the type of wastes, with the highest costs for containerized highly hazardous wastes. The range of average costs for alternative treatment options were: surface impoundments, $20-$30/ton; incineration, $250-$500/ton; chemical stabilization, $100-$120/ton; and other chemical and physical treatment processes, $30-$175/ton. Even assuming an initial 20- to 30-percent increase in land disposal costs, landfilling will remain the least expensive alternative for most wastes. For highly-hazardous wastes, landfilling will probably still be less costly than incineration or other suitable treatment alternatives under EPA's land disposal regulations,

"Toxic Waste Assessment Group, *Alternatives to the Land Disposal of Hazardous Wastes: An Assessment for California* (Governor's Office of Appropriate Technology: 1981).

Financial Responsibility Compliance Costs

EPA has promulgated regulations requiring the owners and operators of hazardous waste TSDFS to demonstrate adequate financial capability: 1) to close a site and conduct necessary routine post-closure activities; and 2) to compensate third parties for damages from releases of waste constituents during the active life of the facility.

These requirements, however, have undergone several administrative changes. The interim status standards initially required that the facilities should create a trust fund based on their estimated costs of closure and post-closure activities. Later revisions allowed more flexibility in demonstrating financial responsibility, such as obtaining a surety bond, letter of credit, closure insurance, or meeting a financial test. For third-party liability, the current regulations require self-insurance backed by a financial test or outside insurance coverage of $3 million per nonsudden accidental occurrence with an annual aggregate of at least $6 million, and $1 million per sudden accidental occurrence with an annual aggregate of at least $2 million. EPA's estimate of the total compliance cost of these regulations is shown in table 66 for four types of facilities. Since the cost for any given mechanism depends on the absolute closure cost or third-party damage and the risk perceived by the institutions backing the facility, it is understandable that surface impound-

Table 66.-Present Value of the Private Costs of RCRA Financial Responsibility Regulations by Type of Facility (in millions of doiiars)

Type Of facillity	Financial assurance Closure	Post-closure	Liability insurance	Total
Storage	$89.6		$47.9	$137,5
Surface impoundment	69.6	$514.6	608.4	1,192,6
Landfill	34.6	268.4	193.7	496,7
Incinerator	15.3	0	6.9	22.3
Total	$209.2	$783.0	$856.8	$1,849.1

SOURCES Environmental Law Institute, "Costs of Implementing Subtitle C of the Resource Conservation and Recovery Act, " OTA Working Paper, October 1982; and Putnam, Hayes & Bartlett, Regulatory *Impact Analysis of the financial Assurance and Liability Insurance Regulations*, 1981, p.40.

ments ranked highest in terms of **costs** and incinerators lowest. The total **cost** calculations were based on an assumed distribution of facilities using each of the alternative mechanisms shown in the table.

The distribution **was** considered by EPA **as** the most reasonable. EPA estimated that if the percentage of facilities that can pass the financial **test** increases **to** 50 percent there will be **a** decrease of 40 percent in compliance **cost.** On the other hand, if the same percentage drops **to 10** percent there will be **a** 70-percent increase in compliance **cost.**

Cost by the types of financial mechanism for landfills are presented in table 67. Trust funds, originally required by ISS rules, are the most expensive form of financial assurance. EPA **assumed** that the facility pays 5 percent of the total closure and post-closure **costs each year** into **a** fund during the interim status, and once the permit is issued the remaining portion is paid over the life of the permit for **a** maximum period of 10 years.

Table 67.—Annual Cost of Financial Assurance Activities per Facility for Owners and Operators of Treatment, Storage, and Disposal Facilities (1981 dollars)

Financial mechanism	Percent of facilities	Amount
Trust funds	17 "/0	$ 1,834 (closure) $4,844 (post-closure)
Surety bonds	Negligible	0.85% of face value
Letter of credit	17 "/0	Negligible
Financial test	33 "/0	$595 (closure)
Insurance policy (closure)	*33 "/0*	***$1,206*** (post-closure)
Insurance policy (liability)		$480$11,040 (sudden) $21,120 (nonsudden)

SOURCES. Environmental Law Institute "Costs of Implementing Subtitle C of the Resource Conservation and Recovery Act, " OTA Working Paper, October 1982; and Putnum, Hayes & Bartlett, *Regulatory Impact Analysis of the Financial Assurance and Liability Insurance Regulations, 1981*

The surety bond is essentially **a** contract be**tween** the facility owner or operator and **a** surety company which guarantees **to** pay for the **costs** of closure and post-closure **activities** if the owner or operator does **not.** The after-tax **cost** of the surety bonds **was** calculated **to be** about 1 percent of the face value of the bond, A letter of credit is similar to the surety bond and commits the bank holding the letter of credit to pay for the cost of closure and post-closure activities if the facility does **not.** The **cost** of the letter of credit consists of the fee to the bank and the cost of providing some form of collateral or about 0.85 percent of the value of the letter of credit. The facility may also fulfill the regulatory requirement by buying insurance coverage which will pay for the closure and post-closure costs if the facility cannot. This is also true OF the liability insurance coverage except the premiums are much higher. Finally, the cosi of a financial test is minimal—the one-time cost of preparing a special auditor's report.

Because the financial requirement is more of a performance standard than a design and operation standard, the unit cost per site is probably more important than the total cost, although no one knows for sure the number of facilities using each of the mechanisms. Although the financial test mechanism appears to be the lowest cost option, the actual cost of the regulation will depend on the stringency of the test,

Federal Administrative Costs

To implement RCRA, the Federal Government must support a wide range of activities from regulation development and the basic research underlying these regulations to enforcement of the final rules. The bulk of these responsibilities and **costs** falls on the EPA. This section outlines the major cost components in

administering EPA's hazardous **waste** management program. *

Data Sources and Limitations.—The Federal expenditure figures presented here come from EPA's 1983 and 1984 budget justification presented **to** the House Committee on Appropriations and from final fiscal year 1983 appropriations for EPA passed in September 1982. Although the 1981 and 1982 figures represent actual expenditures, the 1983 and 1984 figures, as proposed, may not accurately reflect actual outlays in those years,

Some costs incurred by other program offices in EPA may not be included in the estimates presented here, For example, the Office of Planning and Resource Management conducts some RCRA-related research, and the Water Office conducts RCRA impact studies in conjunction with the development of effluent guideline background documents. Although this kind of work maybe funded in part through the Office of Solid Waste and thus be included in the EPA hazardous waste totals, any other program office expenditure (excluding enforcement and research and development) probably will be missed, Not all hazardous waste program costs can be formally thought of as RCRA-induced. Presumably EPA would be undertaking some hazardous **waste** research (e. g., even in the absence of RCRA), but no attempt is made here to estimate what percentage of EPA's activities would fall into this category.

These limitations and characterizations of the Federal administrative cost data suggest that the figures used here are lower bound estimates of actual RCRA implementation costs. However, one would not expect the difference from the true costs to be great.

EPA Administrative Costs .—Total administrative costs of EPA's hazardous **waste** program for the years 1975-83 are presented in table 68 and figure 23. These **costs are** also broken down into three general program activities:

- Abatement, control, and compliance: includes regulatory activities, development of regulations, guidelines and policies, financial assistance to State programs, and waste management strategies (coordinating regional office activities, permitting State programs, and cooperative appeal negotiations).
- Enforcement: originally permit issuance, compliance inspections, and enforcement support (in fiscal year 1983 most responsibilities transferred to other divisions.)
- Research and development: EPA technical support research on waste listing and identification, environmental and health effects, **etc.**

In real terms, expenditures during the years 1975-78 show a generally upward trend with relatively small percentage changes between

*There are other costs incurred by other Federal agencies as a result of Subtitle C of RCRA, such as the costs of compliance with the RCRA regulations at Federal facilities; however, available appropriations budget data did not provide specific cost figures for hazardous waste control expenditures by agency, but rather total environmental control expenditures. Other agencies may incur small costs in implementing specific subtitle C requirements, but no estimates of possible administrative costs to other agencies have been identified.

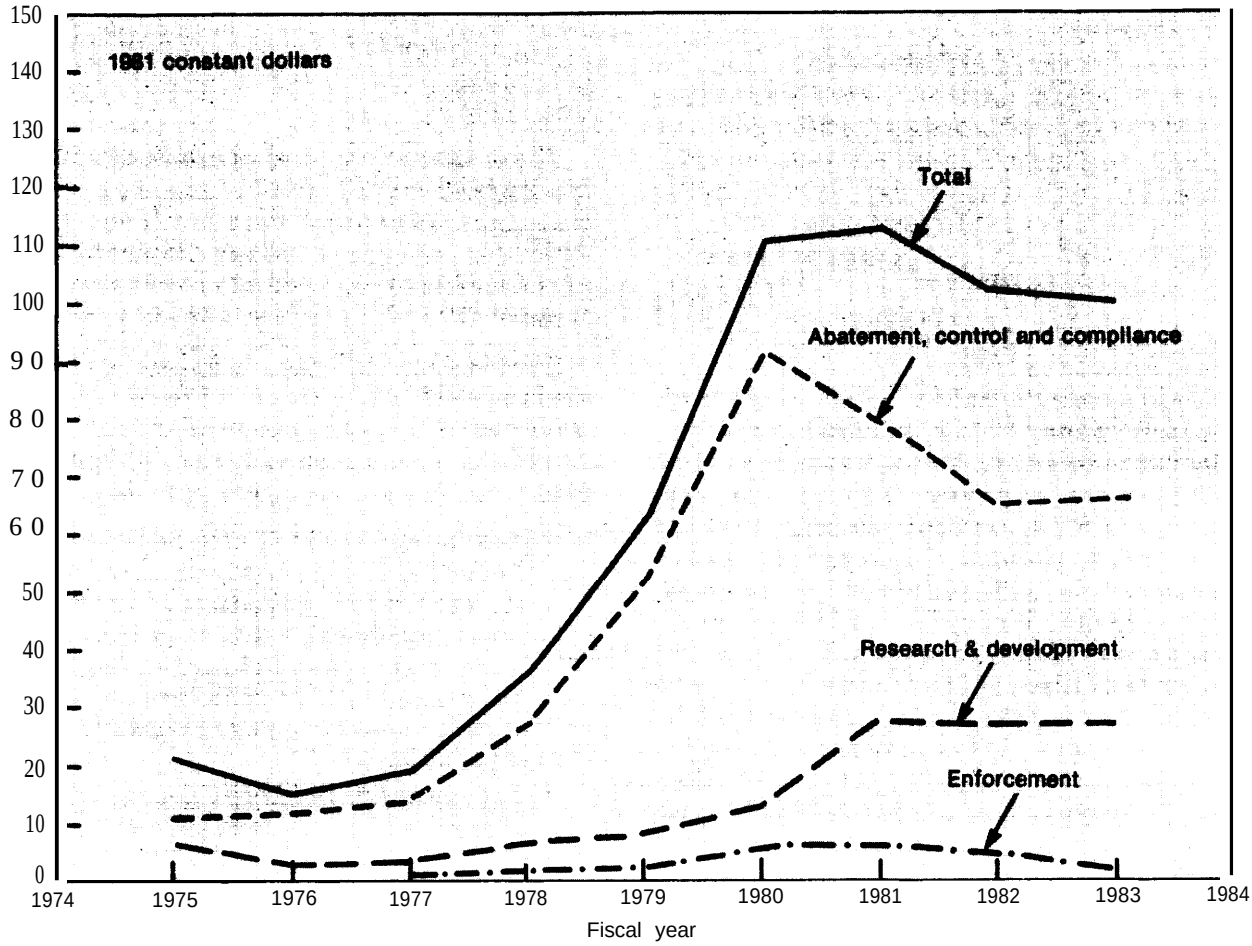
Table 68.—Hazardous Waste Programs, 1975-81[a] (dollars in thousands)

Year	Total	Abatement, control, and compliance	Enforcement	Research and development
1975	$20,184	$12,180	—	$7,374
1976	15,405	12,594	—	2,811
1977.	18,688	14,456	$3	4,229
1978	35,766	27,743	618	7,405
1979	62,521	52,554	1,515	8,452
1980	109,775	90,624	6,038	13,113
1981	141,428	101,705	11,391	28,301

[a]Includes expenditures on solid waste and resource recovery programs that have been largely discontinued in 198283. Solid waste and resource recovery expenditures were approximately $13 million in fiscal year 1981

SOURCE, Congressional Budget Office, "Preliminary Analysis of the Proposed 1983 EPA Budget, " draft staff memorandum, Mar 9, 1982

Figure 23.— EPA Hazardous Waste Program Budget 1975-83[a]



[a]1975-80 Budget includes solid waste, resource recovery, and abandonment sites, in 1961-83, solid waste and resource recovery expenditures were discontinued; abandoned site efforts were transferred to Superfund program

years in all activities except research and development, which dropped by approximately 49 percent. As expected with passage of RCRA in 1976, expenditures from 1978 through 1981 showed the largest percentage increases in real and nominal terms, with total expenditures increasing by over 300 percent; abatement, control, and compliance by 290 percent; enforcement by over 1,000 percent; and research and development by over 300 percent. The generally downward trend in hazardous waste program expenditures in 1980-81 is primarily due to transfer of abandoned site activities to the Superfund program.

The across-the-board decreases in 1982 and 1983 expenditures reflect the budget cuts sought by the Reagan Administration. The largest cuts are in the enforcement budget, which by 1983 will have declined by 86 percent from 1981 levels. However, part of this decrease is due **to** EPA reorganization and the consolidation of permitting and enforcement activities and represents a transfer of expenditures to an all-EPA interdisciplinary office of legal and enforcement counsel.

The three general program activities are broken down into specific expenditure categories for the years 1981-84 in table 69 (unlike the previous table, this table is for authorized trends rather than obligations). The figures demonstrate the relative activity emphasis within the program and the probable changes

Table 69.–EPA Hazardous Waste Program Federal Administrative Costs for Fiscal Years 1981-84

Program component	1981 actual	1982 actual	1983 estimate	1984 estimate
Abatement, control, and compliance	$79,129.9	$73,472.8	***$8&2137***	***$79,213.9***
Regulations, guidelines, and policies	20,221.4	21,474.1	***24,115.7***	***20,592.3***
Financial assistance (grants to States)	39,672.4'	42,344.8[a]	***44,068.0***	***42,500.0***
Waste management strategies (regional offices and permits	14,385.5	9,556.4	13,030,6	16,121.6
Technical assistance	4,850.6	97.5	0.0	0.0
Enforcement	632&4	6,707.0	2,385.7	3,509.5
RCRA permit issuance[b]	3,259.7	3,191.5	(b)	(b)
RCRA enforcement	3,068.7	3,515.5	2,385.7	3,509.5
Research and development	2&301.3	29,246.9	34951.5	27,389.3
Scientific assessment	548.3	715,2	1,543.7	1,511.8
Technical information	157.1	178.9	(d)	(d)
Monitoring systems and quality assurance	9,398.1	6,734.3	7,283.0	7,016.4
Health effects	464.9	1,332.4	1,068.4	968.1
Environmental engineering techniques	17,160.3	16,930.5	18,078.6	13,251.8
Environmental processes and effects	572.6	3,355.6	4,977.8	4,641.2
Total hazardous waste program	$113,759.6	$110.578.4	$116,551.5	$110,122.7

[a]Includes solid wast, and resource recovery grants, discontinued in 1982-83. transferred to Waste Management Strategies in fiscal year 1983
[c]Part of the program effort transferred to Office of Legal and Enforcement Counsel in fiscal year 1983 Remainder includes technical enforcement efforts in regional offices
[d]Consolidated into intermedia programs in 1983

SOURCES 1981 actual: *Hearings on HUD Independent Agencies Appropriations for 1983 Before Subcommittee of the House Committee on Appropriatlens,* 97th Cong , 2d sess part 3 1982-84: U S Environmental Protectlon Agency *Justification of Appropriation* Estimates *for Committee on Appropriations FY1984,* January 1983

taking place over this period, Abatement, control, and compliance activities (regulation writing and analysis, grants to states, regional office funds to assist States, and public information programs) make up the largest portion of overall program expenditures, with the State grant program taking up the largest percentage share (34 percent of the total budget request in 1983), The technical assistance category which involves State, local, and public information programs was phased out in 1982.

Activities for waste management strategies implementation show a marked decrease from 1981-82. This category includes the costs of operating the regional EPA office responsibilities for hazardous waste. The decline in costs shown for regional activities is not reflected in 1983 totals because hazardous waste permit issuance costs, a separate activity under enforcement in 1981 and 1982, are included in the regional category as of 1983. Presumably, part of the reason for the decrease is due to an anticipated greater level of State-controlled programs.

The enforcement activity costs show the largest overall percentage decrease (80 percent) of any program area. This is somewhat misleading, however, since the hazardous waste permit issuance category was included, as of 1983, in the waste management strategies category, and enforcement responsibilities were in part shifted to the Office of Legal and Enforcement Counsel in another EPA program category. Again, the justification for this decrease is not clear; it may be a result of more streamlined administration, greater State responsibility, or it may reflect a reduction in the priority attached to enforcement.

EPA research and development expenditures have remained relatively stable from 1981 to 1983. But this total hides major increases in certain small budget activities, for example, the research on environmental impacts of hazardous wastes (environmental protection and effects). Extramural (external grant and contract) resources declined for activities directed toward waste-listing priorities (scientific assessment); providing guidelines for identifying wastes (monitoring and quality assurance); and the generation of technical data bases to support regulation development. Overall, however, expenditures increased substantially for scientific assessment, health effects, and environmental protection and effects. Expenditures

decreased significantly in monitoring quality assurance and environmental engineering technology, both large-expenditure activities.

State Administrative Costs

Under the RCRA strategy for a national hazardous waste management system, States may assume responsibility for regulating hazardous waste activities by developing and implementing regulatory programs that meet certain requirements. To assist the design of a workable system, and to make that system operational, EPA makes funds available to States. Although these grants can cover a large portion of State expenditures for hazardous waste regulation, each State must contribute a minimum percentage of its own funds to the program. This section presents estimates of State expenditures for developing and operating State hazardous waste programs under RCRA for selected States.

Data **Sources and Limitations.—The data** presented in tables 70 and 71 represent, in most part, actual and budgeted State expenditures for hazardous waste management programs. Obtaining State figures is difficult. Although OTA attempted to obtain this data from EPA, only Regions V, VII, VIII, and IX provided data. Further, only Region V could provide budget figures by activity. Some additional information came from a survey conducted by the Association of State and Territorial Solid Waste Management Officials.

Table 70.—Federal Financial Assistance Grants for Hazardous Waste Management by State, 1981.83
(thousands of dollars)

Region/State	1981	1982	1983 estimate[a]
Region 1:			
Connecticut	$358	$498	$420
Maine	150	209	176
Massachusetts	639	688	749
New Hampshire	150	209	176
Rhode Island	196	272	230
Vermont	150	209	176
Region II:			
New Jersey	893	1,241	1,046
New York	1,682	2,338	1,971
Puerto Rico	170	236	200
Virgin Islands	150	209	176
Region III:			
Delaware	150	209	176
Maryland	410	570	480
Pennsylvania	1,637	2,280	1,917
Virginia	319	532	449
West Virginia	554	770	650
District of Columbia	150	209	176
Region IV:			
Alabama	585	812	684
Florida	760	1,064	914
Georgia	511	710	599
Kentucky	520	723	609
Mississippi	205	285	240
North Carolina	589	819	690
South Carolina	440	612	516
Tennessee	771	1,073	903
Region V:			
Illinois	1,403	1,950	1,644
Indiana	924	1,284	1,082
Michigan	1,229	1,708	1,439
Minnesota	360	500	422
Ohio	1,637	2,275	1,917
Wisconsin	570	791	668
Region VI:			
Arkansas	202	282	237
Louisiana	984	1,368	1,244
New Mexico	150	209	176
Oklahoma	279	388	327
Texas	2,993	4,160	3,506
Region VII:			
Iowa	280	*389*	*329*
Kansas	265	*370*	*311*
Missouri	468	*651*	548
Nebraska	150	*209*	176
Region VIII:			
Colorado	305	423	357
Montana	173	239	201
North Dakota	150	209	176
South Dakota	150	209	176
Utah	192	267	225
Wyoming	150	209	176
Region IX			
Arizona	380	*528*	446
California	2,376	*3,301*	2,783
Hawaii	150	*209*	176
Nevada	150	*209*	176
American Samoa	150	*209*	176
Trust Territories	150	*209*	176
Guam	150	*209*	176
Region X			
Alaska	259	359	303
Idaho	166	231	195
Oregon	396	550	464
Washington	439	610	513
Total	$29,137	$41,700	*$35,226*

NOTE: Columns may not add to totals because of independent rounding.
[a]1983 grants reflect EPA fiscal year 1983 budget request, Congressional appropriations increased grants to State hazardous waste programs to $44 million in fiscal Year 1983 to maintain programs at approximate 1982 levels.

SOURCES: Environmental Law Institute, "Costs of Implementing Subtitle C of the Resource Conservation and Recovery Act," OTA Working Paper, October 1982; and U.S Environmental Protection Agency, State Grants Office, July 1982.

Table 71.—Fiscal Year 1982 Federal Support of State Hazardous Waste Programs

State	Percent of total program cost	State	Percent of total program costs
Alabama	75	Montana	86
Alaska	40	Nebraska	75
Arizona	77	Nevada	68
Arkansas	75	New Hampshire	39
California	43	New Jersey	24
Colorado	58	New Mexico	75
Connecticut	100	New York	58
Delaware	75	North Carolina	74
Florida	89	North Dakota	75
Georgia	75	Ohio	75
Hawaii	85	Oklahoma	66
Idaho	82	Oregon	79
Illinois	79	Pennsylvania	58
Indiana	75	Rhode Island	100
Iowa	62	South Carolina	60
Kansas	73	South Dakota	83
Kentucky	83	Tennessee	58
Louisiana	59	Texas	75
Maine	100	Utah	71
Maryland	65	Vermont	100
Massachusetts	48	Virginia	73
Michigan	69	Washington	73
Minnesota	41	West Virginia	75
Mississippi	59	Wisconsin	75
Missouri	64	Wyoming	n/a

SOURCE Thornas W Curtis and Peter Creedon, *The State of States Management of Environmental Programs in the 1980's*, Committee on Energy and Environment National Governors Association, June 1982

As an accurate reflection of State administrative costs, the data presented here have several notable limitations, First, with the exception of the 1981 data (in some cases), the dollar figures are actual and are for proposed activities rather than actual expenditures. To the extent that, for example, budgets are revised, funds not appropriated, or fiscal year money shifted forward, these figures can differ from actual expenditures. Second, most of the State cost figures are based on financial assistance grant requests to EPA, Since the grant proposals generally include only the minimum State contribution [i. e., that which the State needs to spend to comply with the terms of the grant), the data may be only lower bounds of actual expenditures if States later choose to obligate greater amounts to their programs.

Federal Financial Assistance Grants.—Actual and budgeted Federal grants to all 50 States are presented in table 70 for the years 1981-83. Total financial assistance program funds in any given year are allocated to the States based on a formula that considers: relative population (40 percent); relative amounts of hazardous waste generated (40 percent); relative number of generators (15 percent); and relative land area (5 percent). In addition, the regional administrators have some discretion to vary the actual amounts. (EPA has indicated that this allocation process will be changed.) The States use these figures in formulating their grant requests to EPA, Although the components of the grant requests vary among States, EPA has established working guidelines that call for two-four-person-work years per State for organization and management of interim and final authorization status, and approximate percentages for program activities: program management (15 percent); permitting (50 percent); and enforcement (35 percent). It is not clear how stringently these guidelines are followed in practice.

In theory, the Federal grants provide 75 percent of total State expenditures on hazardous waste program development and implementation. State funds may be drawn from general revenues or in some States from fees on generator, transporter or disposer activities. * In reality, State contributions vary depending on whether the State program is more stringent than that required by EPA and whether the State government is able or desires to appropriate additional funds. Table 72 shows the percentage of Federal support of State hazardous waste programs in 1982.

State Administrative Costs.—Table 71 provides budget expenditures for 22 States for the years for which data are available from the relevant sources. These figures represent State budget expenditures for hazardous **waste** regulatory programs. For example, the State's share of total expenditures ranged from 0.03 percent in Illinois in 1980 to 70 percent in Minnesota in

*For a review of State fee mechanisms, see: U.S. Environmental Protection Agency, *A Study of State Fee Systems for Hazardous Waste Management Programs*, Office of Solid Waste and Emergency Response, SW-956, July 1982. (Contrary to the generally optimistic treatment of fees and taxes as State funding mechanisms for hazardous waste activities in the EPA study, other studies indicate that limitations on the use of these mechanisms under State law present substantial impediments. Additionally, the amounts received from fees and taxes are only a small portion of the total administrative cost of State programs.)

Table 72.—State Expenditures on Hazardous Waste Program Activities for Selected States
(current dollars)

State	1980	1981	1982	# of Iss facilities
Arizona	$32,000	$137,300	$233,100	109
California	683,000	2,947,000	4,385,000	781
Colorado		254,840		97
Hawaii ., ...		6,900	15,000	29
Illinois ., . .	27,585	864,171	679,702	536
Indiana ., ...	99,523	326,044	428,120	312
Iowa.		75,725	237,739	110
Kansas		114,967	123,034	81
Michigan . . .		431,963	569,648	353
Minnesota	137,040	228,223	457,724	121
Mississippi		73,712	135,957	147
Missouri . . . ,		220,586	216,833	140
Montana ., . . . ,		39,833		27
Nebraska . . . ,		68,164	69,633	47
Nevada ., ..., ...	18,000	18,000	108,000	17
North Dakota		68,309		12
Oklahoma		92,950	580,480	123
Pennsylvania 1,968,000		3,369,600	**2,000,000b**	570
South Dakota, ...,..		42,332		11
Texas ,..., ,..., ,..		474,391	739,133	806
Utah. ,, ...,,.., ,,.		117,879		31
Wisconsin	375,051	464,083	236,822	198

[a] Number of facilities reporting under section 3010.
[b] Projected budget

SOURCES Environmental Law Institute, "Costs of Implementing Subtitle C of the Resource Conservation and Recovery Act," OTA Working Paper, October 1982, and EPA Regional Budget Office; Association of State and Territorial Solid Waste Management Officials, State Measurement *Needs Study* (Sept 30, 1981) It should be noted that the data for Pennsylvania, Oklahoma, Mississippi, and Texas appear to have been drawn from actual State budgets, while the other State data reflect the cooperative arrangement grant requests These latter figures may underestimate actual State expenditures

1983, In Wyoming, EPA is operating the entire State program. Most of the data is from Federal grant requests, which may or may not provide an accurate indication of actual expenditures.

Current Total National Costs for Hazardous Waste Control

Considering all spending on hazardous **waste** activities, including those in the public and private sectors and for both RCRA- and CERCLA-related efforts, OTA's estimate of total national expenditures for 1982 is $4 billion to $5 billion. Current combined Federal and State spending is probably in the range of $200 million to $300 million, The previously derived figure of $4 billion to $5 billion (in current dollars) in private sector spending for 1980-81 must be modified by two factors: 1) industrial activity and waste generation in 1982 is substantially lower than in 1980; and 2) private sector spending related to CERCLA activities is substantially greater in 1982 than previously, with a probable current level of $300 million to $400 million. Finally, although the current amount of waste generated is less than in 1980-81, the unit costs of waste management are higher. Thus, while waste generation may have been reduced by 20-30 percent, costs probably have increased by 10-30 percent, Considering the lack of accurate detailed figures, the estimate of $4 billion to $5 billion for total, national spending appears reasonable.

Part II: State Responses to Hazardous Waste Problems

Introduction

This section describes approaches to regulation of hazardous waste under 1) authorized State programs under the Resource Conservation and Recovery Act (RCRA), 2) State regulatory programs under State laws, and 3) alternative State programs.

The section also discusses various alternatives to "command and control" regulation of hazardous waste through such indirect measures as increased civil liability for damages through legal action, additional insurance and financial responsibility requirements, State trust funds, fees and taxes on hazardous waste activities, and other economic mechanisms.

State Programs Under RCRA

Under RCRA section 3006, **a** State may exercise primary responsibility for regulating hazardous waste instead of the Federal program administered by the Environmental Protection Agency (EPA) if the State program meets certain minimum Federal standards. While the final Federal program is being developed and State program applications are be-

ing reviewed, existing State programs that are substantially equivalent to the Federal program can continue in effect under interim authorization. The legislative history of RCRA indicates that Congress anticipated that the States eventually would assume primary responsibility for hazardous waste management. Two incentives are offered for State participation: first, the opportunity to administer a State program in lieu of a Federal program; and second, Federal financial and technical assistance for development and operation of State program activities and support of Federal programs. Federal RCRA grants can pay for up to 75 percent of State programs with the States contributing the remaining 25 percent of the costs. Current economic conditions and budgetary constraints may result in substantially reduced financial and technical assistance. These reductions could induce some States to decline to apply for authorization and to allow the Federal Government to finance and operate a Federal program within that State. However, a recent Association of State and Territorial Solid Waste Management Officials (ASTSWMO) survey indicated that only a few such instances might be expected if funding is maintained.[141] The current EPA administrator, Anne M. Burford, has announced an intention to move toward zero funding of State environmental programs. States would thus receive no Federal funds for operating programs that EPA would have to administer and pay for if the State did not.

As of February 1983, 34 States* and 1 territory had received Phase I interim authorization and 16 States were operating under cooperative arrangements or partial authorizations. Nine States had received Phase II authorization for component A, and many more States were moving to gain Phase II authorization to allow permitting. Still other States, such as Michigan, have announced their intention to apply instead for final authorization. At least one State (Wyoming) has decided not to apply for authorization at this time. with the promulgation of the land disposal regulations in July 1982, EPA announced that States could apply for final program authorization. The current status of State programs is summarized in table 73.

In implementing the State programs for RCRA authorization, at least 15 States have tied their programs to the stringency of the Federal program.[142] State programs can be classified in whole or in part according to these three types:

- State programs that are the same or "mirror image" of Federal program requirements;
- State programs that are "no less stringent than" or "at least as stringent as" the Federal program so that the Federal program provides the "floor" for State requirements.
- State programs that are "no more stringent than" the Federal program in which-the Federal program imposes a "ceiling" on State requirements.

Depending on how the State's legislative mandate is written, these restrictions on State programs can have different effects on a State's ability to deal with hazardous waste management in response to Federal action or inaction.

Under a "mirror-image" approach, as a result of statute or policy decision, a State regulatory program adopts the language of Federal regulations in whole or by reference. The State statute may provide, for example, that the State program will be "consistent and equivalent with" or "the same as" or automatically incorporate the Federal regulations.[143] States with a "mirror" approach depend on the adequacy of the Federal program.

[141] Association of State and Territorial Solid Waste Management Officials (ASTSWMO).

*For RCRA purposes "States" includes U.S. territories and the District of Columbia.

[142] The 15 States are: Colorado, Florida, Illinois, Iowa, Maine, Massachusetts, Montana, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Virginia, and West Virginia,

[143] Illinois hazardous waste legislation authorized the State agency to adopt the EPA regulations as the State program so that the State could quickly receive interim status authorization. Promulgation of standards under Illinois procedures would take a year or more to accommodate public review and comments. In adopting the Federal program by reference, the State did not anticipate that Federal minimum program standards later would be suspended.

99-113 O - 83 - 23

Table 73.—State RCRA Program Authorization

State	Current status	Status of applications if known
Alabama	Phase I Interim Authorization received 2/25/81	Phase II to be submitted 1/83
Alaska	Cooperative arrangement	Unsubmitted–scheduled to be submitted 9/83
Arizona	Phase 1—8/18/82	Phase n-Expected 1984-85
Arkansas	Phase I Interim Authorization received 11/19/82 Phase II received 4/19/82	
California	Phase I Interim Authorization received 6/4/81 Phase II received 1/1 l/83[a]	
Colorado	Cooperative arrangement	Unsubmitted–planned 7/83
Connecticut	Phase I 4/21/82	Pending Request to submit 10/30/82
Delaware	Phase I Interim Authorization received 2/25/81	Phase Ii—unknown
District of Columbia	Cooperative arrangement	Pending–to be submitted by 10/82
Florida	Phase I 5/10/82	Phase II submitted 8/12/82
Georgia	Phase I Interim Authorization received 2/3/81 Phase II received 5/21/82	
Hawaii	Cooperative arrangement	Unsubmitted
Idaho	Cooperative arrangement	Unsubmitted
Illinois	Phase I received 5/1 7/82	Will ask for full final authorization late 1983 or early 1984 and skip Phase II
Indiana	Phase I received 8/18/82	Unsubmitted Phase Ii—to be submitted 8/82
lowa	Phase I Interim Authorization received 1/30/81	Phase II submitted 3/l0/82
Kansas	Phase I received 9/17/81	
Kentucky	**Phase** Interim Authorization received 4/1/81 **Phase** I received 1/28/83	
Louisiana	**Phase** Interim Authorization received 12/19/80	Phase II submitted 10/82
Maine	**Phase** Interim Authorization received 3/18/81	Phase II to be submitted 1/83-2/83
Maryland	**Phase** Interim Authorization received 7/8/81	Phase II anticipated date A - 2/15/83 B - 5/15/83 C - 9/15/83
Massachusetts	**Phase** Interim Authorization received 2/25/81	Phase II to be submitted Fall 1982
Michigan	Cooperative arrangement	Pursuing Phase I—expect submittal 10/82
Minnesota	Cooperative arrangement since 6/79	Unsubmitted Phase I to be submitted 7/83 Phase II to be submitted 7/83
Mississippi	**Phase** I Interim Authorization received 1/7/81 Phase II received 8/31/82	
Missouri	Cooperative arrangement	Phase I & II submitted 9/82
Montana	Phase I Interim Authorization received 2/26/81[b]	Planned Phase II submittal 3/83
Nebraska	Phase I received 5/14/82	Phase II undecided as to all or part 9/82
Nevada	Cooperative arrangement	Unsubmitted
New Hampshire	Phase I receivedII/3/81	Phase II submitted 10/82
New Jersey	Phase I received 2/2/83	
New Mexico	Cooperative arrangement	Unsubmitted Phase 1, II A, B to be submitted 1/83
New York	Cooperative arrangement	Pending—Phase I submitted 1/12/82, Phase II not known
North Carolina	Phase I Interim Authorization received 12/18/80 Phase II received 2/26/82	
North Dakota	Phase I Interim Authorization received 12/12/80	Partial Phase I authorization only, MOUC for generators, treatment, transportation Phase Ii—unknown
Ohio	Cooperative arrangement	Pending Anticipate 11/82 Phase I Anticipate mid 1984 Phase II
Oklahoma	Phase I Interim Authorization received 1/14/81 Phase II received 12/13/82	
Oregon	Phase I Interim Authorization received 7/16/81	Phase II to be submitted 11/82
Pennsylvania	Phase I Interim Authorization received 5/26/81	Phase II to be submitted 12/82
Rhode Island	Phase I Interim Authorization received 5/29/81	Phase 11, Part A, to be submitted
South Carolina	Phase I Interim Authorization received 2/25/81 Phase II received 11/3/82	

Table 73.—State RCRA Program Authorization—Continued

State	Current status	Status of applications if known
South Dakota	Cooperative arrangement	Unsubmitted—will submit Phase I & II 1/84
Tennessee	Phase I Interim Authorization received 7/16/81	Phase II submitted
Texas	Phase I Interim Authorization received 12/24/80 Phase II received 3/23/83	Note 2 different programs TOWR[d]—2/82 received Phase I TOWR—3/83 received Phase II TDH—Phase I 12/80 TDH—Phase II 3/28
Utah	Phase I Interim Authorization received 12/12/80	Phase II submitted
Vermont	Phase I Interim Authorization received 1/15/81	Phase II submitted by 12/82
Virginia	Phase I received 11/3/81	Phase II submitted end 1982
Washington	Cooperative arrangement	Unsubmitted —submitted Phase 1, II A & B expect approval 1/83
West Virginia	Cooperative arrangement	Unsubmitted
Wisconsin	Phase I received 1/15/82	Phase II will go to final authorization 6/84
Wyoming	Cooperative arrangement	Unsubmitted
Puerto Rico	Phase I received	

[a]California is not authorized t. control storage or treatment in surface impoundments Part A only
[b]Montana received partial authorization for Phase I on 2/26/81 and complete Phase I authorization on 2/1 7/82
[c]Memorandum of Understanding.
[d]TOWR—Texas Office of Water Resources; TDH —Texas Department of Health.

SOURCE ASTSWMO Survey for OTA, Government Institutes, Inc , Hazardous Wastes *Facility Handbook,* 3d ed. (1982), prepared by Tom Watson, Ridgway M Hall, Jr , Jeffrey J Davidson, and David R Case; and OTA Staff research

According to testimony presented before a congressional committee, West Virginia's State legislation requires that the State rules be "consistent and equivalent with" the Federal program and must be revised to reflect changes in the Federal regulations. This approach has caused difficulties for the State during EPA's delay and suspensions in implementing the RCRA program. The regulated community in west Virginia, in commenting on proposed State regulations, has argued that, when there is an absence of Federal regulation due to suspensions, modifications, or delays in effective dates, the State cannot regulate in that area. This group argues that State regulation in areas where no Federal regulations are in effect would be inconsistent with the Federal program. West Virginia was challenged for proposing financial responsibility requirements for hazardous waste facility operators when EPA delayed the effective date of those Federal requirements. Thus, every time a void in regulatory coverage is created by a shift in Federal policy, States like West Virginia could be challenged on the appropriateness of State action in that particular area. If this argument is upheld in the courts, such States will have to wait until Federal policy is established to propose regulations.[144]

The "floor" approach reflects a State statute or policy decision requiring that the State program must be "at least as stringent" as the Federal program. For States with "mirror" or "floor" types of programs, a frequent concern has been that less stringent or relaxed Federal requirements could undercut State program efforts or might threaten State program approval. More stringent State requirements could be viewed as inconsistent with the Federal and other State programs or as a constraint on interstate commerce.

The third type of approach, the "ceiling" approach, can cause problems for implementation of State regulatory programs when there are delays or changes in the Federal program. "Ceiling" approaches generally involve a statutory requirement or policy decision that the State programs must be "no more stringent than the Federal program. " Ceiling States are

[144]Testimony of Norman Nosenchuck, AS TSWMO, at hearings on RCRA reauthorization before the Subcommittee on Commerce, Transportation, and Tourism, House Committee on Energy and the Environment, 97th Cong., 2d sess., Apr. 21, 1982.

dependent on the adequacy of the Federal rules. Changes in the Federal program, or suspensions of Federal standards, can be disruptive and could bring State program implementation efforts to a halt. To gain Federal approval, the State requirements must be as stringent as the Federal program, but to meet State law, the State regulations may not be more stringent than the Federal program. When finally in place, these programs should be effectively similar to "mirror" States; however, implementation during a period of frequent changes and reversals in the Federal program might be difficult or impossible.

Colorado's hazardous waste statute adopts the "ceiling approach" and requires that the State program be "no more stringent" than the Federal program. Colorado is currently developing a State RCRA program and is operating under cooperative arrangement. When EPA suspended the Federal ban on disposal of liquids in landfills, Colorado was suddenly left without any apparent authority under its State hazardous waste program to stop the planned landfilling of bulk liquids at the Lowry landfill while EPA "reconsidered" the Federal rule. The adequacy of the landfill operation was then under challenge by State and local officials. In response to public criticism, EPA reimposed the Federal ban. The Lowry dump was later ordered to remedy design failures.

North Carolina's "ceiling" provision also requires that State rules be "no more stringent than" the Federal regulations. Following an initial determination by the State Department of Natural Resources that the July 1982 EPA land disposal regulations were not stringent enough, the Governor imposed an emergency moratorium on the new landfill permit applications pending further study and public hearings.[145] If this review indicates that more stringent State land disposal standards are necessary, the State agency will petition the legislature to amend the State law.

[145] Hazardous Waste Report, vol. 3, October 1982.

Differences Between Federal and State Programs

During the interim authorization period, a State program can receive approval to regulate hazardous waste if the State demonstrates that its program is substantially equivalent to the Federal program and that it has adequate authority and resources to administer and enforce its program. This allows continuation of an existing State program even though it may differ from the Federal program requirements. Without interim authorization, generators, transporters, and treatment, storage, and disposal facilities (TSDFS) would have to comply with both Federal and State requirements. However, once Federal regulations are issued, the State cannot impose less stringent requirements on the same subject matter. Many existing State programs differ from the Federal program in significant ways. Examples of such variations are discussed below based on OTA's contractor surveys and informal communications from State agencies.[146] The primary areas of difference during the interim period are discussed below and in table 74.

Universe of Waste Regulated

The State program provisions for identification and classification of hazardous waste frequently will cover a broader or narrower universe of waste than the Federal program. The State program may include different waste lists or more characteristics for identifying hazardous waste, or its tests for establishing hazardous characteristics may cause more wastes to be included.

California controls a broader universe of waste than the Federal program, including many household, agricultural, and mining

[146] ASTSWMO Survey for OTA; Citizens for a Better Environment, "Approaches to Hazardous Waste Management in Selected States," OTA Working Paper, December 1982; National Conference of State Legislatures, *Hazardous Waste Management: A Survey of State Legislation 1982* (Denver, Colo.: 1982); and Michael S. Baram and J. Raymond Miyares, "Expanding the Policy Options for the Management of Hazardous Wastes," OTA Working Paper, Feb. 1, 1982.

Table 74.—Comparability of State Hazardous Waste Programs to Federal RCRA Program

State	Universe of waste	Generators	Transporters	Facilities
Alabama	RCRA	RCRA	Permit required	RCRA
Alaska	COOPERATIVE ARRANGEMENT			
Arizona	Equivalent, plus expanded reactivity critera	Annual reports Manifest copies to State	RCRA	Proof of financial responsibility; quarterly report
Arkansas	RCRA plus PCBS	RCRA by regulation	Permit and State manifest	RCRA
California	RCRA plus PCBS, metals, waste oil, mining waste, some recycled wastes, and more stringent toxicity criteria	Monthly reports for storage of less than 60 days	Registration, insurance, inspection	No exemptions in general. Special permits for disposal of certain high-hazard waste
Colorado	Some recycled/reused materials covered by RCRA excluded under State law	RCRA by statute	RCRA by statute	Disposal sites revert to State ownership at closure
Connecticut	RCRA by statute	N.E. manifest	License, insurance, bonding for hauler storage	Licenses; special requirements for dewatered sludges
Delaware	RCRA	Annual report, copy of manifest to State	License	Special ground water monitoring requirements
Florida	RCRA by reference	RCRA by reference; generator inspections	RCRA; inspections	RCRA by reference; liability insurance required
Georgia	RCRA by reference	RCRA by reference	RCRA by reference; permit required	RCRA by reference
Hawaii	COOPERATIVE ARRANGEMENT			
Idaho	COOPERATIVE ARRANGEMENT			
Illinois	RCRA plus special wastes, infectious hospital wastes	State manifest tracking system	Permit required; all shipments must be manifested	Prohibits landfilling unless facility has appropriate permit for each waste stream received
Indiana	RCRA	More stringent recycling requirements	Liquid industrial waste haulers must have a permit	RCRA
Iowa	RCRA by reference	RCRA by reference	RCRA by reference	Facility must establish financial responsibility consistent with risk
Kansas	RCRA	Must obtain disposal authorization from State before waste shipment	Registration, insurance; State approval of disposal requests before transport	Waste disposal must be authorized
Kentucky	RCRA by reference	Equivalent	Equivalent	RCRA by reference
Louisiana	RCRA plus State waste list; more stringent toxicity test	State manifest system	Permit required	Each TSDF unit permitted separately; liability insurance required; quarterly reports for onsite disposal
Maine	RCRA	N.E. manifest	License, insurance	Licenses
Maryland	RCRA Plus PCBS	RCRA	License	State permit
Massachusetts	RCRA plus waste oil, PCBS and radioactive waste	N.E. manifest	License. bond	License; liability insurance
Michigan	RCRA plus waste oil, additional toxic wastes, recycled wastes must be sold for gain	State manifest system	License	License; certificates of waste disposal, more frequent inspections
Minnesota	RCRA plus waste oil, recycled wastes, additional waste characteristics	Manifest returned to State; generator waste disclosure and management plan.	RCRA	Monthly reports for off site TSDFS
Mississippi	Equivalent	Equivalent	Equivalent	Equivalent
Missouri	Waste oil, State-listed wastes	Manifest returned to State; generator registration	License, insurance	Similar to RCRA, monthly reports, certification of recyclers
Montana	RCRA	RCRA	RCRA	RCRA
Nebraska	RCRA by reference	RCRA by references	RCRA by reference	Equivalent

Table 74.—Comparabillity of State Hazardous Waste Programs to Federal RCRA Program-Continued

State	Universe of waste	Generators	Transporters	Facilities
Nevada	**COOPERATIVE ARRANGEMENT**			
New Hampshire	**RCRA**	**N.E. manifest**	**License and insurance**	Pemit by rule
New Jersey	**RCRA plus waste oil, PCBS, recycled wastes**	**State manifest; manifest** copies to State	**License, operating** requirements	Monthly ground water monitoring reports
New Mexico	COOPERATIVE ARRANGEMENT			
New York	RCRA by statute		License	**R C R A**
North Carolina	RCRA	RCRA by reference	RCRA by reference	RCRA
North Dakota	RCRA	RCRA	RCRA	RCRA
Ohio	RCRA	RCRA	Transporter registration	RCRA
Oklahoma	RCRA plus PCBS, no exemption for recycled wastes	RCRA	Registration, manifest for recycled wastes	RCRA; storage requirements for recyclers
Oregon	No waste listing, regulate by waste characteristics	Manifest exemption for generators shipping less than 2,000 lb/load	RCRA	Substantially equivalent
Pennsylvania	Primary neutralization units	Quarterly reports; manifest to State; must get authorization from TSDF before waste shipment	License	Facility must authorize that it is capable of handling wastes before shipment
Rhode Island	9 waste characteristics	N.E. manifest		
South Carolina	No exemption for recyled waste; additional listed wastes; more stringent corrosivitv test	Manifest copies to States; must obtain authorization from TSDF before waste shipment	License; liability insurance Permit	Licenses; recycling regulated; quarterly reports for onsite TSDFS
South Dakota	NO PROGRAM			
Tennessee	"Equivalent	"Equivalent " " " " " "	Equivalent	Ground water monitoring wells approved by State geologist
Texas	RCRA plus halogenated hydrocarbons	RCRA	RCRA, hauler storage is regulated	RCRA, liability endorsement
Utah	RCRA, waiver for some recycled wastes	RCRA	RCRA	RCRA
Vermont	19 classes of hazardous wastes, additional wastes regulated	N.E. manifest	License	Permit by rule, recovery operations regulated
Virginia	RCRA	RCRA	Permit	RCRA
Washington	Larger universe of waste, mining wastes, and degree of hazard system for extremely hazardous wastes	RCRA	RCRA	Insurance; location restrictions for extremely hazardous waste facilities; buffer zones
West Virginia	COOPERATIVE ARRANGEMENT			
Wisconsin	RCRA, more stringent recycling provisions	Manifest to State, annual report	License	License, quarterly report, treatment at wastewater treatment facilities must be permitted
Wyoming	NO PROGRAM (EPA PROGRAM OPERATING IN STATE)			

NOTES: **RCRA** = State program is nearly identical to Federal regulations.
Equivalent = State program **is** equivalent, but not identical to Federal regulations.
RCRA by reference - State program adopted Federal regulations by reference.
— = not classified.

SOURCES: Robert A. **Finlayson,** "Should State **Rules** Be Tougher Than EPA's?" Solid Waste Management, vol. 25, pp. 78, SO-82, May 1982; *Hazardous* ***Waste Regulatory*** *Guide:* ***State Waste Management Programs*** **(Neenah, Wis.: J. J. Keller & Associates, Inc., 1982); and Citizens for a Better Environment,** *Approaches to Hazardous Waste Management in Selected States,* **OTA Working Paper, December 1982,**

wastes, along with drilling muds, sewage sludge, tannery waste with trivalent chromium, and cement kiln dust. Additionally, States may use methods of identifying hazardous waste that result in more wastes being classified as hazardous. The California waste extraction test, used to determine whether toxic constituents can leach into the environment, is generally considered to be more stringent than the test required by the Federal regulations.

Several States use a "degree-of-hazard" type of waste classification system.[147] California's waste classification scheme distinguishes between "hazardous" and "extremely hazardous" wastes. A separate disposal permit is required for each shipment and disposal of extremely hazardous waste. *

Exclusions and Exemptions From Universe of Waste

Many States have limited the small generator exemption to exclude fewer generators than the Federal exemption.[148] At least 20 states, including 5 of the nation's 10 largest waste generating States, have no small quantity exemption, more stringent requirements with regard to quantity than EPA's exemption, or do not allow hazardous wastes from small generators to be disposed of in sanitary landfills. Half of those States that have the same quantity cutoff as EPA have some form of reporting requirement to keep track of the exempted waste and its disposal, or to limit disposal options. One significant feature of some States limited small generator exemptions is that special provisions may apply to these generators that are not as extensive as for large generators. (Table 75 includes a summary of State small generator provisions,) Several States also include hazardous waste recyclers under State regulatory programs. This is frequently done because the States have experienced hazardous waste problems as the result of "recycling activities."

Licensing or Permitting of Waste Haulers

Special inspection and/or licensing requirements for hazardous waste are imposed in some States. They may also require special training for haulers. California requires permits for each shipment of hazardous waste. Liability insurance or bonding requirements for waste haulers are another common difference from the Federal program.

More Extensive or Detailed Manifest Requirements for Tracking of Hazardous Wastes.

California, New Jersey, and Michigan are examples of States with manifest systems that require more extensive information than the Federal manifest. States may require that the generator, transporter, and disposal facility operator each submit a manifest for the same shipment. This "paper" trail has two advantages: 1) manifesting of all hazardous waste makes any exits from the system more detectable, thus assisting in enforcement, and oversight, and providing an incentive for waste handlers to comply; 2) more extensive manifest information can assist the State in developing waste management plans and regulatory programs, although this aspect has not been implemented extensively in two States where it is used because of budgetary and practical limitations in processing the data.

More Stringent Facility Standards for TSDFS

During interim status and final authorization, States may impose more stringent requirements than the Federal program—e.g., a stricter standard for design of facilities.

By statute, since 1982, New Jersey has required installation of a system for leachate collection, interception, and treatment in all waste disposal facilities. New Jersey also restricts the siting of chemical waste facilities in or near river flood areas.

While recognizing that only certain wastes are technically or economically amenable to

"'OTA's technical memorandum on degree of hazard describes other State approaches to degree of of hazard waste classification systems. See U.S. Congress, Office of Technology Assessment, *Nonnuclear Industrial Hazardous Waste, Classifying for Hazard Management—A Technical* Memorandum, OTA-TM-M-9, November 1981.

*A description of the California degree-of-hazard classification system is presented in ch. 3.

[148]State small generator requirements are described more fully in OTA Staff Memorandum, "The RCRA Exemption for Small Volume Generators," July 1982,

Table 75.—Summary of State Small Quantity Generator Provisions

State	Small quantity cutoff	Difference from Federal standard
Alabama	+	May be required to submit plan to Board of Health before T/D (onsite or off site)
Alaska	100 kg/mo	Lower cutoff
Arizona	+	
Arkansas	+	Disposal in permitted hazardous waste facility
California	None	No small generator exemption
Colorado	+	None
Connecticut	+	1) 100-1,000 kg/mo; A.R. 2) hauler permit
Delaware	+	
Florida	+	No disposal in landfill without approval
Georgia	+	Some wastes classified as "special waste" require special handling under solid waste program
Hawaii	Cooperative arrangement	
Idaho	Cooperative arrangement	
Illinois	100-1,000 kg/mo exempt from all but manifest	All generators must manifest if produce more than 100 kg/mo special waste
Indiana	200 kg/mo	Disposal of small generator waste only in specified landfills
Iowa	+	—
Kansas	+ but manage 100-1,000 kg as regulated	TSDF operator recordkeeping on source, quantity, disposal of waste received
Kentucky	+	Small generators must register with State
Louisiana	Must petition for small generator exemption	Must petition—no plan to approve
Maine	+	Manifest for hazardous waste disposal in licensed hazardous waste facilities
Maryland	+	—
Maasachusetts	20 kglmo	20-1,000 kg/mo must use manifest, licensed hauler and licensed hazardous waste facilities.
Michigan	100 kg/mo	Must use licensed hazardous waste facility
Minnesota	None	Small generator must comply with all requirements except some papework
Mississippi	+	Guidelines for facility accepting small generator hazardous wastes
Missouri	100 kg/mo	Lower limit
Montana	+	—
Nebraska	+	Disposal in landfill requires department approval; and compliance with ground and surface water regulations
Nevada	CA	—
New Hampshire	100 kg/mo	Lower limit—requires packing, labeling and proper disposal
New Jersey	100 kg/mo	Lower limit
New Mexico	None	No quantity exemption
New York	1,000 kg/mo for M 100 kg/mo for State reg.	Regulate quantities between 100 and 1,000 kg/me; A.R. Disposal of hazardous waste at approved TSDF, correct packing, storing, inspection
North Carolina	+	—
North Dakota	+	Approval of department for disposal of other than household quantities
Ohio	+	Must use permitted facility
Oklahoma	+	—
Oregon	Varies by characteristic	Lower cutoff
Pennsylvania	+	None
Rhode Island	200 kg/infectious waste	No small generator exclusion—except infectious waste
South Carolina	100 kg/mo	Lower limit; State approval before disposal
South Dakota	+	Inspection of solid waste facility for small generator disposal
Tennessee	+	Small generator 100-1,000 kg must notify State
Texas	+	Requires written authorization for permitted facility to receive small generator waste
Utah		Manifest for all industrial Class I and hazardous waste; A.R. for TSDF
Vermont	220 lb	None
Virginia	+	Lower cutoff; State notification all generators; may require A. R.; disposal in subtitle D facility; requires CBC approval

Table 75.—Summary of State Small Quantity Generator Provisions—Continued

State	Small quantity cutoff	Difference from Federal standard
Washington	Varies by DOH classification	Regulate to 0.18 kg/mo for some waste mixtures
West Virginia	+	Notification and recordkeeping requirements for small generators
Wisconsin	+	> 100 kg/mo must make A. R.; provide results of waste determination; notice of delivery to disposal site operator
Wyoming	—	—
District of Columbia	+	All hazardous waste must be accompanied by manifest (will lower to 100 kg/mo in 1 year)

Key + Same as EPA rules (1,000/kg)
A.R Annual Report
CBC Case by Case
DOH Degree of hazard
T/D Treatment/disposal

SOURCE ATSWMO Survey for OTA (1982), OTA Staff Memorandum, "The RCRA Exemption for Small Volume Generators, " July 1982; J J Keller & Associates, Inc , *Hazardous Waste Regulatory Guide, State Waste Management Programs,* Neenah, Wis , September 1982

recycling, detoxification, incineration, or other treatment processes that are generally recognized as alternatives to landfilling, and that even these processes will result in some residues that will be landfilled, several States are moving toward limiting land disposal of certain wastes. These bans are being implemented to encourage the use of alternative treatment and disposal options, to avoid the use of what could become scarce capacity in suitable land disposal facilities, and to reduce hazards to the public and the environment from land disposal.

Standards for generators and hazardous waste TSDFS under State programs have some interesting variations that impose more stringent requirements or incentives to promote alternatives to landfilling. By far the most stringent are the restrictions on land disposal of hazardous wastes. These range from outright bans on certain land disposal practices to requirements that a generator demonstrate that there are no feasible alternatives to landfilling.

New York and California are currently developing limited bans on landfilling of certain hazardous wastes. California's ban is scheduled to be implemented in stages starting in 1983 with restrictions on landfilling of cyanides and toxic metals above certain concentrations, acid wastes, PCBS, and extremely hazardous liquid organic wastes. New York has recently denied two land disposal permits on the ground that the applicants failed to provide adequately for technologies that offer alternatives to landfilling. Alternatives include the requirement of pretreatment of liquids such as neutralization, detoxification, solidification, or encapsulation before land disposal. Michigan bars landfilling of any liquid wastes without some form of pretreatment to solidify the waste or remove it from the waste stream. Governor Thompson of Illinois has announced his intention to reintroduce legislation, which failed in 1982, that would ban landfilling of hazardous waste. (Illinois already has a statutory provision that restricts land disposal of hazardous waste after 1987 unless the generator demonstrates that there is no technologically feasible and/or economically reasonable alternative to landfilling.) Illinois requires a separate waste stream permit for each waste stream received from a generator for each facility in addition to the basic facility permit. Similarly, Arkansas provides that no "high hazard" waste can be landfilled if it could be destroyed by incineration, and further establishes a rebuttable presumption that incineration is feasible unless demonstrated otherwise,

Other more stringent regulatory requirements may consist of more detailed and extensive permit and licensing reviews for land disposal facilities than for recycling or treatment facilities. New York requires each major facility to prepare a 10-year management plan that would include a description of steps the facility is taking to promote the development and use of alternative technologies to reduce waste volume and toxicity and short- and long-term environmental emissions (air, water, and solid waste). Michigan requires

that construction permit applications for new facilities include an environmental assessment evaluating the effect of the proposed facility on air, water, and other resources, and an environmental failure mode assessment.

New York requires an onsite environmental monitor (State agency inspector) at certain solid waste disposal facilities that pose potentially serious environmental damage or public health threats. The staff and equipment needed for onsite environmental monitors are to be paid by the operator. Depending on the type of facility and the nature of hazard posed, the State could require full-time, part-time, or temporary onsite monitors. Certain facilities would always be required to have monitors, including commercial-secure land burial operations, commercial hazardous waste incinerators, and commercial treatment facilities handling acutely toxic wastes. Some onsite treatment or disposal facilities which manage acutely toxic hazardous waste are also likely to require onsite monitors,

Several States do not vest regulatory responsibility for all aspects of hazardous waste activities in a single agency. In both Texas and California, the administration of the State RCRA program is split between two agencies. In Minnesota, the State Pollution Control Agency shares hazardous waste regulatory authority with the county governments.

Other State Regulatory Programs

EPA does not require that a State enact specific RCRA-type legislation controlling hazardous waste in order to gain program approval. States may obtain authorization based on their regulatory and enforcement powers under any State laws that are adequate to control hazardous waste. States have controlled the management of hazardous wastes or the effects of waste disposal under a variety of laws dealing with solid waste, air and water pollution control, wildlife protection, hazardous substances, siting, land use, and public health and safety. For example, State laws, which may be later incorporated into the EPA authorized State hazardous waste program, may limit the disposal of certain types of hazardous waste, or may limit the disposal or treatment of hazardous wastes in certain areas-–such as residential or coastal areas—or within a certain distance of rivers, and other navigable waters or flood zones. State law may require that the generator or facility operator demonstrate that there is no economically and/or technically feasible alternative to land disposal or incineration. State laws may require additional permits for hazardous waste facilities besides those required by RCRA and other applicable Federal permits.

New York is moving to regulate air emissions from the burning of waste oil and hazardous waste mixtures under State air pollution control legislation. California's Air Resources Board monitors the air quality impacts of hazardous waste activities.

Some States have passed special legislation to regulate the selection and approval of sites for new hazardous waste management facilities (see table 76). Some of these siting laws establish siting commissions which are independent of the hazardous waste permitting agency and can impose additional, and more stringent siting and land use controls than the State regulatory program.

Several States are moving toward establishing a preferred hierarchy of' hazardous waste management techniques in their siting programs. Minnesota's waste management plan gives highest priority to alternatives to land disposal including: industrial process modification to reduce or eliminate waste generation; recycle, reuse, and recovery methods; and conversion and treatment technologies to reduce the hazard of the waste in the environment. Minnesota also requires the State Waste Management Board to consider technologies for retrievable storage of hazardous waste for later recycling, reuse, recovery, conversion, or treatment. States may require special siting board approval or advanced submittal of waste facility siting proposals for consideration as part of a comprehensive State waste management plan and may condition permit approval on compliance with other legal requirements. These

Table 76.—Summary of State Hazardous Waste Facility Siting Programs

	AZ	CO	CT	FL	GA	IL	IN	IA	KS	KY	ME	MD	MA	MI	MN	NE	NH	NJ	NY	NC	OH	OR	PA	RI	TN	UT	WA	WI
Siting decision by:																												
Existing agency	X															X						X						
Siting board			X	X	X		X	X	X	X	X	X		X	X			X	X	X	X		X		X	X		
Local group		X				X							X				X							X			X	
Impasse resolved by:																												
State preemption	X		X	X		X	X	X	X	X		X		X	X		X	X		X	X	X	X		X	X		X
Mediation arbitration													X											X				
Local veto		X														X			X									X
Financial assurances:																												
Trust funds	X		X	X					X	X				X						X	X	X	X		X			X
Financial responsibility mechanisms		X	X	X	X		X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X		X
Other				X				X		X																		
Other assurances:																												
Inspections	X	X	X	X		X			X	X		X	X	X				X			X	X	X	X	X		X	X
State ownership	X									X		X										X						X
Contingency plans		X								X		X	X	X				X						X				X
Future use restricted	X	X	X						X	X			X	X				X		X	X	X	X	X				X
Incentives and compensation:																												
Local taxes or fees		X	X		X		X			X	X		X				X	X		X				X			X
Tax prepayment													X															
Other			X				X											X			X			X				

SOURCES: National Conference of State Legislatures, *Hazardous Waste Management: A Survey of State Legislation, 1982* (Denver, Colo.: 1982); Citizens for a Better Environment, *Approaches to Hazardous Waste Management in Selected States*, OTA Working Paper, December 1982; and OTA Staff research.

may or may not be integrated with RCRA authorized programs. Table 77 summarizes State options to promote alternatives to land disposal of hazardous waste.

Nonregulatory Options for Management of Hazardous Waste

Regulation is one approach to dealing with the problems that hazardous waste pose to human health and the environment. Control over hazardous waste management is established directly through standard setting, permitting, and civil and criminal enforcement. Through direct regulation, costs are internalized. Hazardous waste generators, transporters, and disposers are forced to pay the costs of responsible management of hazardous waste for protection of human health and the environment through compliance with regulatory requirements.

Table 77.—Summary of State Options for Encouraging Alternatives to Land Disposal of Hazardous Waste

State	Fee structures	Tax incentives	Bonds	State ownership	State waste management plan	Regulatory exclusions	Fast track permitting	R&D programs	Land burial restrictions
Alabama	X								
Alaska									~
Arizona	X			x					x
Arkansas	X								~
California	X				x			x	x
Colorado									
Connecticut	X					x			
Delaware									
Florida	X		X						x
Georgia		X	x	x					
Hawaii									
Idaho									
Illinois	X	x	x					x	x
Indiana	X	x	x			x			
Iowa									
Kansas	X						x		
Kentucky	X			x			x		x
Louisiana	X								
Maine	X								x
Maryland	X			x					
Massachusetts	X				x				x
Michigan	X	x			x				x
Minnesota		X			x		x		
Mississippi	X		X						
Missouri	X	x		x		x			x
Montana									
Nebraska	X	x							
Nevada	X								
New Hampshire	X								
New Jersey	X				x	x		x	
New Mexico									
New York	X	x						x	x
North Carolina	X	x	x	x					
North Dakota									
Ohio	X								
Oklahoma									
Oregon	X	X							
Pennsylvania									X
Rhode Island									
South Carolina	X								X
South Dakota									
Tennessee	X					X			X
Texas						X			X
Utah									
Vermont									
Virginia									
Washington				X					X
West Virginia	X								
Wisconsin	X	X							
Wyoming									

SOURCES: ASTSWMO, Survey for OTA, 1962; Citizens for a Better Environment, "Approaches to Hazardous Waste Management in Selected States," OTA Working Paper, December 1962; National Conference of State Legislatures, *Hazardous Waste Management: A Survey of State Legislation, 1982* (Denver, Colo.: 1982); The Council of State Governments, *Waste Management in the States* (Lexington, Ky.: 1981); Fred C. Hart Associates, inc. (for EPA) *A Survey of State Fee Systems for Hazardous Waste Management programs,* EPA contract No. 66-01-5133, May 25, 1962; National Conference of State Legislatures, *A Survey and Analysis of State Policy Options To Encourage Alternatives to Land Disposal of Hazardous* Waste (Denver, Colo.: July 1961); Michael S. 13aramand J. Raymond Miyares, "Expanding the Policy Options for the Management of Hazardous Wastes," OTA Working Paper, Feb. 1, 1962; and OTA Staff research.

Other institutional mechanisms can induce hazardous waste handlers to adhere to minimum standards of care and to bear the costs of proper hazardous waste management or to suffer the economic penalties of improper hazardous waste management, thus internalizing costs, Nonregulatory approaches that are in use or under consideration by various States include expanded liability under common law and statutory provisions, insurance requirements, hazardous waste taxes and fees, trust funds, and State superfunds, State hazardous waste facility siting programs discussed previously also have nonregulatory aspects.

These alternative approaches are directed at deterring improper waste management and promoting sound alternative practices by requiring that responsible parties bear the costs of their actions. Direct incentives such as tax exempt financing, preferential treatment of alternative technologies, fast track permitting, State ownership of waste facilities, and State research and development programs are other nonregulatory approaches.

These nonregulatory approaches are independent of the regulatory system. They can serve as an effective and complementary part of a State's comprehensive response to hazardous waste problems.

Liability

Increased liability for hazardous waste activities could encourage more responsible and environmentally sound management practices, Although there are only a few cases in which damages for improper or illegal hazardous waste disposal have been imposed, the legal trends point clearly toward substantial damage awards in future hazardous waste cases. The prospect of significant liability from past and present activities is influencing State and industry action. In the meantime, the legal barriers to winning lawsuits for damages or other relief for the impacts of hazardous waste activities are being lowered through judicial decisions and State legislation.

Government officials, private attorneys, and insurers have one message for generators, transporters, and facility operators: the risks of substantial financial losses from liability for unsafe hazardous waste activities are increasing rapidly. The prudent business manager should take every available action to reduce that risk by initiating better waste handling practices, or by avoiding generating and disposing of hazardous waste where possible, and by planning now to meet any future liability. If increased liability is to be an effective incentive for generators and disposers to seek alternative hazardous waste management options to remove the risks to human health and the environment (and to their financial well-being), it is clear that substantial legal liability must be seen as a probabIe, costly, and swift result of unsound waste management activities. Recent legal developments have mot-cd in that direction.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) imposes liability for the costs to government agencies for cleanup, remedial action, and emergency response and for damages to natural resources, Other Federal laws impose fines and punitive damages for violations of regulations or statutory provisions and several recognize citizen suits as alternative enforcement mechanisms. Many States have similar laws, Except for limited coverage under the CERCLA Post-closure LiabiIity Trust Fund, however, damages for injury to private persons or property are not now covered by CERCLA or RCRA. Provisions dealing with liability for injuries to third parties were dropped as part of the compromise to pass CERCLA and were deferred for further study, The CERCLA 301(e) study group recently recommended adoption of broad tax-based personal injury and property damage compensation measures for hazardous waste activities.[149]

Lawsuits involving hazardous waste activities can be expected to increase as more sites

[149] *Injuries and Damages From Hazardous Wastes—Aria lysis and Improvement of Legal Remedies:* A *Report to Congress in Compliance with Section 301(e) of the Comprehensive Environmental Response, Liability, and Compensation Act of 1980 (Pub lic Law 96-510) by the Superfund Section 301(e) Study Group,* 97th Cong., 2d sess., 1982, 2 vols (hereafter 301(e) Study Group report).

are discovered and the public awareness of dangers from exposure to hazardous chemicals grows. These lawsuits can seek monetary damages and/or injunctive relief. The amounts sought by private parties in such lawsuits can be staggering. (One class action case involving hazardous waste dumping in Tennessee is seeking damages of $2.5 billion.) Courts can also award punitive and/or exemplary damages in appropriate circumstances. A court order or injunction may compel a responsible party (e.g., a generator, transporter, or facility operator) either to take a specific action (i.e., remove the wastes, clean up the site, provide an alternative water supply, provide long-term health monitoring and care for exposed persons) or to refrain from taking an action (e. g., no more dumping) and to bear all the costs entailed.

Theories relied on for recovery for injuries and property damage from hazardous waste management are based on common law causes of action, sometimes expanded by statute, and include negligence, strict liability, nuisance, and trespass.

Legal Remedies for Injuries and Losses From Hazardous Wastes

The traditional common law remedies for personal injuries and property damage are available in hazardous wastes cases.[150] Negligence and strict liability are directed at compensating injuries due to the actions of another. private nuisance and trespass are intended to protect possessor interests in land against unreasonable interference from the activities of another. Public nuisance actions seek to protect the broader public interest from unreasonable land uses. Each of these theories has aspects that make it an appropriate mechanism for redress in some cases and not in others. In some instances, state statutory provisions have modified or replaced these common law remedies to ease some of the recurring barriers to recovery. Frequently, lawsuits involving hazardous wastes will include several claims reflecting different theories of liability. A consequence is that the court's decision may be based on a blending of the various concepts behind toxic torts and may not give a clear indication of the precise theory invoked to provide recovery.

Negligence .—Negligence is commonly defined as a failure to conform one's conduct to a legally recognized standard or duty of care. An action for negligence is brought to recover compensation for personal injury and for property damage from the negligent party. To prevail in a negligence suit, the plaintiff must prove four elements:

1. the existence of a duty or obligation recognized by the law to conform to the standard of conduct for the protection of others against unreasonable risks;
2. a failure by the defendant to conform his or her conduct to the required standards;
3. a causal connection between the defendant's conduct and a resulting injury to the plaintiff; and
4. an actual injury or loss.[151]

The standard of care by which the defendant's conduct is measured in negligence cases may be established by prior judicial decisions, statute, regulation, or by analogy from other cases with similar circumstances. In negligence cases of first impression, the standard of care will be what the jury believes a reasonable or prudent person would do under similar conditions or circumstances. A generator or facility operator might be held accountable for injuries on the premise that it was negligent not to have investigated the effects of various disposal options available and selected an option reasonably designed to avoid the type of harm suffered by the plaintiff. Alternatively, a generator or operator's failure to warn of the hazards posed by the wastes might be considered negligent, especially if the plaintiff might have avoided the risk had he been aware of it. Many generators do not dispose of their own wastes, yet they might be held liable for the

[150] Those interested in a more detailed discussion of liability theories for damages from hazardous waste activies and of barriers to recovery under these remedies should consult the report of the CERCLA 301(e) study group.

[151] W. Prosser, *Handbook of the Law of Torts*, 143 (4th ed. 1971).

improper disposal actions of the facility to which their wastes were sent for failing to anticipate or take precautions against the negligent actions of others. (The liability provisions in Superfund make generators liable for the Government's cleanup costs for improper or unsafe disposal resulting in release of hazardous substances without regard to fault—i.e. whether or not the generator exercised due care.)

Some formulations of the negligence standard use the concept of a duty to protect others against an "unreasonable risk" of harm. An unreasonable risk is defined as one of such magnitude as to outweigh what the law regards as the utility of the act or the manner in which it is done. In hazardous waste cases, the community's need for hazardous waste disposal might thus be weighed against the requirement to protect against unreasonable risks, and the risks posed by the facility may be found not to be unreasonable. In some States, however, statutory provisions or common law principles have established that violation of certain statutes or regulations constitutes negligence per se.

While recovery under a negligence theory in hazardous waste cases is an available option, establishment of a duty of care is only part of the case. In some jurisdictions, it will be necessary to show that the defendant knew, or should have known, of the risks involved at the time of the disposal because of the legal principle that there is no duty to avoid or warn of unknowable risks. Given the insidious and long-term consequences of hazardous waste disposal, the dangers posed by the defendant's action may not have been foreseeable based on the state of knowledge at the time. Another difficulty in negligence cases, and in most hazardous waste cases, will be the evidentiary problem of proving: 1) a connection between exposure to a particular waste, chemical substance, or mixture and the injury suffered; and 2) that the chemical originated in the defendant's waste or disposal facility. Often the injury and the resulting lawsuit arise many years after the disposal or exposure, thus adding more difficulties in locating parties, witnesses, and establishing a causal connection.

Strict Liability .-Negligence actions are based on the premise that the defendant failed to take reasonable care to protect others, but some activities are so inherently or abnormally dangerous that injuries or losses can occur even when the defendant exercises the utmost care. To deal with such circumstances, the strict liability theory was developed. Under strict liability, anyone who engages in certain risky activities is legally responsible without regard to fault (i.e., strictly liable) for any injuries resulting from those activities. Many of the early cases involved blasting and aerial spraying. Whether hazardous waste management can be seen as one of the categories of activity that are subject to strict liability under common law principles is not yet clear.[152] Several States have by statute imposed strict liability on hazardous waste activities and the standard of liability for cleanup of hazardous waste releases in the Clean Water Act, section 311, and CERCLA cases is strict liability.

There are various formulations of the strict liability standard recognized in American courts. Some jurisdictions hold that strict liability is absolute without regard to the degree of care exercised. Other jurisdictions recognize some limited defenses that allow a balancing of interests. A third formulation bases strict liability on the magnitude of the risks involved and the relative ability of the parties to sustain the risks of loss.[153] Activities covered by strict liability differ from those that are considered as negligence or public nuisance in that they have some social utility, even though a serious risk is imposed which is not a normal incident of everyday life (so that the plaintiff would be unlikely or unable to avoid the risk). Strict liability awards compensation for the injuries and losses suffered. Like negligence, it is invoked "after the fact, " i.e., after the injury has occurred. Strict liability eases the plaintiff's

[152] Strict liability for hazardous waste activities was found in *Department of Transportation v. PSC Resources, Inc., 175* N.J. Super 447, 419 A2d, **1151** Div. 1980). But a different conclusion was reached in *Elwell v. Petro Processors, Inc.,* 364 So. 2d 604 [La. App. 1978), cert. denied, 336 So. 2d 575 (La. 1979).

[153] See so I (e) study **group** report at 1,2. See also *New Jersey* v. *Ventron Corp,* 182 N.J. Super. 210 (App. Div. 1981) where current and past owners of a mercury processing plant were held liable for costs of cleaning up the wastes dumped at the site and the contamination of surface waters.

burden of proof somewhat by eliminating the need to show "fault" and by limiting available defenses. However, the plaintiff still faces substantial evidentiary problems in demonstrating a causal connection or nexus between the plaintiff's injury and the defendant's hazardous waste activities.

Nuisance.—Nuisance, in essence, is a common law remedy that can be invoked whenever one's use of land unreasonably interferes with another's use and enjoyment of a right. This right may be either a possessor interest in land in private nuisance actions, or a more general right of the public (e. g., to be free from unsafe conditions or from unwarranted air, water, or noise pollution) in public nuisance actions. Public nuisance and private nuisance actions are distinct in origin and in the rights protected. However, in both actions, the courts frequently impose a balancing test that weighs the relative social or economic utility of the activity involved against the rights of or harm suffered by the complaining party. In some hazardous waste cases, this balancing of the equities may recognize the social necessity of hazardous waste facilities and deny or limit the monetary or injunctive relief sought by the plaintiff as abatement of the nuisance.[154]

A private nuisance is an unreasonable interference with a person's interest in the private use and enjoyment of land. The person bringing the nuisance action must be the one whose possession of the land is impaired, i.e., the owner or tenant. Private nuisance differs from trespass in that the interference with the use or enjoyment of the property must be unreasonable and significant. under modern case law, to be unreasonable, the nuisance must be shown to be the result of the defendant's negligent, intentional, or ultrahazardous activities. To be significant interference, it must be more than the consequences of ordinary community activity. The private nuisance theory adopted by the Restatement (Second) of Torts would require a court to balance the "gravity of harm" suffered by the plaintiff against the utility of the defendant's conduct in determining whether the conduct was unreasonable.[155]

Nuisance actions have been successfully pursued in environmental pollution cases.[156] Actual damage or harm to the plaintiff's land or a resulting injury need not occur for a nuisance to be found. The threat of personal discomfort or disease from a hazardous waste facility or the prospect of future losses from the impacts of the facility's activities creates an interference with the use and enjoyment of property. This threat is a sufficient basis for the issuance of an injunction requiring removal of the nuisance. Proposed hazardous waste facilities similarly could be enjoined under a theory of prospective nuisance—that the facility if built would cause interference with the plaintiff's use and enjoyment of land.

Nuisance actions are not limited to the person who created the nuisance, (e.g., the facility operator or the anonymous dumper of toxic wastes). An innocent purchaser or owner of land on which an artificial condition creates a nuisance can be held liable if the new owner fails to take action to abate the nuisance within a reasonable period of time after he discovers or should have discovered the condition. Unlike the plaintiff who must be in possession of the land affected, the person who created the nuisance but who transferred or sold the property on which it is located can be sued in a nuisance action.

Public nuisance is defined as an unreasonable interference with a right common to the community at large. The conduct is considered unreasonable and, thus, a nuisance if its utility does not outweigh the gravity of the harm it produces. This test allows a rough balancing of the benefits and burdens from a particular activity. Every state has a statutory provision authorizing suits to abate public nuisance.[157]

[154] *Boomer* v. *Atlantic Cement CO., 72* Misc. 2d 834, 340 N.Y. S. 2d 9 (1972).

[155] *Restatement (Second) of Torts*, §827.

[156] Private nuisance *actions* are appropriate for the interference with use and enjoyment created by noise, by odors, and other air pollution, by water pollution and the contamination or pollution of subsurface waters. See cases cited by 301(e) study group at 105.

[157] 301(e) study group report, vol. II at 171.

Public nuisance actions differ from private nuisance actions in that the right to be protected is one enjoyed by the public at large and is not tied to interest in publicly owned land. The cause of action arises out of a defendant's unreasonable use of his land for activities that interfere with this public right. Public nuisance actions are commonly brought by public officials, however, many State public nuisance statutes also authorize citizens to bring these actions on behalf of the public. Public nuisance actions are generally directed at obtaining injunctive relief for abatement of the nuisance. Private damages are not usually recoverable by private citizens asserting public nuisance claims unless it can be shown that the damages they have suffered are in addition to and distinct from the general harm to the public interest created by the nuisance. Many State laws make the violation of statute or regulation, such as regulations governing hazardous waste facilities, a public nuisance. A public nuisance case may also require the weighing of equities before finding a nuisance. As in the private nuisance case, the fact that a facility is permitted is not an absolute defense, although it may be raised to show public recognition of the utility of the activity.

A private or public nuisance action can be pursued to enjoin the defendant from entering into an activity that will constitute a nuisance, or from continuing a nuisance already begun, or to seek compensation for the damages suffered. Damages can be recovered for harm or loss to the plaintiff's property and for any personal injuries suffered as a consequence of the nuisance. A single nuisance action may seek more than one remedy.

Generally, a prerequisite to injunctive relief is a finding by the court that the harm to the plaintiff is irreparable, i.e., it cannot be remedied by the payment of compensation, Of course, payment of compensation may not be a complete remedy where the nuisance and its harms are of a continuing nature.

Other remedies may also be fashioned by the court in a nuisance action, such as a combination of damages and an injunction, a delayed injunction, or an order for affirmative action. A delayed injunction, which does not take effect until a specified period of time has passed, may prove useful in developing technology areas, where all possible adverse effects are not known or the technology to minimize potential risks is unavailable at present. The delay could give the defendant an opportunity to consider various alternatives to cure the nuisance. Through the use of a remedy such as the delayed injunction, the courts can effectively bring pressure to force improved technology and to minimize potential risks otherwise imposed by hazardous waste management.[156]

Trespass.—A right of action in trespass arises out of the defendant's interference with the plaintiff's right to the exclusive enjoyment of his property. Originally, under common law, recovery under trespass provisions was absolute upon showing of an actual invasion of the plaintiff's property by the defendant or by an object or substance under the defendant's control. Trespass by environmental pollution would seem to be another possible common law remedy in hazardous waste cases. However, most State courts today require that the invasion be shown to be intentional, negligent, or the result of an ultrahazardous activity or of an abnormal or unreasonable use of property.

Injuries caused by the defendant's negligence or high-risk activities might also be remedied by suing on a negligence or strict liability theory instead of in trespass, since the defendant's conduct is the major factual issue in all three cases. However, in some States, the longer statute of limitations applicable to trespass cases may be advantageous in some circumstances.

A trespass is "intentional" under the general rule adopted in the Restatement (Second) of Torts if the defendant acted purposefully to enter, lead, or set an object in motion that almost certainly would come to rest on the

[158] In *Village of Wilsonville v. SCA Services,* as a result of a public nuisance suit, a State-permitted hazardous waste facility was ordered closed with all wastes to be exhumed and removed from the dump site, and the site decontaminated. Compliance with the site closure and cleanup order was phased to allow completion of necessary preparation studies. 77 Ill. App. 3d 618,396 N.E. 2d 552 (1979), affd No. 10052885 (Ill. May 22, 1981).

plaintiff's property.[159] Except in the case of "midnight dumpers, " the plaintiff faces a difficult burden in showing that the defendant intended that toxic waste constituents would migrate onto the plaintiff's property. Intentional action might be shown if the defendant knew or should have known that rain, wind, or surface runoff would carry hazardous substances onto the property. Whether land burial of hazardous substances with subsequent migration of toxic constituents in ground water would be considered an intentional trespass is uncertain. Several commentators have concluded that existing precedent would not support such a finding because it would be difficult to demonstrate: 1) that trespass with ground water transport was an "almost certain" result of land burial and 2) that the defendant knew or should have known of such a probable result .[180]

Trespass actions can result in a court order barring further trespass and requiring removal of the invasion and/or the recovery of damages for injuries or property loss resulting from the invasion. There have been trespass cases involving air and water pollution where substances have migrated onto the plaintiffs property from the defendant's activities.[181] A major difficulty in trespass actions in some jurisdictions is that the courts have not recognized a landowners's right to pure, uncontaminated percolating ground water, so that even if an intentional invasion were shown, it might not result in liability. As in private nuisance actions, trespass cases require that the complaining party be in possession of the property affected. In trespass, there is no balancing of the plaintiff's exclusive right to the use and enjoyment of his property against the social utility of the defendants activity or the relative costs to the parties.

Barriers to Recovery.—In bringing these actions, plaintiffs face many procedural and evidentiary problems. There are, as well, substantial difficulties in gaining expansion of established legal theories to cover hazardous waste cases, although a clear trend exists. Among the common problems that are anticipated in these cases are the statute of limitations, proof of causation, identification of responsible parties, and the availability of such theories as joint and several liability, or enterprise liability in cases involving multiple defendants.

Statute of limitations: The local rule that lawsuits must be filed within a specified period of time after the act that caused the harm, or the discovery of the injury, can pose a barrier to private damage actions involving long-term chemical exposure, abandoned waste sites, diseases with long latency periods, or situations where contamination of hazardous waste is not readily apparent. In such cases, victims may be barred from filing a lawsuit before they are even aware of their injuries. This difficulty is reduced somewhat in States that have adopted a discovery rule that starts the period during which a lawsuit must be filed when the plaintiff discovers the injury.[182]

Proof of causation: The Superfund section 301(e) study group concluded that the burden on the plaintiff of proving that the injuries suffered were the result of the defendant's conduct may be a formidable problem in suits involving hazardous waste.[183] Developing the evidence necessary to demonstrate liability may involve expensive and detailed scientific testing and presenting of expert testimony in several different fields. The costs of preparing a successful case may be so steep that only those cases involving potentially high damage awards would warrant incurring the expense under the prevailing practice of contingent fee arrangements for the plaintiff's attorneys.

Identification of responsible parties: In some cases, the victims may encounter difficulty in determining which parties to sue. Where the possible defendants can be identified, many years may have elapsed since waste disposal.

[159] *Restatement (Second) of Torts*, §§158, 165 *(1965)*.

[180] David, "Groundwater Pollution: Case Law Theories for Relief' 30 MO. L. Rev. 117 (1974): Davis, "Theories of Water Pollution Litigation, " 1971 Wise, L. Rev. 738; *Phillips v. Sun Oil Co., 307* N.Y. *328, 121* N.E.2d 249 (1954).

[181] See 301(e) stud, group report at 101-104.

[182] The 301(e, study group report at 43-45. The report notes that 39 jurisdictions have adopted some form of the discovery rule either by statute or judicial interpretation at 133 n.4.

[183] The 301(e) study group report at 69-71.

The whereabouts of facility operators or generators may be unknown, and companies may have changed ownership or may have gone out of business. In other cases it may be difficult to ascertain the original wastes or their sources so as to identify the responsible generators.

Joint and Several Liability/Enterprise Liability.—The availability to plaintiffs and to potentially responsible parties of theories that can be used to apportion fault and liability for damages among a group of defendants can be of some advantage in hazardous waste cases when the responsible party cannot be distinguished from other group members under the evidence available or when several defendants contributed to the situation causing the injury. These theories can slightly ease the plaintiff's burden of proof and can expand the pool of responsible parties from which damages can be recovered.

Insurance

Relevance to Waste Management

Insurance is one of the oldest and most commonly used techniques for dealing with risks. Today, there are several different types of insurance coverage available to hazardous waste firms. Comprehensive General Liability Insurance Policies offer full coverage for sudden and accidental pollution on an "occurrence" basis (i.e., covering all claims arising from events occurring during the policy year whenever the claim is filed), Environmental Impairment Insurance offers coverage for nonsudden pollution incidents on a "claims made" basis (covering all claims made in the policy year without respect to when the incident causing them occurred), A third type of coverage, currently available only to generators in the chemical industry, combines coverage for sudden and nonsudden pollution incidents in a single comprehensive contract on a claims made basis, Because of the lack of loss experience and the relative infancy of risk assessment in the hazardous waste management area, insurers are likely to move increasingly to the use of claims made policies for hazardous waste activities.

The impact of insurance depends largely on the underlying rule of liability and the terms and availability of coverage. Payment of settlements and damage awards to injured parties is made part of a hazardous waste facility's ongoing operating costs through liability insurance coverage, Premiums for liability coverage are tied, to some extent, to the loss experience of the particular facility, and thus tort actions are a form of economic incentive to avoid health and safety risks that may produce a poor loss experience and ultimately higher premiums. To the extent that premiums are experience-rated, it is generally believed that facility owners and operators will seek to minimize the sum of the cost of safety measures, insurance costs, and uncovered liability costs.

The availability and price structure of insurance coverage may create significant incentives for management to act affirmatively to avoid losses due to environmental contamination. While such losses may be covered by insurance and therefore may not be incurred initially by the insured party, such claims will substantially increase premiums, and loss avoidance can become economically preferable. Reliance on an insurance mechanism assumes that a private sector business will provide valuable oversight of its hazardous waste activities, through routine inspection, monitoring, and risk evaluation, as well as eventually through attempts to minimize premiums, in the task of managing the risks from those activities. But insurers generally have been wary of proposals that would cast them in the role of surrogate regulators,

If insurance brings about the results expected in theory, it can be a strong incentive to achieve some of the goals that otherwise would have to be achieved solely through "command and control" regulation. Insurance requirements under RCRA, CERCLA, and State programs can be seen as complementary to the regulatory requirements,

On the other hand, insurance can blunt the incentives created by other regulatory and nonregulatory approaches to risk management.

Insurance spreads hazardous waste risks over time, and across the industry among like situated firms and facilities. This spreading may tend, in particular cases, to decrease the economic incentive to avoid health, safety, and environmental risks among individual generators, transporters, and facility owners and operators, unless they are somehow convinced that others are undertaking similar avoidance measures.

Overall, the impact of insurance on the risk management decision is an ambivalent one: Without insurance, the existing regulatory or nonregulatory incentives have little practical impact on judgment-proof parties. Insurance makes available an amount of money to be used to respond to adverse judgments. Insurance compensation to victims of hazardous waste activities often can be made without resort to the courts, thus avoiding the delay, costs, and evidentiary burdens facing the plaintiffs in liability actions. Moreover, judgments requiring abatement of or compensation for the adverse impacts of hazardous waste activities would lose their effectiveness as an incentive for better waste management if generators, transporters, or facility operators could avoid the financial consequences by simply going out of business.

For insurance to operate as an effective and complementary mechanism in the existing Federal and State system: 1) insurance coverage for hazardous waste activities must be available and affordable; 2) the level and scope of coverage must be adequate for the magnitude of risks insured; 3) the coverage must continue after closure of the facility; and 4) more consistent and perhaps standardized risk assessment procedures must be used.

EPA financial responsibility requirements for hazardous waste treatment, storage, and disposal facilities require certain minimum levels of liability coverage either through an insurance policy or self-insurance. EPA is currently considering whether to promulgate rules for additional financial responsibility requirements for corrective action at land disposal facilities.

Fees, Taxes, and Other Economic Incentives to Encourage Alternatives to Land Disposal

One of the key assumptions in setting up a national regulatory program to deal with hazardous wastes was that as the program was implemented, hazardous waste disposal costs would rise significantly, It would then become economically attractive for generators to adopt new processes and to seek alternatives to land disposal, Preliminary economic analyses of the cost impacts of the RCRA regulations, however, appear to indicate that while the costs of compliance are significant, the cost increases are not of such magnitude as to create a substantial economic incentive to shift to other disposal and treatment alternatives. By far the most significant impact of the interim status standards for land disposal operations was the requirement to install a ground water monitoring system, but the cost per unit of waste deposited varied significantly depending on the size of the facility. EPA's analysis of the cost impacts of the final land disposal rules indicate that primary impacts will fall on small onsite landfills and small surface impoundments, and that significant economies of scale will dilute the initial economic impacts at large commercial landfills.[184] Potentially, the most substantial cost component of the July 1982 land disposal regulations is corrective action (ground water pumping and cleanup). However, currently there is no requirement for operators to demonstrate their financial capability to carry out corrective actions to receive such a permit.

Because it is now apparent that increased regulatory compliance costs alone might not be significant enough to induce a change in disposal practices, many States are studying the effectiveness of various financial incentives to influence hazardous waste management activities. Among the most typical approaches are fees, taxes, and direct financial or technical assistance to preferred management technologies. Table 78 summarizes State fee mechanisms; table 79 shows availability of tax incentives and bonds.

[184] See discussion of regulatory impact analysis in the preamble to the land disposal regulations, 47 F.R. 32,337-32,348, at 32,342, July 26, 1982.

Table 78.—State Fee Mechanisms

	Facilities	Transporters	Generators
Alabama	I	—	T
Alaska	—	—	—
Arizona	—	—	—
Arkansas	P,A,M	B	
California	T,F	V,B,I	T
Colorado	—	—	—
Connecticut	—	—	G
Delaware	—	—	—
Florida	S	—	G,T
Georgia	—	—	—
Hawaii	P	—	—
Idaho,	—	—	—
Illinois	T	—	T
Indiana	T	V,B	—
Iowa	—	—	—
Kansas	P,T	—	T
Kentucky	P,A,M	—	R,G
Louisiana	P,A	—	
Maine	P,A,M	O	G
Maryland	P,A	—	—
Massachusetts	P	V	—
Michigan	P,A	V	—
Minnesota .,	—	—	—
Mississippi	T	—	T
Missouri	P,A,T	V	T,G
Montana. .,	—	—	—
Nebraska .,	—	—	—
Nevada	—	—	—
New Hampshire	P,A	B	—
New Jersey ...,	P,M,T	V	T
New Mexico.	S	—	—
New York	—	—	—
North Carolina.	F	—	
North Dakota.	—	—	—
Ohio	P,A	V,B	T
Oklahoma. ...,	—	—	—
Oregon	P,M	—	—
Pennsylvania	—	—	—
Rhode Island	P,A	V	—
South Carolina	—	—	—
South Dakota	—	—	—
Tennessee	P,A	Q	—
Texas	—	—	—
Utah	—	—	—
Vermont	—	—	—
Virginia ...,	—	—	—
Washington	—	—	—
West Virginia. ...,	P,A	—	—
Wisconsin	P,A	—	—
Wyoming .,	—	—	—

Key: A = annual registration/other periodic fee; B = base; F = facility fee; G = generator fee; I = Inspection; M = monitoflng/surveillance fee; O = other; P = permit application fee; Q = quantity; R = registration; S = surcharge; T = tipping fee; V = vehicle registration

SOURCES: ASTSWMO, SurveyforOTA, 1982, Citizens for a Better Environment, "Approaches to Hazardous Waste Management In Selected States," OTA Working Paper, December 1982, National Conference of State Legislatures, *Hazardous Waste Management A Survey of State Legislation1982* (Denver, Colo 1982), The Council of State Governments, *Waste Management in the* States (Lexington, Ky 1981), Fred C Hart Association, Inc (for EPA), *A Survey of State* Fee *Systems for Hazardous Waste Management Programs,* EPA contract No 6841-5133, May 25, 1982, and National Conference of State Legislatures, *A Survey and Analysis of State Policy Options To Encourage Alternatives to Land Disposal of Hazardous Waste* (Denver, Colo July 1981)

The creation of an economic incentive may be only part of the reason for a State adopting such an option. Some fees may be imposed to deter land disposal and, additionally, to pay for administering the regulatory system, or to provide funds for research and development of alternatives, or for the State superfund for site cleanups and victim compensation,

Facility Fees

A substantial number of States impose a fee or tax of some kind on hazardous waste treatment, storage, and disposal facilities. There is, as would be expected, a wide variation in the types and applicability of these charges and in the disposition of the proceeds. Among the different types of fees imposed are administrative fees for permit applications, licenses, inspections, and similar government requirements, and tipping fees or surcharges levied on wastes received at facilities which may or may not be passed on to the generator.

Administrative Fees

These fees range from minimal charges to assessments that are intended to reimburse the agency for the full cost of administering its programs. There are three types of administrative fees for facilities: permit application fees or charges for filing an initiaI application or permit modification; permit renewal or annual operating fees or other fees assessed on a periodic basis for operating facilities; and monitoring or surveillance fees assessed for site inspection visits or monitoring which may be required as a condition of a permit,

The basis for these fees varies. For example, some States impose fees only on offsite facilities or exempt recyclers. State fees on hazardous waste facilities are set on one or more of the following criteria:

- base fee—minimum charge with no variation among facilities;
- onsite and offsite facilities;
- commercial or noncommercial facilities;
- size of the facility measured by capacity, number of units, or the area of the site;
- facility waste management category, i.e., treatment, storage, disposal, or recycling;

Table 79.—State Fee Revenues (as of Apr. 1, 1982)

State	FY 1982 Hazardous Waste Program Budget		FY 1982 RCRA Hazardous Waste Program fee		
	Total	State share	Revenue collected	As a percent of total program budget	As a percent of state matching share
Arkansas	$347,669"	$65,777	**$20,000**	*60/0*	*30 "/0*
California	7,686,012	4,384,628	4,384,628[a]	57	100
Hawaii	97,500	15,000	Very minor	Very minor	Very minor
Indiana	1,172,587	293,147	Not collected yet	o	0
Kansas	504,100	135,000	80,000	16	59
Kentucky	872,883	149,805	87,000[b]	10	58
Louisiana	2,000,000	960,000	900,000	45	94
Maryland	564,000	300,000	300,000	53	100
Massachusetts	1,547,000	803,000	18,000		
Michigan	2,277,664	569,632	†	+	+
Missouri	797,082	147,082	208,100	26	100
New Hampshire	531,000	325,000	t	t	t
New Jersey	1,981,929	740,520	200,000'	t	t
Ohio	3,123,540	953,592	558,000[b]	18	59
Oregon	599,285	127,211	76,128	13	60
Puerto Rico	720,302	233,827	Insignificant	Insignificant	Insignificant
Rhode Island	271,884	235,000	Not collected yet	0	0
Tennessee	1,839,000	768,000	495,000d	27	64
West Virginia	792,000	198,000	+	+	+
Wisconsin	1,055,300	263,843	70,000[e]	7	27

†Data not available.
[a]Agency budget proposed for next fiscal year includes expected fee revenue of $78 million.
[b]Annualized estimate.
[c]Includes solid waste fee 'evenue
'No fees collected yet This is the expected revenue for the fiscal year with collections starting in April 1982 In fiscal year 1983 the portion funded by fees is expected to Increase to 40 percent of total program funding
'N. fees collected yet. Expected yearly hazardous waste revenues

SOURCES NGA/ASTSWMO Survey, March 1982, Fred C. Hart & Associates, Inc (for EPA), *A Survey of State Fee Systems for Hazardous Waste Management Programs,* U S EPA contract No 68-01-5133, May 25, 1982; reprinted in *Hazardous Waste Report, vol.* 3, Sept 6, 1982

- waste handling technology used at the facility: landfills, deep well injection, land application, incineration, surface impoundment, chemical or biological treatment; and
- volume or quantity of wastes received or disposed of at the facility.

Transporter Fees.—At least 14 States levy fees on hazardous waste transporters. Transporter fees are generally imposed as vehicle fees (a charge on each vehicle used to haul hazardous waste), base fees (generally levied on each firm engaged in hauling hazardous waste), or some other type of fees. Three States utilize other types of transporter fees. Maine charges transporters an import fee on waste generated in other States. Tennessee bases its fee on the amount of wastes transported. California charges an annual inspection fee for waste haulers.

Generator Fees.—California, Kentucky, Missouri, Florida, and Ohio impose generator fees. These States use three different types of fees: tipping registration, and waste generation.

Tipping Fees.—Tipping fees are charges assessed on the receipt of waste at a facility. They are considered generator fees because they are paid either directly by the generator or by the facility operator. In the latter instance, the facility collects the fees "as a trustee of the State" and forwards the receipts to the State agency. Tipping fees in the form of surcharges are imposed at facilities where the generator pays a charge for waste. These surcharge fees may exempt onsite disposal operations where no fee is paid.

Registration Fees.—Kentucky requires generators to pay an annual registration fee based on the amount of hazardous waste to be generated. Besides providing a source of revenue, this type of charge can provide reasonably accurate data on waste generation in a State. Such information helps with receipt projections from other fees as well as other aspects of the program.

Waste Generation Fee.—This type of fee is a tax on hazardous waste generation. It is assessed directly on the generator. Missouri sets a $1 per tonne charge with a maximum annual assessment of $10,000.

Other Tax Mechanisms

As an alternative to the negative economic incentives of imposing fees and taxes to increase the costs of hazardous waste disposal, some States use positive economic mechanisms such as tax incentives and financial assistance to encourage proper waste disposal practices and the development of alternative management technologies, For example, several States provide for limited tax exemptions or credits for business equipment and real estate taxes for pollution control equipment or hazardous waste treatment facilities, By excluding the facility from payment of higher taxes, a benefit is bestowed, Accelerated depreciation is another tax device to give favored treatment to hazardous waste technologies. Other States allow use of tax-exempt bonds as financing for the development and construction of hazardous waste facilities. Some States favor alternative treatment technologies such as recycling or incinerators over land disposal facilities in their tax incentive programs,

Use of Fee Revenues

Proceeds from these fees can be put to various uses. The fees can be deposited to a special account to fund agency hazardous waste regulatory activities, deposited to general revenues, or deposited to a special fund for a designated use (e.g., as for cleaning up abandoned sites or sponsoring research and development on alternative waste management technologies,)

While there appear to be a variety of fee mechanisms available to and used by States, the amounts reported by States as generated through this mechanism in most instances are relatively small compared to funding needs. Fees, however, are an appealing source of revenue for State programs in a time of declining Federal grants (see table 79). Considering **the amount** of money received and the various restrictions on its use, it is clear that fees alone are not currently adequate to meet State revenue needs for enforcing hazardous waste programs.

At a time of increasing regulatory activity, and with the prospect of declining Federal contributions, the significant limitations in reliance on existing State fee mechanisms include the following:

- The administrative fees frequently do not cover full agency costs and would have to be raised substantially if they were used to sustain agency activities. (A permit application of $5,000 or even $25,000 may not cover the costs of technical review and hearings for a large landfill facility.)
- Fee generation may not provide a stable, predictable source of revenue. Fees based on administrative procedures are dependent on a flow of permit applications and renewals. Value and quantity fees are subject to fluctuations in business cycles.

  The schedule of costs may not be tailored to different types of facilities; thus the fee charged might not be proportionate to the administrative costs incurred (e.g., onsite storage tanks may not require the same level of attention as a commercial landfill).
- The State government structure may limit the imposition or use of certain fees through statutory or constitutional provisions. In such instances, the ability of States to respond quickly to reduced Federal grants by promptly imposing or raising fees may be significantly constrained by State law or constitutional considerations, such as biannual meetings of the legislature or the inability to obtain passage of the required legislation. Michigan's fee structure to fund its waste facility and closure fund was held unconstitutional because the fee was not high enough to cover the costs of potential post-closure liability.
- The fees may already be dedicated to another major State program, such as cleanup of existing or abandoned hazard-

ous waste sites or compensation of victims of hazardous waste activities. using the fees to finance the regulatory program would detract from other efforts.

State "Superfunds"

Many States have enacted laws which are similar to CERCLA that provide for emergency response and cleanup for hazardous substance releases. These State trust funds may be financed from special State taxes, from fees assessed on hazardous waste generators, transporters, and facility operators, or may include State general revenues appropriations.

At least two State funds, California and New Jersey, provide for the compensation of victims of hazardous waste activities. These States then can proceed against the responsible parties for reimbursement of any compensation paid to "innocent" victims. Table 80 summarizes the availability and scope of State superfunds for hazardous waste cleanups.

one of the unresolved issues involving coordination of State superfund and CERCLA cleanups is the extent of the limitation in CERCLA on State taxes that duplicate the oil and chemical taxes in CERCLA. Some industry groups have argued that section 114(c) limits the use of State superfund monies as the State's contributing share in CERCLA cleanups because the State taxes would then be imposed for the same purpose as Federal Superfund taxes. In a case challenging New Jersey's tax on chemical and oil products, the Federal courts deferred to State court jurisdiction. The State courts interpretating State law have concluded that New Jersey's tax is not in conflict with section I14(c) of CERCLA.

In addition to imposing a tax financing a trust fund mechanism for cleanup of hazardous waste dumps, at least 15 States have created statutory provisions concerning liability for cleanup costs for those which cause or contribute to hazardous waste dumps that must be cleaned up. The extent of liability and conditions for recovery actions vary significantly among the States.[165]

[165] For a more exhaustive discussion see 301(e) study group report vol. II and the NSCL report, *Hazardous Waste Management in the States, 1982.*

Part III: Implementation Issues of the Current Regulatory System

Technology Development and Environmental Protection

Because Subtitle C of the Resource Recovery and Reclamation Act (RCRA) is primarily directed at controlling hazardous waste at disposal, the point where the waste enters the environment, little attention is given to reducing the amount of waste at the source of generation. Subtitle C focuses on establishing proper operating standards for treatment, storage, and disposal facilities (TSDFS). Other provisions of RCRA authorize research and development and informational activities to promote recycling, resource recovery, and waste reduction. However, these programs have largely been underfunded and ineffective in dealing with hazardous waste problems. The Environmental Protection Agency (EPA) solid and hazardous waste programs contain only a few incentives to encourage the use or development of recycling and recovery techniques, source reduction methods, or other techniques to reduce the hazardous characteristics of the waste. Overall, the effects of the current regulations continue to favor disposal technologies, particularly landfilling, over other waste management options.

The Clean Air Act (CAA) and the Clean Water Act (CWA), impose technology-forcing standards on industrial polluters, thus stimulating generator participation in the development of effective control strategies. In contrast, RCRA standards for hazardous waste generators require only waste identification, maintenance of certain records and reports, and proper packing, labeling, and manifesting of wastes

Table 80.—Summary of State Superfund Legislation

State	Fund financing: Facility fee tax	Generator fee tax	Transporter fee tax	Appropriations	Bonds	Cost reimbursement	Penalties/fines	Other	Uses of fund: Program administration	Emergency response	Spill cleanup	Abandoned site cleanup	Facility closure	Perpetual care	Site/resource reclamation	Equipment, training	Health effects & other studies	Victim compensation	State Superfund share	Fund limits	Responsible party liability
Alabama		x					x		x					x							
Alaska																					
Arizona			X																	X	X
Arkansas							X														
California			X						X	X								X	X	X	X
Colorado				X					X	X	X									X	
Connecticut	X	X						X				X	X					X		X	X
Delaware																					
Florida		X	X		X		X	X	X		X		X			X			X	X	X
Georgia				X						X		X		X	X						
Hawaii																					
Idaho																					
Illinois			X							X								X		X	
Indiana			X							X						X				X	
Iowa																					
Kansas			X							X		X		X							X
Kentucky			X								X		X		X						X
Louisiana			X			X	X	X	X		X		X								X
Maine		X	X	X	X					X						X					X
Maryland		X		X						X				X							
Massachusetts		X		X			X	X		X											X
Michigan		X			X	X				X				X							X
Minnesota																					
Mississippi																					
Missouri		X	X	X	X			X	X	X	X										
Montana																					
Nebraska																					
Nevada		X		X			X	X		X											X
New Hampshire		X		X			X		X	X				X		X					X
New Jersey		X	X			X			X		X	X	X	X				X			X
New Mexico				X		X			X												
New York		X	X		X		X			X		X			X		X		X		X
North Carolina			X		X		X	X	X												X
North Dakota						X															
Ohio			X						X	X	X	X			X		X				x
Oklahoma				X												X					
Oregon		X						X													
Pennsylvania					X		X		X												
Rhode Island																					
South Carolina		X	X																		X
South Dakota																					
Tennessee		X		X					X				X	X							
Texas			X				X												X		
Utah																					
Vermont																					
Virginia																					
Washington																					
West Virginia																					
Wisconsin		X		X		X			X				X	X		X					x
Wyoming																					

SOURCES National Conference of state Legislatures, *Hazardous Waste Management: A Survey of State Legislation, 1982* (Denver, Colo. 1982); The Council of State Governments, Waste *Management in* the States (Lexington, Ky.: 1981); National Conference of State Legislatures, *A Survey and Analysis of State Policy Options to Encourage Alternatives to Land Disposal of Hazardous* Waste (Denver, Colo July 1981); and OTA Staff research

before shipment offsite. This difference in environmental regulatory schemes between RCRA, CAA, and CWA is in part explained by the fact that disposal of hazardous solid waste does not necessarily occur at the place it is generated; thus, to control the environmental effects of hazardous waste disposal, it was not necessary to impose standards or limits on the amount of hazardous waste generated.

In considering passage of RCRA, Congress was concerned that such limits on waste generation might prove to be a complex, and perhaps unworkable, strategy with the potential for inordinate disruption of industrial activities. Recognizing that generation of solid and hazardous waste is an unavoidable consequence of a modern industrial society, Congress opted instead for a longer term, indirect strategy. By significantly increasing the costs of waste disposal through regulation of waste facilities, industrial generators would be pressured to reduce their output of hazardous waste and to promote development of alternative waste treatment technologies.

Recycling and Resource Recovery Technology

EPA has relied primarily on various exemptions and exclusions from hazardous waste regulations to promote recycling and resource recovery activities. This approach has been criticized as an insufficient incentive for recycling and also for providing inadequate protection against mishandling of such waste. EPA is considering further changes in RCRA regulations that wouId exclude some recoverable waste materials from being classified as solid waste, if the waste is reclaimed and used onsite as process feedstock.[166] In contrast, no exclusion would be made if the waste is sent offsite to another firm which reclaims the material for use as feedstock, or if the process waste is not used by the firm that recovers it, or if the waste is first stored onsite and then reclaimed. Without this exclusion, the material is considered as solid waste and potentially hazardous waste subject to subtitle C regulations. EPA would also reclassify waste burned as fuel, or as a component of fuel, as solid waste subject to RCRA regulations. A maximum period for onsite accumulation of reclaimable materials would be set, and reclamation of a significant portion of the waste would be required annually to qualify for the exemption. Although the approach is not without its problems, it would significantly extend the period of time that hazardous waste could be held. It might promote increased generator efforts at reducing the amount of hazardous waste produced. Offsite or commercial recycling activities and the burning of waste as fuel would be subject to RCRA regulations and, where appropriate, standards would be set for recycling facilities.

The suggested changes exempting generator recycling activities could have serious consequences for some commercial hazardous waste facilities that derive a substantial portion of their revenues from the sale of materials reclaimed from solid and hazardous waste. These commercial facilities will continue to be required to meet RCRA regulations for operation and storage permits for recycled wastes, and it could be difficult for them to maintain a competitive position in the market in reclaimed materials.

Land Disposal Regulations

On July 26, 1982, EPA published interim finaI regulations for permitting land disposal facilities (landfills, surface impoundments, waste piles, and land treatment units).[167] EPA developed a two-tiered strategy in these regulations.

1. a **liquids management strategy** to minimize the formation of leachate and to contain the hazardous waste constituents in appropriately designed facilities; and
2. a ground water protection and response **strategy** consisting of monitoring to detect and track any migration of hazardous constituents if the facilities fail to contain the waste, and corrective action to remove the contaminants from ground water if certain specified concentration levels are exceeded.

[166] 47 F.R. 55,580, at 55,584, Dec. 13, 1982.

[167] 47 F.R. 32,274-32,388.

Given the inadequacy and uncertainties about current containment designs, such a two-tiered approach presents substantial problems. EPA's strategy focuses on the effectiveness of remedial action once contamination has occurred, rather than preventive measures for protecting human health and the environment, There is only limited experience in cleaning ground water and soils contaminated with industrial hazardous waste. Moreover, EPA's monitoring requirements may not result in collection of adequate data for identifying ground water contamination. If land disposal of all hazard levels of wastes is allowed to continue (as the July 1982 rules seem to allow), it is essential that a rigorous monitoring program be implemented at all such facilities. Without it there can be little assurance that exposure of humans and ecosystems to hazardous constituents will be prevented through early detection and prompt corrective action,

Analysis of the design technology used in land disposal facilities (presented inch. 5) indicates that current technology cannot assure complete containment of hazardous waste constituents. EPA has also acknowledged that all land disposal sites eventually will release mobile constituents to the environment. Some of the technical difficulties associated with land disposal containment strategies are summar

1. Studies of existing landfills that incorporated the designs suggested by EPA indicate that leakage will occur. The causes of these liner failures have been attributed to one or more design, construction, or operation errors, No state-of-the-art technology landfill design can be considered as providing an absolutely secure containment system over many decades, Additional in situ and ambient monitoring of new and existing facilities is necessary to evaluate their performance.
2. There is little long-term operating experience with liner and cover materials. All liner materials are vulnerable to failures that increase the rate of liquid migration through the liner.
3. Current experience suggests that few failures of liners in landfill facilities can be repaired; rather, corrective action often must be used to reduce the effects of environmental contamination.
4. The fate of constituents released from a facility is uncertain. Some may become immobilized in soil; others may migrate and be incorporated in food and water sources. An adequately designed monitoring system is thus an essential element of any protection strategy to detect contamination promptly and to assist in the formulation of effective remedial measures,

Major Criticism of the Land Disposal Regulations,– OTA has surveyed several reviews of these regulations made by various groups.[168] Several points of concern are common to all.

A general criticism made by environmental groups, citizen groups, academics, and industry is that the regulations use very general performance standards rather numerical performance standards or specific design standards. This was done to promote flexibility in the permit process so that specifications could be developed for each facility. This approach places a very significant burden on the permit writer to determine whether a particular facility provides adequate protection of human health and the environment. While most environmental regulatory strategies require some exercise of judgment by the permit writer, the EPA land disposal regulations do so to an unusual degree. The general performance standards do not provide objective guidelines against

[168]David Burmaster, "Critique of the Monitoring Pro\' isions in EPA's Interim Final Regulations for Hazardous Waste Landfills, " OTA Working Paper, Oct. 18, 1982; Environmental Defense Fund (ED F], "Comments on the Interim Final Hazardous Waste Land Disposal Regulation s," Nov. 23, 1982: League of Women Voters of the United States, letter to Rita Lavelle, Oct. 5, 1982; testimony before the Subcommittee on Natural Resources, Agriculture Research and Environ ment of the House Committee on Science and Technology, Nov. 30, 1982; K. W. Brown, Texas A&M University; H. Johnson, National Solid Waste Management Association; D.W. Miller, Geraghty & Miller, Inc.; N. V. Mossholder, Stablex Corp.; P. A. Palmer, Chemical Manufacturers Association, H. C. Robinson, Hazardous Waste Treatment Council,

which to judge the adequacy of a facility, Without these guidelines, facility operators cannot anticipate what will be required of them for permitting, and key decisions about the sufficiency of particular land disposal permit applications will be left to the judgment of the permit writers. This is a critical problem as the availability of necessary technical expertise (e.g., in ground water monitoring, corrective action, and risk assessment) is limited throughout the Nation. This situation can lead to uneven interpretation and enforcement standards of the land disposal. The effectiveness of public participation in permitting is also diminished because concerned citizens have little guidance as to the adequacy of the facility's design and operation specifications or the appropriateness of the permit writer's interpretation.

The land disposal regulations allow waivers and exemptions from certain performance standards to be made by the permitting authority if there is a lower potential for exposure to hazardous wastes or their constituents. The regulations do not require that more stringent permit conditions be added for management of more hazardous materials or for those situations with potentially high risk to human health and the environment, although the preamble suggests that the permit writer could impose such stipulations upon consideration of the hazard levels of the wastes and the specific site conditions.

The regulations provide that land disposal facilities are not to be constructed within seismically active areas. New and existing facilities in a 100-year flood plain must be constructed to withstand flooding. The regulations do not require consideration of other potential natural catastrophes, or of the protection of drinking water sources, wildlife habitat, or the presence of other sensitive environments.

Exemption From Detection Monitoring Program

The regulations grant a waiver from detection monitoring requirements for land disposal designs using double liners with a leak-detection system between the liners, The exemption is made to encourage use of the state-of-the-art approach which EPA apparently assumes is effective in containing the waste and detecting any liquid migration. Little information is available, however, about the integrity and reliability of such systems over time, The primary liners of several facilities with similar design features have begun to leak early in the life of the facility. [169] Environmental groups argue that the waiver is not needed as an incentive to use state-of-the-art design, and that EPA could require all facilities to use that configuration. Moreover, without a detection monitoring system in place, the effectiveness of the design cannot be determined, background water quality will not be established before contamination, and a post-closure monitoring system will not be in place to indicate leakage and trigger the corrective action requirement. An additional complication with the provision is disagreement over what constitutes evidence of a leak in such facilities. The rules provide that the presence of any liquid between the liners is presumed to indicate leakage. If liquid is detected, the liner must be repaired promptly to maintain the ground water monitoring exemption, If such repairs are not made, the facility must immediately initiate a detection monitoring program (which may require a permit modification). Some industry representatives advocate a modification of EPA rules to specify that a leak exists when the detection system indicates the presence of "leachate" rather than "liquid," between the liners. These industry critics argue that the occurrence of liquid between liners is expected in the landfill operation and does not indicate a leak in the system. The use of leak-detection systems should provide earlier and more reliable warnings of potential migration of waste constituents. An important advantage is the greater ability to take corrective action, especially if the system is designed for pump-out control. The criteria used for determining failure will require careful evaluation, in-

[169] Testimony of William Sanjour before the House Committee on Science and Technology, supra, note 168. Peter Montegue, "Four Secure Landfills in New jersey—A Study in the State of the Art in Shallow Burial Waste Disposal Technology, " (draft report) [Princeton, N. J.: Princeton University, 1981).

eluding leachate characteristics and site conditions.

The exemption removes any opportunity for obtaining data on the reliable performance of these facilities. Environmentalists and some industry critics have suggested that all facilities, regardless of the type of design, should be required to implement adequately designed detection monitoring programs. This would serve as a backup for the leak-detection system and could serve to verify that liquid does not migrate through such liners and result in environmental contamination.

Exemption of Existing Portions. -Existing portions of land disposal facilities are not required to incorporate the same design specifications new facilities or units constructed after permit issuance, e.g., installation of single liners and leachate collection systems, EPA's decision to provide a limited exception is not based on the feasibility of installing such containment but on concern for the potential interruption of facility operation during the retrofitting process and on EPA's interpretation of the 1980 RCRA amendments providing for distinctions between new and existing facilities in setting performance standards. The "existing portions" exemption could have serious consequences for the protection of human health and the environment and on the development of safer treatment and disposal alternatives. The existing active portions of interim status land disposal facilities are not required to install liners and leachate collection systems. Moreover, the rules do not require surface impoundments to install leachate collection systems—a significant change from the January 1981 standards for surface storage impoundments.

The "existing portion" is defined as the "land surface area of an existing waste management unit described in the original Part A permit application on which wastes have been placed before the issuance of a final permit. ''170 EPA has determined that each surface impoundment, or landfill cell or trench is a unit. Any lateral expansion from the "Part A" surface area is not considered an "existing" portion, but EPA does not limit the depth or height to which waste may be placed within this area before or after permit issuance. EPA estimates that it could take at least 5 years to review and permit all existing land disposal facilities.

During the period before permit issuance, existing interim status facilities can continue to construct and use additional new landfill and surface impoundment units without installing liners and leachate collection systems, even where such installation is clearly feasible without disrupting operations. The only apparent limit on construction and use of additional unlined units is that they may not go beyond the boundaries of the original Part A application and may not significantly increase the facility's design capacity without EPA approval, These units can continue to be used without retrofitting after the permit is issued. In contrast, a new facility which must have a permit for construction and operation would have to install liners and leachate collection systems at each of its units during the same period,

The continued use of these unlined existing facilities without any attempt at containment or retrofitting could result in situations endangering public health and the environment and require costly remedial action. Evidence of problems experienced with past waste disposal practices is well-documented (see table 81).

Table 81 .—Contamination of Ground Water by Industrial Wastes

State	Number of incidents	Fraction attributed to: Industrial waste[a]	Landfill leachate[b]
Arizona	23	30 "/0	260/o
Connecticut	64	44	—
Florida	92	35	—
Illinois	58	21	28
New Jersey	379	40	—
South Carolina	89	31	—

[a] Presumably such contamination would be related to hazardous industrial waste, for the most part, rather than ordinary solid waste

[b] Landfills could include both subtitle C and D types; but presumably the source of the contamination is hazardous waste

SOURCE V I Pye, "Groundwater Contamination in the United States," September 1982 (date based on numerous surveys which are documented)

[170] 47 F.R. 32,349, July 26, 1982; to be codified at 40 CFR 260.10,

Existing units of land disposal facilities that receive waste after Jan. 26, 1983, will be subject to ground water protection monitoring and corrective action requirements (these are called "regulated units"). However, because of the limitations inherent in the detection monitoring program (similar to the interim status standards (ISS) monitoring requirements discussed later in this section), contamination of ground water sources by existing facilities in many cases is not likely to be detected until pollution has reached serious proportions. The outcome of EPA's decision on applicability of containment and ground water protection standards to existing facilities is likely to encourage the continued use of existing unlined land disposal units, with potentially increased contamination of ground water sources. An alternative would be to define "existing" portion as only those facility units or portions of facilities that were in use before the effective date of the RCRA regulations—e.g., Jan. 26, 1983, or before Nov. 19, 1980. Additionally, all existing facilities could be reviewed to identify those where retrofitting or installation of other containment technology is technically feasible.

Disposal of Liquids in Landfills

Although the first tier of land disposal strategy is to limit the amount of liquid in the facility that could form Ieachate or increase the hydraulic head, the rules allow disposal of bulk and containerized liquids if the facility has at least one liner and a leachate collection and removal system. In allowing this practice, EPA expressed the opinion that few existing landfills would qualify. The leachate collected must be removed from the landfill and treated. This treatment could mean placing the liquids back into the landfill, resulting in continuous recycling of the liquid. For certain wastes, this could result in possible decreases in the concentration of hazardous constituents. Critics emphasize that free liquids can migrate readily through a landfill, possibly dissolving harmful constituents that may be encountered in the migration path. The adequacy and effectiveness of leachate collection and removal **systems over long periods of time in landfills have not been demonstrated.** EPA rules provide that the collection system must operate over the life of the facility and at closure until leachate is no longer produced. This could be in excess of 30 years. Recycling liquids through the landfill could delay and complicate the eventual treatment of leachate or liquids. Furthermore, the continued presence of high volumes of liquids in a facility only serves to enhance potential damage to side walls and bottom liners.

Impact on Development of Other Technologies

Overall, the costs of complying with EPA's regulations of waste management appear to favor the continued use of land disposal techniques over other alternatives, such as incineration, or biological or chemical treatments. Many in the waste management industry expected that implementation of RCRA would make alternative treatment technologies more cost competitive and encourage the growth of an industrial segment devoted to the alternative treatment of hazardous wastes. This has not been the case: '7'

> To begin with, the construction of a high technology facility requires a large amount of capital. Furthermore, a great deal of that capital must be invested with the prospect of years of waiting before it can begin to generate a profit, Because of these two factors, disposal of toxic wastes by high technology . . . costs more than does unregulated Iandfilling. Therefore, there cannot be an economic return on the invested capital for such a facility so long as toxic waste which can be readily incinerated, treated, or stabilized is nonetheless directed to landfills because they are cheaper. Apparently it has been the perception of those who might have invested the capital that the EPA is unwilling to adopt a set of regulations which will result in high technology disposal being an economically viable alternative.

"lStatement of H. Clay Robinson for the Hazardous Waste Treatment Council in hearings on EPA's land disposal regulations before the Subcommittee on Natural Resources, Agricultural Research, and the Environment of the House Committee on Science and Technology, 97th Cong., 2d sess., Nov. 30, 1982, at p. 2.

Several factors support this conclusion: 1) Exemptions for existing portions of land disposal facilities allow them to escape more stringent design and performance standards required of new facilities and units; 2) There are insufficient restrictions on the type of wastes that can be placed in land disposal facilities; and 3) Differences in the quality and stringency of regulations for management technologies create an economic bias toward continued use of land disposal.

For example, as discussed in chapter 5, regulations for incinerators force this technology to perform much closer to its operational limits, Incinerators must achieve a destruction removal efficiency (DRE) of 99.99 percent or better. This is a difficult standard for some facilities to meet. In contrast, the land disposal regulations provide only limited incentives for the uses of more advanced landfill design (double liners with leak-detection systems and with external monitoring). EPA, in acknowledging that land disposal facilties eventually will release hazardous waste constituents to the environment, established the second-tier monitoring and remedial action strategy. By imposing stringent requirements for technologies which result in immediate, permanent destruction (e.g., incinerators) and less stringent requirements for other technologies, such as land disposal (which may require costly corrective action, where feasible) EPA is effectively promoting the use of the latter. At the same time, little attention is given to exploring incentives that would encourage the use of those technologies that reduce the hazard of industrial wastes.

Appropriate Use of Land Disposal Technology

It is widely acknowledged that there are appropriate circumstances for use of land disposal technologies for some hazardous wastes. For example, treatment technologies, such as incineration, produce residues that must ultimately be disposed. Landfills are appropriate facilities for containment of detoxified and immobilized waste provided that the facility is adequately designed and has an effective monitoring program. Biodegradable waste constituents can be deposited in the land if the facility can safely contain the wastes for the length of time required for degradation of the material. Treatment methods are available that can immobilize most, and reduce the toxicity of many, toxic metals before disposal.

Regulations for land disposal reflecting the most advanced state of treatment, containment, and monitoring technologies could promote the mandate of RCRA for protection of human health and the environment by: 1) reducing the risks associated with land disposal and 2) making the immediate costs of land disposal more comparable to other treatment options.

There are substantial long-term and indirect costs for containment options that the regulations do not address, such as the costs to future generations for increased health problems or the costs to provide remedial action at landfills in the future, The actual level of these costs and the extent to which they are incorporated into the operational expenditures of a facility will depend on: 1) Federal requirements for demonstrating financial responsibility for remedial actions and liabilities for damages, and 2) the extent of effective Federal enforcement. Current policies in these areas result in incomplete internalization of these costs, skewing the management options toward land disposal. However, not all generators have opted for the least costly alternative. Some assessed the potential long-term costs, liabilities, and uncertainties associated with land disposal options and have chosen treatment and waste reduction techniques. While many companies may wish to take this type of voluntary action, for a variety of reasons they are unable to do so—e.g., the size of the firm and of its competitive position may preclude the additional capital expenditures required.

Monitoring

Given the potential magnitude of environmental and health problems that could result through mismanagement of hazardous waste, adequate monitoring requirements for RCRA-permitted facilities are essential, Current EPA

regulations require air emissions and process monitoring for incinerators, and ground water monitoring for land disposal facilities. Although other environmental laws may impose additional monitoring requirements, these generally have not been applied to RCRA facilities.

A general criticism of the RCRA regulations for hazardous waste management facilities is that the monitoring requirements may be insufficient to detect environmental contamination. Process and source monitoring has been specified, however, ambient monitoring is primarily limited to ground water monitoring at land disposal facilities, Although emissions of hazardous volatile organic compounds from surface impoundments and landfills has been documented as contributing to air pollution problems, monitoring to determine if these emissions pose a health hazard is currently not required under EPA regulations. The provisions for waivers and variances from various monitoring requirements also means that there may be no way to detect contamination during operation and after closure.

More expansive use of ambient monitoring holds the greatest potential for minimizing risks that might result from hazardous waste management. Ambient monitoring provides information on the appearance of statistically significant levels of contaminants in air, soil, water, and biota. By taking representative samples from potentially affected locations and environmental media and then analyzing them for a broad spectrum of potential contaminants it is possible to control risks reliably. If contamination of air, water, or land can be detected sufficiently early (before widespread contamination and actual damage) and corrective action taken, the human exposure will be reduced, Ambient monitoring, therefore, should be given a greater role in the RCRA regulatory program.

RCRA requires periodic operator inspections of equipment and structures at all hazardous waste facilities to assure that the facility is in compliance with applicable standards. The frequency of these inspections is based on the potential for deterioration or malfunction of particular equipment within each facility. EPA regulations establish specific inspection frequencies for different facilities and provide that more detailed inspection programs are to be set in the permit. Storage tanks, for example, must be inspected weekly to detect leaks and fugitive emissions. Inspection and monitoring records must be kept onsite for a period of 3 years.

Regulations for treatment and storage facilities primarily rely on visual inspections and process monitoring to detect malfunctions or possible releases into the environment. Monitoring requirements for incineration include process monitoring (feed-rate temperature, carbon monoxide, etc.) and the destruction removal efficiency rate for principal organic hazardous constituents in the waste feed and on emission rates of hydrogen chloride and particulate. Required monitoring of actual emissions from an incinerator is limited to trial burns conducted as part of the permitting process. As discussed in chapter 5, because of the criteria used to select principal organic hazardous constituents and the uncertainties about the adequacy of surrogate measures for DRE, this approach has been questioned.

Land Disposal

The monitoring requirements for landfills are severely limited in scope. With the exemption of land treatment facilities, primary emphasis is given to ground water monitoring, and that requirement can be waived under some circumstances. Testing of air, soils, vegetation, and other organisms for possible contamination is not required.

In general, the detection monitoring requirements at land disposal facilities may not serve as a reliable and effective early warning of environmental contamination. Significant contamination can occur before statistically significant changes in water quality can be detected. Some industry commenters have suggested that the EPA-suggested statistical method used to determine changes in ground water quality may tend to give a very high number of false

positives (indicating contamination where none exists).

Under the compliance monitoring regulations, as with detection monitoring, severe contamination could occur before statistically significant differences are noted between background levels and ground water samples. According to EPA, analytical methodologies have been specified for all but 9 of 387 Appendix VIII constituents that during compliance monitoring must be tested for annually. However, the state of the art in chemical analysis makes it difficult to analyze for **all 387** hazardous waste constituents even if it is required only once a year. Moreover, facilities may petition to drop certain Appendix VIII constituents from required monitoring. Although testing for 387 Appendix VIII constituents may appear burdensome, these substances represent only a portion of the hazardous waste, and reaction products that could be present in ground water from a leaking land disposal facility.

Sampling is a critical and currently inexact step in any monitoring program. EPA ground water monitoring regulations for interim status and permitted facilities provide little guidance in designing monitoring programs for particular facilities. The minimum number and frequency of samples required may not be adequate for collection of meaningful data. The regulations place the burden on the facility operator for designing and the permit writer for approving an appropriate monitoring program and sampling schedule to provide "representative" measures of water quality and to detect possible contamination. More frequent sampling at more locations might provide better information on, and reduce uncertainties about, (constituent behavior in landfills. Regardless of the statistical procedure used, differences between background and the monitoring signal using only a small number of samples would have to be very large (i.e., in some cases, order of magnitude changes) before statistically significant changes would be identified. Thus, ground water contamination could be substantial before statistical analysis verified that significant changes had occurred.

Seasonal variations also can influence constituent concentrations. Unless particular care is taken in the timing of a sampling effort, quarterly or semiannual sampling periods might not reflect these variations adequately, and thus misleading conclusions may be drawn.

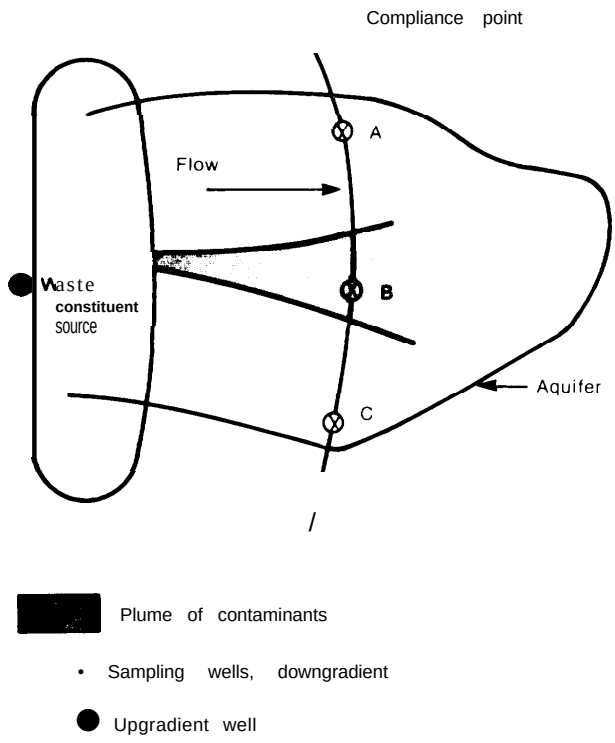
Location and Number of Sampling Wells .—Proper location, depth, and installation of monitoring wells is critical to obtaining adequate and representative environmental samples of ground water to establish background levels and to measure any contamination. The number of monitoring wells is also critical because of the difficulty in predicting location of a plume before migration has occurred. EPA rules apply a general standard that the number and location of monitoring wells be sufficient to measure background levels unaffected by the facility and to immediately detect any migration of waste constituents from the facility. EPA has suggested that a minimum number might be one upgradient well and three downgradient wells. Given the uncertainties surrounding plume behavior and frequent lack of hydrological information, three monitoring wells may not be adequate. A 1977 EPA document recommended at least one downgradient well for every 250 ft of downgradient site border. However because of the complexity of many ground water systems there appear to be no universally acceptable rule of thumb that could be applied.[172]

Figure 24 illustrates a hypothetical problem related to well location. Because of the position of the plume, contamination of ground water is noted only in well B. The concentration of contaminants in a plume can vary sharply over short distances. If the plume at well B carries a low concentration, contamination would appear significantly lower than it is in fact, By the time contamination reaches well C, a good fraction of this aquifer already would be polluted. Typical corrective action initiated at this late stage in plume migration might not be adequate to restore the quality of

[172] U.S.EPA, *Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities*, EPA/530/SW-611, August 1977, p. 41

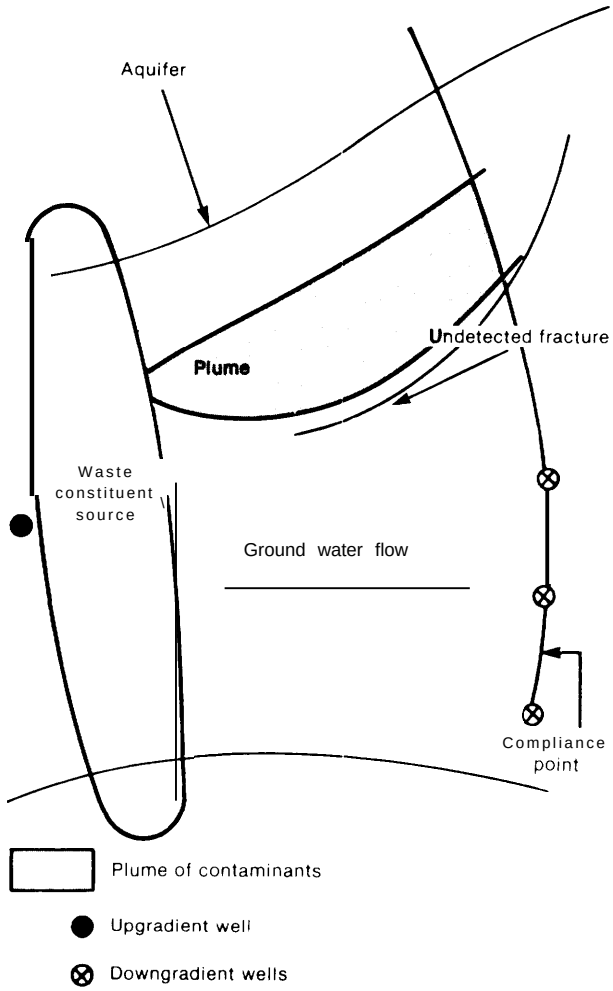
90-139 O - 84 - 25

Figure 24.—Sampling Well Locations for Ground Water Monitoring Program



SOURCE Office of Technology Assessment

Figure 25.—Plume Migration May Not Flow With Ground Water Due to Gravitational Influence and/or Undetected Fractures in the Aquifer



SOURCE: Office of Technology Assessment.

the aquifer or, if it is, it would be very expensive. Such a situation could be prevented if more wells were required, if they were more evenly placed, and if they were at different depths over the aquifer rather than only at the compliance point of a facility,

Furthermore, the movement of plumes of contaminants may be different than the direction of flow in the ground water. Concentrations of contaminants that are lighter or denser than ground water have been occasionally found to move in unpredictable patterns. Monitoring downgradient wells in such situations might not detect plume migration, and reliance on one upgradient and several downgradient wells may not provide the appropriate data. Figure 25 shows another hypothetical case in which undetected hydrologic features such as fractures or solution channels may influence ground water flow in unanticipated ways so that three downgradient wells could miss altogether the flow of contaminants from the source.

Testing Methodology and Establishing Acceptable Concentration Levels.— Decisions regarding the type and number of constituents that the detection and compliance programs are to monitor will be made by the permit writers in regional or State agencies.

If detection monitoring indicates possible contamination from a regulated unit at the compliance point, the operator must initiate a

compliance monitoring program, This will generally require a modification of the permit to specify the ground water protection standard. (For existing facilities, where possible contamination is indicated during permit review, EPA will require immediate implementation of a compliance monitoring program as a condition of the initial permit.) The ground water protection standard consists of four elements:

1. the hazardous constituents to be monitored;
2. the concentration of each hazardous constituent that triggers the corrective action requirement (the compliance level);
3. the compliance point at which the level of contaminants is to be measured; and
4. the compliance period over which the ground water protection standard is applied.

In establishing the concentration limits for the contaminants, the Regional Administrator will use one of the following criteria:

- the background level of the constituent in the ground water; or
- the maximum concentration limits (MCL) for the 14 hazardous constituents which have been set under the Safe Drinking Water Act National interim Primary Drinking Water Standards, if the background level is below the MCL; or
- an alternate concentration limit if the facility owner or operator can demonstrate that the constituent will not pose a present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded.

During compliance monitoring, EPA will require testing for all of the 387 Appendix VIII toxic constituents at least annually. EPA has not established acceptable concentration levels for most of these hazardous constituents; therefore "background level" will be the predominant ground water protection standard used.

One concern is that the hazardous constituents selected for detection and compliance monitoring may not be representative of the range of substances leaching into ground water from the facility. An additional concern is that background levels may not provide adequate protection of public health and the environment in some areas, particularly if there is already some uncorrected contamination from past waste disposal practices at or near the facility. The land disposal regulations do not specify that wells establishing background water quality be located so as to avoid contamination by waste migration from nonregulated waste management units in the waste management area.[173]

The second standard of pollution up to the established MCLS for drinking water gives the facility an additional margin of permissible pollution before corrective action is required in cases where contamination exceeds background levels. The maximum contaminant limits were adopted in 1975 based largely on the 1962 Public Health Service Drinking Water Standards, including standards for bacteria, turbidity, 10 inorganic ions, and 6 persistent pesticides. These standards originally were intended to set minimum requirements for drinking water quality in public waste systems and not as measures of acceptable environmental contamination for ground water.

Approval of an alternate concentration limit could allow contamination in excess of background or of the MCLS in individual cases. The burden of establishing an alternate concentration limit is on the facility operator. The alternate concentration limit or "narrative criteria" is probably the most controversial of the protection standards because it is set largely on a site-specific basis. The regulations specify factors for the Regional Administrator to consider in deciding whether to approve an alternate concentration limit for compliance monitoring at a facility where possible ground water contamination has been indicated. In deciding if the constituent will not pose a substantial present or potential hazard to human health or the environment, the Administrator will consider such factors as potential adverse effects on surface and ground water quality; the characteristics of the waste; its potential for migration; hydrological characteristics of the facility and surrounding area; the rate and direc-

[173] See 47 F.R. 32,352; to be codified at 40 CFR 264.97 (a)(1).

tion of ground water flow; distance to current and future ground water users; other sources of contamination; potential damage to the environment; and the persistence and permanence of any effects of exposure.

Critics of the alternate concentration limit argue that establishment of acceptable levels of contamination on a case-by-case basis raises significant public policy issues related to potential exposure to carcinogenic, mutagenic, embryotoxic, teratogenic, or otherwise toxic substances that should not be left to the discretion of the Regional Administrator or State permit writer, but rather should be resolved on a uniform national basis.

Hazard/Risk Classification

In the initial development of regulations for implementing the RCRA mandate, EPA chose not to use a waste hazard classification system because:[174]

1. EPA considered that none of the proposed systems was adequate for distinguishing differences among industrial wastes; and
2. the Agency considered that the regulations achieved the objectives of a hazard classification system.

EPA stated its intention that waste management regulations would eventually be tailored to reflect differences in potential hazards of wastes, as well as differences in environmental conditions surrounding the facility site. Current regulations for waste identification and facility permits include provisions that involve some evaluation of the degree of hazard or risk posed by the waste, but only in the most qualitative **and** site-specific ways.

At certain points in the process of listing and delisting hazardous wastes, assessments of hazard levels are possible, but EPA's decisions are **not** based on any comprehensive degree-of-hazard system based on scientific criteria open to external review. The generic lists of hazardous wastes include those materials which are considered by EPA to be the most hazardous, and for which the most information concerning health and environmental impact was available. In deciding to list a waste, EPA can consider such factors as toxicity, mobility, persistence, and possibilities of mismanagement,

EPA does distinguish between different hazardous wastes in the RCRA regulations by designating some listed wastes as "acute hazardous wastes'' 175 or "toxic wastes. ''[176] Under EPA's small generator exemption, generally available to firms that generate or accumulate waste in amounts less than 1,000 kg/month, the exemption level for wastes that are designated as either acutely hazardous or toxic is reduced to 1 kg/month. There does not appear to be a sound technical basis for deciding which wastes are acutely hazardous or toxic wastes.

EPA regulations authorize waivers of some facility standards for certain types of hazardous waste. For example, EPA exempts incinerators that burn waste deemed hazardous solely because it is ignitable, corrosive, or reactive from some of the interim status incinerator standards and from some of the permit standards, **if** the operator demonstrates that the waste would not reasonably contain any Appendix VIII toxic constituents. EPA adopted the exemption because such wastes do not pose the hazards that the interim status and final technical facility standards for incinerators are intended to control.[177]

Current regulations suggest areas where formal risk-assessment methodologies might be used to assist decisionmakers, such as in establishing individual facility permitting conditions, in granting variances or waivers from ground water monitoring requirements, or in granting variances in liability insurance coverage.

EPA considered the use of quantitative risk assessment as part of its hazardous waste regulatory scheme in the February 1981, **proposed** land disposal regulations "environmental performance standards. ''178

[174] 45 F.R. 33,164, May 19, 1980.

[175] 40 CFR 261.33(e) (1982).

[176] 40 CFR 261.33(f) (1982).

[177] See the Jan. 23, 1981, Phase II incinerator standards preamble, 46 F.R. 7666.

[178] 46 F.R. 7666.

Industry critics, who had earlier advocated the use of more flexible performance standards rather than design standards, characterized the proposed EPA risk-assessment approach as "potentially nightmarish in application. " To conduct the risk assessment, applicants would have to supply detailed hydrological studies and submit health effects data. EPA informally estimated that such backup studies might cost as much as $1 million per facility. In May 1981, EPA published a notice that it was encountering "profound conceptual difficulties" in the proposed risk-assessment approach and sought further comment, The July 1982 land disposal regulations did not require the use of formal quantitative risk assessments in permitting facilities or in granting variances.

EPA's January 1981 proposed variance procedure for permitted incinerators also would have incorporated the use of quantitative risk assessment on a case-specific basis. In permitting incinerators, it would have allowed a more detailed consideration of factors related to protection of human health and the environment not addressed in the 99.99 percent DRE performance standard (e.g., the absence of any limit on the actual mass of hazardous constituents emitted), site- and waste-specific factors, toxicity, incinerator design, location, climate, and population distribution. EPA observed that use of risk analysis could provide flexibility in determining the necessary level of protection.

In publishing its revised incinerator standard in June 1982, EPA deferred action on the proposed use of risk assessment but did not rule out its eventual application.[179] EPA noted that a risk analysis of the type proposed requires extensive data, which are rarely available and which therefore must be collected either directly or simulated by computer model, The accuracy and precision of the data and models used must then be analyzed before meaningful risk analysis can be conducted, A primary goal of EPA's ongoing regulatory impact analysis (RIA) is to characterize the risks to human health and the environment associated with the incineration of hazardous waste, According to EPA, "the RIA will provide valuable information regarding the feasibility of conducting site-specific risk assessments, therefore any action on the January 1981 proposaI for use of risk assessment to be used in setting variances from the performance standard would be premature. '[180] EPA's risk-cost policy model discussed in the appendix to this chapter is the principal assessment model being used in its regulatory impact analysis.

Certain solid and hazardous wastes are excluded or exempted from RCRA regulation by statute and by rule, These exceptions frequently have been made without any assessment of the inherent hazard of the wastes or the potential effects on human health or the environment from improper handling of these wastes, In contrast, listed waste and mixtures of listed wastes must be managed as hazardous waste without respect to the concentrations of such hazardous constituents or their degree of hazard until and unless they are delisted. Critics argue that this ad hoc system of exemptions and exclusions allows certain potentially hazardous waste to escape proper management or oversight. Exempted or excluded materials, regardless of the reason for, or the status of, the exemption, can be buried in subtitle D landfills which may not adequately contain these wastes. Because of the design of these facilities, hazardous constituents potentially could be released into the environment.

One of the most controversial exemptions is the small quantity exemption. Wastes from small generators are not tracked through the manifest system and can be treated or disposed of either in permitted hazardous waste facilities or in subtitle D sanitary 1andfilIs. EPA incIuded this initial exemption in its regulatory program because of the administrative problems in overseeing thousands of small generators, such as drycleaners, gas stations, and paint stores. The exemption was based on administrative convenience and not on the hazard posed by the waste and its unregulated disposal.

A report by the Subcommittee on Oversight and Investigations of the House Committee on

[179] 47 F.R. 27,518, June 24, 1982.

[180] Id.

Interstate and Foreign Commerce concluded that:

> small generators who produce especially dangerous hazardous waste will not be adequately regulated. The amount of waste produced should not be the only criterion considered. The degree of hazard posed by the waste generated is, in the Subcommittee's opinion, much more important.[181]

Some supporters of the small quantity exemption argue that a high rate of dilution will assumedly take place when a limited amount of hazardous material is disposed with large amounts of nonhazardous substances. However, there is little evidence to support this assumption. Sanitary or municipal landfills in industrial regions will frequently receive small quantities of hazardous wastes from several sources so that the overall load of hazardous waste in these landfills, which were not designed to contain them, could be substantial. If the waste is primarily low-hazard material that is rapidly degraded, there may not be a serious problem. If, however, the material is highly toxic, the consequences could be severe. The proposed National Priority List contains many solid waste landfills that received hazardous waste from firms that probably would be considered small generators under current rules. Past disposal practices at these sites pose substantial threats today to human health and the environment. Under a small generator exemption that focuses on the quantity of the waste and not the degree of hazard that it poses, these inadequate disposal practices will continue.

Risk Management

The use of various methods for quantitative evaluations of risk is receiving increasing attention in the Federal hazardous waste programs under RCRA and the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA). Examples of different risk estimation approaches include:

1. estimations of the risk associated with operation of particular management facilities, used in granting waivers or variances to RCRA regulations;
2. risk/cost models to be used in policy and regulatory development for RCRA; and
3. use of the hazard ranking system in identifying priority sites for Superfund cleanup.

Risk Estimation

In deciding whether a facility qualifies for a waiver or variance of certain RCRA regulations, the rules specify that the potential for harm to human health and the environment must be considered. For example, land disposal facilities can be exempted from ground water monitoring programs if it is shown that there is low potential for migration of the waste from the facility to drinking water sources. Such risk estimates are generally of a qualitative and judgmental nature and do not follow any specified or formalized quantitative methodology. As discussed above, EPA has considered incorporating the use of quantitative risk-assessment techniques in the permitting of hazardous waste land disposal facilities and incinerators. The tools available for performing risk assessment are not yet at final stages of development; therefore, results generated must be interpreted cautiously if they are to be incorporated into the decisionmaking process. The difficulties of using risk-assessment tools are generated primarily by limitations on the assumptions used in these models. Generalizations may be inaccurate for specific sites, inadequate data bases may be used, criteria for assessing hazard and risks are lacking, and long-range performance cannot be predicted using currently available data.

A recent study prepared by Engineering Science for the Chemical Manufacturers Association attempted to estimate risks associated with incinerators and landfills.[182] Certain generic problems were emphasized:

[181] Subcommittee on Oversight and 1nvestigations, Committee on interstate and Foreign Commerce, *Hazardous Waste Disposal* (Committee Print), 96th Cong., 1st sess (1979).

[182] Engineering *Science, Comparative Evaluation of Incinerators and Landfills for Hazardous Waste Management,* report for the Chemical Manufacturers Association, Washington, D. C., 1982].

1. Because of the many assumptions required in determining most estimates, the result is at best an approximation of the actual risk. This may be particularly true when calculations are required prior to actual operation of a facility. In this situation, data are limited, and assumptions about performance efficiency will skew the results, The difficulties and uncertainties in predicting the environmental fate of constituents (as discussed in ch. 6) also contribute to this problem.

2. Currently available data bases are inadequate for reliably estimating risks. Data relating to health effects from exposures are incomplete and are not standardized with respect to test organisms, protocols used, and routes of exposure. Also, published information may not be conclusive. For example, one compound may be considered carcinogenic in one study, but noncarcinogenic in another; it may produce adverse effects in mice, but not in rats. In addition, it should be emphasized that the absence of evidence in any test situation does not equal evidence of no effect. Because of such problems, predictions of the potential risk to human health resulting from future use of a waste management facility will be very uncertain.

3. Criteria for acceptable risk or standards for acceptable environmental concentrations of constituents do not exist for most hazardous waste constituents. Without such criteria or standards, judgments about acceptable levels of risks resulting from operation of a facility would be arbitrary.

4. The methodologies used do not consider changes in risk over time for either facility operation or the environmental fate of constituents. For example, if emissions from a facility are marginally acceptable, current models do not permit consideration of a decrease in efficiency over time that could lead to potential accumulation and environmental buildup of constituents, as well as low-probability accidental releases that may be larger than steady-state release values.

A major omission in EPA's various proposals for implementation of risk estimation **is development of criteria on which to judge whether such risk estimates represent an acceptable level of risk to human health and the environment. A permit writer or RegionaI Administrator must decide: 1) whether the estimation methodology is appropriate, z) whether the quality of data is adequate, and 3) acceptable risk levels. Decisions on all of these will be difficult if agency permit writers do not have either training or sufficiently detailed interpretive guidance documents.**

Hazard Ranking System for CERCLA

In order to set priorities for remedial action at uncontrolled hazardous waste sites, CERCLA requires that EPA establish specific ranking criteria based on: relative risk or danger, population at risk, hazardous potential of a substance or substances at a site, potential for drinking water contamination, potential for direct human contact, and the possibility of destruction of sensitive ecosystems. To meet this mandate, EPA developed the Hazard Ranking System (HRS).[183] (It is also referred to as "the Mitre Model" because it was initially developed by that group for EPA.) The HRS is a tool for applying uniform technical judgment regarding the potential hazards presented by a facility relative to other facilities. EPA's description of this system is presented in the appendix to this chapter.

An OTA review of the HRS identified certain problem areas in the methodology for assigning a hazard score for any site which could result in a ranking that does not adequately reflect the risk posed by releases at the site.

1. The score for hazard potential is based on only the most hazardous substance in the site rather than a composite of all constituents. In contrast, all substances are used to quantify the magnitude of this hazard. For example, one site may contain predominantly low-hazard wastes (e.g., 100 tons) with small quantities of a highly hazardous substance (e.g., only 8 tons). Another site might have the same amount (8 tons) of an equally high-hazardous substance, but no other

[183] 47 F.R. 31,210-31,243, July 13, 1982 to he codified at 40 CFR Part 300.

material. This latter site, in comparison with the first, would receive a lower score based only on volume, although the hazard is equal.

2. Low-population areas will tend to receive a lower score than high-population areas using the HRS, making it less likely that CERCLA funds for remedial action would be allocated to sites in these mostly rural areas, without regard to the relative number of persons actually exposed and the nature of the hazard. One major component of the HRS is based on the size of the population served. If 100 or fewer persons are being served by a threatened water source, the score would be less than if a larger number of people were involved. While it is reasonable to expect that those sites near urban centers may present a threat to large numbers of people, this is not always the case. For example, if the dilution potential were large (i.e., constituents from the site migrate toward a large river), the actual exposure dose to the population may be quite small. The number of people served by a potential water source is only an indicator of the population at risk; it should be emphasized that the number of people actually exposed to hazardous constituents may not be proportional to the population served. If the HRS is used to determine allocation of funds to priority sites, then CERCLA funds will be used only when large numbers of people maybe exposed, and may not be allocated when relatively few people are actually exposed, without regard for the degree of hazard posed by a site.

3. Another component of the score is based on distance to some specified point of exposure. For ground water, it is the distance to the nearest well drawing water from an aquifer; for surface water, it represents the distance to the closest water intakes; and for air, it is the distance to the nearest sensitive environments. prior to a release from a site, these are reasonable factors to be used. The greatest hazard is presumed to be located nearest the site in question. Following a release from a site, however, distance to an exposure point has only marginal significance for the degree of hazard posed. Because of the mobility characteristics of contaminant plumes within ground water aquifers, it is possible that a well located 3 miles from a site could have higher concentrations of hazardous constituents than a well located only 2,000 ft from it. The important factor after constituents have been released to the environment is whether direct evidenc:e of contamination exists at any exposure point.

In addition to these three specific problems, a more general criticism of the HRS is that no provisions exist for incorporating additional technical information about a site. The HRS has merit as a tool for processing substantial amounts of information on many sites. Certain types of technical information, however, that can be helpful for assessing relative degrees of hazard are not used. Such information would include:

1. amounts and kinds of observed releases (e.g., whether a release involves the most hazardous substances at a site);
2. possible attenuation of the released constituents along a route of transport;
3. particularly sensitive populations receiving known doses;
4. transient populations that may receive acute exposures; and
5. populations at risk, which are located at distances greater than the 3-mile limit imposed by the HRS.

At issue is the extent to which the current procedure may lead to inaccurate conclusions about the hazards posed by any site. It is conceivable that a truly hazardous site may not score sufficiently high to receive attention and that a site, which may pose a relatively lower threat, could receive a score that suggests high hazard. It should be possible to develop methodology so that HRS scores reflect actual hazard. For example, problems associated with both waste quantity and population can be resolved by assigning a maximum score for both of these factors whenever the toxicity-persistence Score is above a certain level. The criticism concerning distance to exposure point could be addressed either by adding another factor to the scoring system that indicated direct evidence of contamination at exposure points, or by replacing the distance

factor with one more relevant to direct exposure regardless of distance. A mechanism that incorporates additional data would have the added benefit of providing an incentive for States and industry to obtain more detailed information about particular sites.

Risk/Cost Policy Model

In response to a request by the Office of Management and Budget to conduct a regulatory impact analysis under President Reagan's Executive Order 12291, including consideration of using degree of hazard as a basis for RCRA regulation, EPA has developed a risk/cost policy model. The model consists of a multidimensional framework that organizes and combines various characteristics of waste (W), environmental settings (E), and management technologies (T). Scores for cost and risk are assigned to each W-E-T combination. The costs are defined as representing real resource costs such as capital and operating expenditures; risks are defined as risk to human health only and are based on toxicity and exposure measures. **There is no consideration of environmental hazard.** Details regarding the model and the OTA critique are presented in the appendix to this chapter.

The data base compiled for the model currently includes 83 industrial wastes. Information on these wastes includes physical characterizations, toxicity data for hazardous constituents, concentrations of waste constituents, an estimate of the total amount of generated waste by type, a mean value expressed as kg/day/generator, and potential treatment technologies. A broad range of technology choices has been provided. Any W-E-T combination can include one to three treatment technologies, one transportation option, and one land disposal option. Typical routine release rates representing some level of risk are included in the data base, as are costs for each treatment and disposal technology. Three indicators of human health risk have been identified: assimilative capacity of surface water located near a site, contamination potential of nearby ground water sources, and population density near a site. Each is represented by different levels—high, medium, or low.

Any model that will be used to develop policy and set priorities for regulatory reform should describe realistic conditions as closely as possible. The risk/cost policy model incorporates inadequate data management practices and unrealistic measures of human health risks; thus, the results could lead to policies and regulatory changes that have detrimental rather than beneficial impact on a national waste management approach,

The data base includes some wastes that currently are considered nonhazardous and are regulated under Subtitle D of RCRA (solid, nonhazardous wastes). EPA is attempting to establish subtitle C policies and regulations using a data base that is a mix of hazardous and nonhazardous substances. The technologies considered as major **single** treatments for the wastes in this model are incineration and chemical fixation/stabilization. Available information concerning waste management options suggests that these are not the major alternatives currently used.

The measures used to assess risk for various environmental conditions are so simplistic as to yield inaccurate estimates:

1. Flow rate of surface water is the only measure used to assess assimilative capacity. The potential for assimilation in any water system actually depends on a variety of factors, of which flow rate is only one.
2. The only measure used to represent the contamination potential of ground water sources is soil permeability. This oversimplifies the influence different factors have on ground water contamination and does not accurately represent the potential migration through soil or movement of a plume of constituents through ground water.
3. population density near a facility is assumed to represent the population at risk. This is inaccurate, as identification of a population or individuals at risk depends on several exposure factors and individual

sensitivities to the constituents involved, more than the numbers of people residing near a facility.

Modifications made to risk scores give disproportionate and unjustified weight to dilution capability and size of the nearby population without considering the actual environmental fate of the constituents. As the model is formulated, a persistent compound released into an environment with a low-population density could receive a lower risk score than a biodegradable constituent released at a location with a high-population density; thus, the actual risk posed by a waste may be misrepresented through the use of this methodology.

Regardless of which waste or technology is incorporated within a W-E-T combination, the risk scores decrease with decreasing population density. Because of the way costs have been identified for the various treatment options, there is a bias in favor of land disposal. **Thus, results of this model will represent land disposal located in areas of low-population density as having the most favorable costs and risks when compared with other waste management alternatives and population densities.**

Appendix 7A.–Hazard Ranking System

As part of the National Contingency Plan, EPA developed a Hazard Ranking System (HRS) to be used to prioritize those uncontrolled sites that might require CERCLA funds for remedial action. The HRS methodology is applied by EPA and the States using data from observed or potential releases to obtain a score representing an estimate of the risk presented by each release. The score for each release is then used with other considerations in determining its placement on the National Priority List. This system is summarized by EPA as follows:[1]

The HRS assigns three scores to a hazardous facility:

- S_M reflects the potential for harm to humans or the environment from migration of a hazardous substance away from the facility by routes involving ground water, surface water, or air. It is a composite of separate scores for each of the three routes.
- S_{FE} reflects the potential for harm from substances that can explode or cause fires.
- S_{DC} reflects the potential for harm from direct contact with hazardous substances at the facility (i. e., no migration need be involved).

> The score for each hazard mode (migration, fire and explosion and direct contact) or route is obtained by considering a set of factors that characterize the potential of the facility to cause harm . . . Each factor is assigned a numerical value (on a scale of O to 3, 5, or 8) according to prescribed guidelines, This value is then multiplied by a weighting factor yielding the factor score. The factor scores are then combined; scores within a factor category are added; then the total scores for each factor category are multiplied together to develop a score for ground water, surface water, air, fire and explosion, and direct contact . . .

The HRS does not quantify the probability of harm from a facility or the magnitude of the harm that could result, although the factors have been selected in order to approximate both those elements of risk. It is a procedure for ranking facilities in terms of the potential threat they pose by describing:

- the manner in which the hazardous substances are contained,
- the characteristics and amount of the harmful substances, and
- the likely targets.

Table 7A.1 shows the factors used and the information required in applying the HRS.

[1] National Oil and Hazardous Substances Contingency Plan, 47 FR 31, 180, July 16, 1982.

Table 7A.1 .—Comprehensive List to Rating Factors

Hazard mode/ factor category	Factors		
	Ground water route	Surface water route	Air route
Migration			
Route characteristics	• Depth to aquifer of concern • Net precipitation • Permeability of unsaturated zone • Physical state	• Facility slope and intervening terrain • One-year 24-hour rainfall • Distance to nearest surface water • Physical state	
Containment	• Containment	• Containment	
Waste characteristics	. Toxicity/persistence • Hazardous waste quantfty	• Toxicity/persistence • Hazardous waste quantity	. Reactivity/incompatibility • Toxicity . Hazardous waste quantity
Targets	• Ground water use • Distance to nearest well/population served	• Surface water use . Distance to sensitive environment • Population served/distance to water intake downstream	• Land use • Population within 4-mile radius • Distance to sensitive environment
Fire and explosion			
Containment	• Containment		
Waste characteristics	• Direct evidence • Ignitability • Reactivity • Incompatibility • Hazardous waste quantity		
Targets	• Distance to nearest population • Distance to nearest building • Distance to nearest sensitive environment • Land use • Population within 2-mile radius • Number of buildings within 2-mile radius		
Direct contact			
Observed incident	• Observed incident		
Accessibility	• Accessibility of hazardous substances		
Containment	Containment		
Toxicity	• Toxicity		
Targets	. Population within 1-mile radius • Distance to critical habitat		

SOURCE 47 F R 31, 221, July 16, 19S3

Appendix 7B. –Risk/Cost Policy Model

In response to a request by the Office of Management and Budget to consider degree of hazard as a basis for regulation, EPA has developed a risk/cost policy model. This model was developed by three consulting firms and presented in a report, *Risk/Cost Policy Model Project, Phase 2 Report.* [2] The abstract of the report states:

> The RCRA Risk/Cost Policy Model establishes a system that allows users to investigate how tradeoffs of costs and risks can be made among wastes, environments, and technologies (W-E-T) in order to arrive at feasible regulatory alternatives.

There are many components in the system. Eighty-three hazardous waste streams are ranked on the basis of the inherent hazard of the constituents they typically contain, The system assesses these waste streams in terms of the likelihood and severity of human exposure to their hazardous constituents and models their behavior in three media—air, surface water, and ground water. The system also incorporates the mechanisms by which the constituents are affected by the environment, such as hydrolysis, biodegradation, and adsorption.

A second integral part of the system is the definition of environments in which the hazard components are released. Thirteen environments including a special category for deep ocean waters are defined on the basis of population density, hydrology, and

[2] ICF, Inc., *RCRA Risk/Cost Policy Model Project, Phase 2 Report,* submitted to EPA, Office Solid Waste, Washington, D C., 1982.

hydrogeology. The system adjusts the exposure scores of the waste streams' hazardous constituents to account for their varying effects in the three media in each of the environments.

The third component of the system consists of the technologies commonly used to transport, treat, and dispose of the hazardous waste streams. This includes 3 types of transportation, 21 treatment technologies, and 9 disposal technologies. The system determines cost and release rates for each of these technologies based on the model's existing data base. It also incorporates estimates of capacities of the technologies, the amount of waste to be disposed of, and the proximity of the wastes to the available waste management facilities,

The model contains a multidimensional framework that combines various characteristics of waste (W), environmental settings (E), and management technologies (T), which includes treatment, disposal, and transportation technologies. Each combination of W-E-T includes one waste, one environmental setting, up to three treatment technologies, one disposal technology, and one transportation technology. Scores (based on logarithmic scales) are assigned to each W-E-T for cost and risk. Costs are defined so as to represent real resource costs such as capital and operating expenditures; the latter include labor, utilities, maintenance, and transportation. Risks are defined as risk to human health only and are based on toxicity and exposure methods; no consideration is given to environmental hazards.

The data base compiled for the model currently includes 83 industrial wastes. Information has been gathered regarding physical characteristics of the wastes, toxicity data on hazardous constituents, concentrations of these constituents, an estimate of the national amount generated for each, and an average value that represents kg/day/generator.

Table 7B.l illustrates the technologies included in the data base; a broad range has been considered. Specific treatment options have been identified for each waste based on engineering judgments of the consulting firms. For each waste, several technology choices have been identified. For example, a particular waste might have the following treatment choices listed in the data base:

1. chemical coagulation as a single treatment;
2. vacuum filter and evaporation/drying in combination;
3. incineration as a single treatment (assuming pretreatment);
4. chemical fixation/stabilization as a single treatment; and
5. chemical precipitation and incineration in combination.

Table 7B.l.—Treatment, Transportation, and Disposal Technologies for the EPA Risk/Cost Policy Model

Treatment	Transportation	Disposal
Phase separation		
Chemical coagulation	Onsite	Double-lined landfill,
Filter press	Local	Single-lined landfill,
Centrifuge	Long distance	Unlined landfill,
Vacuum filter		Double-lined surface impoundment
Component separation		
Evaporation/drying		Single-lined surface impoundment
Air stripping		
Steam stripping		Unlined surface impoundment
Solvent extraction		
Leaching		Land treatment
Distillation		Deep-well injection
Reverse osmosis		Ocean
Carbon adsorption (PAC)		
Ion exchange		
Chemical transformation		
Chemical precipitation		
Chemical destruction		
Electrolytic decomposition		
Chemical flxatlon/stabilization		
Incineration		
99.990/o DRE		
99.900/, DRE		
99.000/o DRE		
90.00°\o DRE		

SOURCE: ICF, Inc., 1982.

The technology element of each W-E-T combination includes a choice of one to three treatment technologies, one transportation option, and one land disposal option. Thus, a W-E-T combination for the above example would include one of the single or combined treatments, one of three transportation options, and one of nine disposal options. For all technologies, typical routine release rates representing some level of risk are included in the data base. Costs associated with each treatment and disposal technology also are provided.

The model identifies three environmental indicators of human health risk: assimilative capacity of surface water located near a site, contamination potential of nearby ground water sources, and population density near a site. Each indicator is represented by different levels—i.e., high, medium, or low. All possible combinations of these indicators representing 12 environmental settings are illustrated in table 7B.2. Deep ocean waters constitute a separate environmental setting.

Two different levels are used to represent assimilative capacity for surface waters, Low assimilation represents a high-risk situation and is identified by the following conditions:

1. low-flow streams;

Table 7B.2.—Environmental Settings Used in the EPA Risk/Cost Policy Model

Popultion density	Assimilation	Contamination
1. High (< 520 people/km^2)	Low (<3 x 10' m^3/day)	High (0.2 km/yr)
2. High	Low	Low (20 km/yr)
3. High	High (<3 x IO^a m^3/day)	High
4. High	High	Low
5. Medium (< 52 people/km')	Low	High
6. Medium	Low	Low
7. Medium	High	High
8. Medium	High	Low
9. Low (<52 people/km^2)	Low	High
10. Low	Low	Low
11, Low	High	High
12. Low	High	Low
13. Deep ocean waters		

SOURCE: ICF, Inc , 1982

2. large streams where drinking-water intakes are located downstream and within 6 hours of the waste facility at an average flow rate; and
3. areas subject to frequent flooding-e. g., a 100-year flood plain.

High-assimilative capacity represents high rates of flow or high-volume surface waters–i.e., large streams, estuaries, or lakes. This category is considered a low-risk situation in the model.

Criteria for determining low-risk levels for contamination potential of ground water include:

- locations above aquifers already contaminated to ***100*** times current drinking water standards;
- soil permeability of less than ***10-6*** cm/sec and depth to ground water saturation greater than 10 m; and
- soil Permeability less than 10^{-4} cm/sec and depth to ground "water saturation greater than 100 m.

High-risk levels for ground water contamination include all other conditions and those locations with major earthquake threats.

Population density near a waste management facility is used to indicate the population at risk. High-population density is defined as that with greater than 520 people/km', medium density as 52 to 520 people/km^2, and low density as any area with less than 52 people/km^2.

Limitations in Use of the Model

As is evident by the following exerpts from the *Risk/Cost Policy Model Project, Phase 2 Report,* those most directly involved with development of the model have a clear grasp as to its limitations. EPA staff working on the model appear to understand that it is in at early stage of development, that there are considerable uncertainties associated with results, and that a need exists to spend more time in development and validation of the model.

> EPA's purpose in developing the RCRA Risk/Cost Policy Model is to assist policy makers in identifying cost-effective options that minimize risks to health and the environment, The framework of the system is intended as a screen—to identify situations that are of special concern because of the risks they pose and to determine where additional controls may not be warranted in light of the high costs involved. The framework uses a data base that is too imprecise and general to be the sole basis for regulations. The results of the model will be used in more detailed Regulatory Impact Analysis to determine whether some type of regulatory action is warranted. s
>
> * * *
>
> . . . results of the model will be used at a high level of generality (to set priorities rather than to design specific regulations) . . .[4]
>
> * * *
>
> Most important, this model cannot be used to evaluate particular permit applications.[5]
>
> * * *
>
> This degree of imprecision means that the results cannot be used in a specific regulation-making context. We could, of course, use our general methodological approach to reach specific conclusions, but to do would involve substantial effort and time, which should probably be spent only on a very small number of regulatory options of the highest priority. Even if we used the tool in such a limited fashion, we would have to make substantial changes in the present assumptions, Because of the level of generality at which we operated, it would be improper to apply the risk and cost values to a specific situation.[6]

[3] ICF, op.cit,. abstract
[4] Ibid , p 1 b
[5] Ibid , p 1 8.
[6] Ibid., p 1 1(1

* * *

> Although a number of assumptions hamper specific analysis, we believe that the tool is highly useful at the general level of application for which it is intended.[7]

* * *

> The risk/cost policy model provides a framework for debate over alternatives, but requires restraint in applications and interpretation. The major assumptions and simplifications render detailed insight into the specifics of a regulation impossible.[8]

Statements made by the Administrator of EPA before congressional committees, however, suggests that the Agency intends to use this model for regulatory reform and rulemaking. In the land disposal regulations and in several statements presented at congressional hearings (as illustrated below) during the past year by senior officials, EPA has indicated that it will use the model quite soon. It must be emphasized that while these statements do not specifically refer to the Risk/Cost Policy model, it has been referred to as the Agency's degree-of-hazard approach.'

> Reexamination of existing regulations—in light of the extensive comments received on Phase I and Phase 11 regulations, we are undertaking a major reexamination, including: . . . An analysis of the cost/risk/feasibility factors in managing various types of waste to enable use to tailor standards for the control of specific classes of hazardous waste; . . .[10]

* * *

> Even as we near completion of RCRA'S regulatory framework, we continue our pursuit of the Administrator's goals in the area of regulatory reform. To this end, all our regulations are now undergoing a degree-of-hazard analysis to determine whether the requirements need strengthening or whether they are already too stringent.[11]

* * *

> Tailoring of standards for specific wastes—apart from the specific regulatory activities discussed immediately above, EPA is conducting regulatory impact analyses for each of the various types of waste management units, In addition, it is conducting a degree-of-hazard study which will examine various combinations of waste types and volumes, treatment and disposal technologies, and environmental settings. This study is intended to identify ways in which RCRA Subtitle C standards could be tailored to better address particular problems. Based upon these studies, EPA hopes to propose appropriate regulatory amendments in 1983 and promulgate them in 1984.[12]

OTA believes that it will be some time before the model offers results of sufficient certainty to have confidence in its use for policy development or regulatory reform. At some time in the future, after results are verified, it would be appropriate to use it as a "screening" tool, to determine Agency priorities and areas for regulatory reform, and to "tailor" or "fine tune" RCRA regulations. In conjunction with other work, the model might be used to determine which wastes might be prohibited from landfills, what wastes would qualify for exemption from small quantity generators, and what facilities might qualify for regulatory exceptions and variances, or for class permits.

OTA Critique of the Risk/Cost Policy Model

Preparing a critique of this model from the Phase 2 Report was exceedingly difficult. Important information about actual application was missing, and many errors were noted. The report was poorly written—therefore, several interpretations for appropriate use of the methodology were possible. Only after a 6-hour meeting with the contractors and EPA representatives did OTA feel that sufficient information was in hand to attempt this critique. This fact **must be emphasized.** If persons trained in the various disciplines that are incorporated in the model have difficulty interpreting both methodology and results, it seems unlikely that administrative officials will be able to apply the model correctly.

Even when a model is to be used **only** as a screening tool for developing policy and setting priorities for regulatory reform, it is important that its elements describe real conditions as closely as possible. Because the Risk/Cost Policy Model incorporates inadequate data about management practices and unrealistic assumptions, reliance on its results could lead to policies and regulatory changes that have detrimental rather than beneficial impact on a national waste management approach.

Inadequate Data

There are several problems noted with the data base used in the Risk/Cost Policy model. The model considers 83 industrial wastes, of which 80 percent are currently considered as hazardous by EPA. The

'J[bid., p. 1. I 1.
[8]1 bid., p. 5.7,
[9]C. Haymore, "EPA's Degree-of-Hazard Program," *Waste Age*, January, 1982.
[10]A.M. Gorsuch, statement before the U.S. House Subcommittee on Environment, Energy, and Natural Resources, Oct. 21, 1981.
[11]R. M. Lavelle, statement before the U.S. Senate Subcommittee on Environmental Pollution, June *24, 1982.*
[12]U.S. Environmental Protection Agency, *Hazardous Waste Management System: Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Office of Solid Wastes, Washington, D. C., 1982.

total volume represents 50 percent of EPA's estimate for annual hazardous waste generation in the United States. For some applications this data base may be reasonable, especially for preliminary screening functions; however, if used to set priorities or tailor regulations this data base may be limited. Large amounts of federally unregulated wastes, which some States define as hazardous, are not included; this could lead to Federal policies that do not consider adequately actual management choices commercially available to deal with these wastes, In addition, there appears to have been no attempt to correlate this data base with the broad diversity in quality of wastes currently being regulated. Thus, results from any analysis using this model would not reflect current needs or problems in hazardous waste management.

The data base includes wastes not designated as hazardous and therefore are actually regulated under Subtitle D of RCRA.

1. wastes containing metals that are likely candidates for hazardous designation at some future date;
2. a single nonhazardous waste that might compete for disposal space in subtitle C permitted landfills; and
3. a single metal-fluoride waste that is water soluble and therefore may be classed as hazardous at some future date.

This model treats these wastes as though they are **hazardous** and regulated under subtitle C. The developers of this model apparently assumed that **all wastes** would be regulated under subtitle C in the future. while this situation would be preferable to the exclusionary system currently being used by EPA, **it would seem inappropriate to tailor subtitle C regulations using a data base that does not accurately reflect current management or hazard conditions.**

Although a broad range of technologies are included, actual matching of technologies with particular wastes are rather limited, Furthermore, the choice of technology included in W-E-T combinations is not based on current management practices, but rather reflects engineering judgments about how a waste **might** be treated. For example, incineration is the predominant treatment technology in this data base and is applied as a **single treatment** to 47 of the 83 wastes. Only three waste streams have incineration listed as an option in combination with another treatment technology. Such widespread use of incineration as a **single-treatment** option is not reflected in available data for management of subtitle C wastes.

Chemical fixation/stabilization is the second most predominant, single-treatment technology applied to wastes in the data base. It is listed as a single-treatment option for 36 wastes and in combination with other treatments for 27 wastes. Broad application of chemical fixation/stabilization is not representative of current disposal practices as this data base would suggest.

Costs associated with each treatment and disposal technology are part of the data base. The basis for the estimates of cost was engineering judgment rather than actual costs associated with operating facilities. In addition, differences in such factors as treatability of waste streams, volume, and concentrations of hazardous constituents that will affect costs associated with treatments apparently were not considered.

Inaccurate Assumptions Used in the Model

The Risk/Cost Policy Model attempts to make an enormously difficult analytical problem more tractable by using restrictive and simplistic assumptions about environmental exposure. While OTA would agree that waste, environment, and technology are the three important elements in determining risk from waste management choices, **the assumptions used in the model for each of these elements are so simplistic that inaccurate risk estimates may be expected.**

The concept of determining and using assimilative capacity of surface waters and contamination potential of ground water as measures of environmental or human health risk has merit. The indicators chosen to represent these two concepts, however, have flaws in underlying assumptions and contrary, to a statement in the abstract, **the W-E-T concept as developed in this model does not represent the environmental behavior of waste constituents.**

Unfortunately, the criteria used for assigning high and low levels of assimilative capacity and contamination potential have little relation to the meaning of these two ecological concepts. When considering the first, flow rate is used as the **only** measure and is considered to represent assimilative capability of surface water. The assimilative potential of **any** ecosystem (forest, stream, or lake), however, depends on the capacity of that system to remove, isolate, or destroy a constituent. This capacity is influenced by severaI factors incIuding:

1. physical factors of an ecosystem;
2. quality and quantity of biota present; and
3. chemical characteristics of a pollutant.

Flow rate is only one physical factor of a surface water system that determines distribution of a pollutant and certainly is **not** the **most** important factor. Distribution patterns may increase or decrease the potential assimilation of a constituent into a system. Thus, flow rate cannot be considered a direct measure of assimilative capacity nor can it be considered a reliable measure of surface water contamination.

For example, the actual level of assimilation in a given situation would depend on relative persistence of a constituent, its chemical reactivity within the identified environment, the potential for photodegradation, the ability of biotic populations to degrade it (thus, removing it from food sources), and sedimentation or sorption rates contributing to its long-term isolation. It is conceivable that both degradable and persistent constituents in a slow-flowing stream (a characteristic considered in this model to represent low-assimilative capacity and, therefore, high risk) could present the same level of risk. If the persistent compound were isolated from human contact by burial in sediment or accumulated in nonedible aquatic animals, the risk for human exposure would be minimal. High-assimilative capacities (and therefore low-risk levels) are attributed to those locations that discharge into fast-flowing streams, large estuaries, or lakes. However, a persistent constituent could be discharged to a lake, bioaccumulated through the food chain, posing an increased risk to human populations, **Thus, use of flow rate as the sole measure of surface water contamination can hardly be considered as representative of real conditions.**

There are similar problems with criteria for assigning high- and low-contamination potential of ground water sources, The model defines risk in terms of an adverse effect on human health and does not consider effects on the environment. Therefore, it seems misleading to classify an environmental setting in which drinking water standards have been exceeded as a low risk. In addition, the simplistic, dichotomous characteristics of soil permeability that are used as indicators for contamination potential seem unduly rigid and ambiguous. It is not clear how these relate to real conditions of either natural soil profiles or engineering designs of a facility. Many other factors found in subsurface environments influence levels of contamination potential.

The risk/cost model uses population density as an indication of a population at risk. The number of people residing near a site, however, has little meaning for the probability that an adverse effect will occur, the generally accepted definition of risk. The chance of **observing** the effect is greater with larger populations, but the risk to individuals and the proportion of a population likely to be affected are not changed by density. This is a factor that EPA consistently ignores in many of the risk assessment models.

This misconception of risk suggests that EPA does not understand the importance of **actual dose received by a population.** The density within some radius of a waste site is not relevant. **Only that group of individuals receiving a particular dose is the population at risk;** it can be either nearby or far-removed from a site of contamination. Also, the exposure may represent an acute situation—i.e., one single dose, or a chronic situation with several exposures occurring over time. In addition, the dose may vary considerably. Such variations may result from different levels of intake or routes of exposure (e.g., amount of water consumed daily), variation in concentration levels for each intake, and variation in type of chemicals for each intake. Moreover, there is the additional problem that sensitivities of specific individuals to chemicals can vary greatly,

The concept that higher population densities result in greater risks is wrong. Population density is not an adequate indicator of the likelihood of individuals being exposed to a hazardous constituent. It is quite conceivable that only a few people in an urban area would be exposed (e. g., if the major source of drinking water is not drawn from the contaminated site); in contrast, if all local wells are affected, everyone residing in a low-density area could receive contaminated water. If the exposure is indirect (as in distribution of a pollutant in food), density becomes even less important.

Methodology

Overall risk scores are compiled using measures representing waste, environment, and technology as discussed above and are represented logarithmically. Factors in the scores include:

1. **waste—an** inherent hazard score and an exposure score for either air, surface water, or ground water;
2. environment-adjustments to exposure scores based on population density, assimilative capacity, and contamination potential; and
3. technology—adjustments to a final risk score based on release rates estimated for selected treatment/transportation/disposal technologies.

Inherent hazard score is defined as the probability of a response per unit of intake, This score is

determined for 140 compounds considered to be potentially hazardous constituents of the 83 waste streams. The scoring system used for assigning inherent hazard is based on identifying a minimum effective dose (MED) for each compound. An MED represents the smallest amount of a chemical required to produce an effect in a laboratory population. This effect could range from skin rashes to death. Therefore, each MED represents some minimal level of response; for example, if the following doses are identified for three hypothetical chemicals:

Chemical	*MED*	*Effect*
Chemical A.	100.00 mg/kg body weight	X
Chemical B	3.00 mg/kg body weight	Y
Chemical C	0.01 mg/kg body weight	Z

It would indicate that some effect X is noted for chemical A in a laboratory test population only after administering a dose of 100 mg/kg; chemical B and C produce effects that are qualitatively different from chemical A and at much lower doses. Also, because the effects resulting from an exposure are different for C and A, these MED values do not imply that C is more toxic than A. Such an interpretation is possible only if the effects of both chemicals were identical.

Once a human MED has been identified or calculated from animal data, this dose is divided by a factor of 10. Because an effect resulting from low doses usually can be detected in 10 to 30 percent of the test population, an assumption made in the model considers that this division will represent an approximation of that dose which would "yield a l-percent probability of producing adverse effects," in the population at risk. An inherent hazard score is then assigned for this value. The scale for the inherent hazard score has been set arbitrarily to represent an order of magnitude difference in each unit change—i.e,, a score of 2 represents an inherent hazard that is 10 times greater than a score of 1.

The score, however, may be misleading as the model differentiates among doses not quality of effeet—e.g., cancer is considered equal to skin rashes. Thus, although the doses represented by two scores of 2 and 3 may be 10 times different, the quality of effects could be reversed; the effect for a chemical with a hazard score of 3 (low dose) may represent skin rashes, while the effect for a chemical with a score of 2 (higher dose) could be death.

In addition to an inherent hazard score, an exposure score is assigned for each compound for one of three exposure routes (air, surface water, or ground water], primarily based on half-life of the chemical. In assigning this score, some consideration also is given for bioaccumulation potential [in surface only), potential removal by conventional water treatment (in surface water and ground water), and adsorption to solid surfaces (in ground water only). It should be emphasized that transport potential of a compound is considered equal to degradation. Therefore, if a constituent is highly volatile and might be transported readily from water to air, the constituent is considered to be degradable in water and the half-life relatively short. However, there are several circumstances where a volatile compound discharged into water would not be readily transported to air—e.g., is adsorbed onto deep sediment or ingested into biota.

Certain modifications are made to individual media exposure scores based on the three environmental indicators previously discussed.

1. Modifications 'to the surface water exposure score for assimilative capacity increase the score by one unit (one order of magnitude change) for low assimilation (i.e., low-flow rate) and decrease by one unit for high assimilation (i.e., high-flow rate or large volume of water). Such factors as actual concentration or amount of compound being discharged and the volume of water within which the compound is diluted (for low assimilation) are not considered.
2. A similar problem exists when considering modifications for ground water contamination. Velocity of ground water flow is the deciding factor. High velocity decreases a ground water exposure score by one unit for compounds with half-lives greater than 10 years. If the velocity is very slow, compounds with half-lives of 100 years or greater have exposure scores increased by one unit, The actual potential for risk in this situation, however, would depend, in part, on distance traveled prior to human exposure. Circumstances could arise where distances are short enough that human exposure would be possible, particularly for compounds with half-lives of 10 years. Also, there are documented cases when contaminant plumes do not move at the same rate, or even the same direction as the ground water flow.[13]
3. A value judgment is made that all exposure scores (air, surface water, and ground water) should be adjusted according to density of nearby populations. If density is high the score is increased, thus, the overall risk value is increased. If population density is low, the score

[13] David Burmaster, "Critique of the Monitoring Provisions in EPA's Interim Final Regulations for Hazardous Waste Landfills, " OTA Working Paper, 1982.

is **decreased.** Unit changes established for the model are illustrated in table 7B.3 and reflect a consistent bias **against rural areas.**

This modification scheme gives disproportionate and unjustified weight **to** dilution capacity and size of populations without regard **to** the fate of compounds in each medium.

Costs for each treatment, disposal, and transportation technology were estimated based on the "typical" facility. For treatment technologies these estimates were further rounded-off to a value closest to the boundaries set in the cost score. These boundaries represent a difference of two between scores. (These scores are based on log z.) For example, a cost score of 3 represents technology costs that are two times greater than a cost score of z. No attention was given to the fact that these costs would vary depending on the waste being treated.

There is a potential inability to discriminate among the W-E-T combinations solely on the basis of cost in a manner that has real meaning. Given two hypothetical W-E-T combinations, W-E-T 1 and W-E-T z, the costs associated with the latter must be twice as large as the former before they will be considered different in the model. Because of the way costs have been allocated to various technologies in the data base, it is possible that no differences will be observed when using the same technology for two different wastes, Likewise, it is unlikely that differences in costs for different technologies and the same waste will be large enough to merit a change in cost score. Because costs do depend on characteristics of the waste, real values, however, might be very different when comparing the use of two different treatments for one waste.

Misleading Results and Conclusions

As the model currently is formulated, there are certain misleading outcomes that could have serious ramifications in setting RCRA policy and regulatory reforms. Concentrations of **a** specific constituent can vary considerably among wastes found in the data base; such differences, however, are not reflected in the inherent hazard score. For example, lead is found in waste from paint production and in wastes from metal production; the concentration factor for the first is 0.01 and for the second, 0,03. Although there is three times the amount of lead in one waste, the inherent hazard score assigned to each would be the same, Differences in concentration would only be recognized if the treatment process affected original levels. More realistic differences in hazard and perhaps in the overall risk might be obtained if the inherent hazard score were adjusted for differences in constituent concentrations in the waste.

Table 7B.3.—Unit Changes for Population Density

	Air			Surface water			Ground water		
Half-life	H	M	L	H	M	L	H	M	L
3 minutes ... , ...	+2	+ 1	– 1						
30 minutes	+ 1	+1	– 1	+1	–1	–2			
6 hours	+ 1	0	–1	+1	–1	–2	+2	–1	–2
3 days ... , ...	0	0	0	+1	–1	–2	+2	+ 1	–2
30 days	0	0	0	0	0	0	+2	+1	–2
1 year.	**0**	**0**	**0**	**0**	**0**	**0**	+2	+1	–2
10 years.	0	0	0	0	0	0	+2	+1	–1
100 years.	0	0	0	0	0	0	+1	+1	–1
1,000 years	0	0	0	0	0	0	0	0	–1

KEY: H—high density, M—medium density, L—low density,

SOURCE: ICF, Inc., 19S2

A major outcome of this model is that for any given waste, risk scores calculated for surface and ground water **decrease** from high- to low-population density, as illustrated in table 7B.4. Thus, the lowest risks, irrespective of waste type or technology choice, will always be those areas with low-population densities. The implication of this use of population density for determining overall risk is alarming. When more **people reside near a malfunctioning waste site, that site would have a higher priority or would require more stringent control technology than a site associated with a lower density of people, regardless of the actual level of hazard or degree of exposure.** Determining policy and regulatory reform on the basis of variations in population density (urban v. rural) poses difficult political and ethical questions.

Misleading results about risks can arise in another way also. For example, determination of surface water exposure scores for two hypothetical chemicals give the following results:

Chemical A, half-live=3 days . 2 2
High-population density . . . . +1 Low population ., –2
Low-assimilative capacity, . . + 1 Low assimilation. + 1
Modified exposure score . . 4 1

Chemical B, half-life= 1 year 4
High-population density ... , 0
High-assimilative capacity . . – 1
Modified exposure score . . 3

Although chemical A could be discharged into water with low assimilative capacity (e.g., a stream with a low-flow rate), the location near an urban area results in an exposure score four orders of magnitude as high as that in the rural environment. Because chemical B is discharged into surface water with high assimilative capacity (e.g., a stream with a high-flow rate), it has a lower score than chemical A even though chemical B is considered more persistent. A situation could exist whereby

Table 7B.4.—Differences in Risk Score for Twelve Environmental Settings With Example Waste Streams

EPA No	Constituents	Media	Risk scores by environmental setting[a]											
			1	2	3	4	5	6	7	8	9	10	11	12
K060	ArsenIC	A	9	9	9	9	9	9	9		Y	9	9	9
Amonia still		S	13	13	11	11	13	13	11	13	13	13	11	11
lime sludge from		G	13	11	13	11	13	11	13	11	12	10	12	10
coking operation	Phenol	A	7	7	7	7	6	6	6	6	5	5	5	5
		s	7	7	5	5	5	5	3	3	4	4	2	2
		G	11	9	11	9	11	9	11	9	10	8	10	8
	Cyanide[b]	A	11	11	11	11	11	11	11	11	11	11	11	11
		s	6	6	4	4	4	4	2	2	3	3	1	1
		G	12	10	12	10	12	10	12	10	11	9	11	9
	Naphthalene	A	5	5	5	5	5	5	5	5	5	5	5	5
		s	3	3	1	1	1	1	–1	–1	0	0	–2	–2
		G	8	6	8	6	8	6	8	6	7	5	7	7
K073	Chloroform[b]	A	8	8	8	8	8	8	8	8	6	8	8	8
Chlorinated		s	5	5	3	3	3	3	1	1	2	2	0	0
hydrocarbon		G	10	8	10	8	10	8	10	8	9	7	9	7
waste from	Carbon tetrachloride[c]	A	11	11	11	11	11	11	11	11	11	11	11	11
chloralkali		s	5	5	3	3	3	3	1	1	2	2	0	0
process		G	10	8	10	8	10	8	10	8	9	7	9	7
	Hexachloroethane	A	8	8	8	8	8	8	8	8	8	8	8	8
		s	3	3	1	1	1	1	–1	–1	0	0	–2	–2
		G	8	6	8	6	8	6	8	6	6	4	6	4
	1,1,2 Trichlorethane	A	6	6	6	6	6	6	6	6	6	6	6	6
		s	3	3	1	1	1	1	–1	–1	0	0	–2	–2
		G	8	6	8	6	8	6	8	6	7	5	7	5
	1,1,1 Trichlorethane	A	7	7	7	7	7	7	7	7	7	7	7	7
		s	3	3	1	1	1	1	–1	–1	0	0	–2	–2
		G	9	7	9	7	9	7	9	7	8	6	8	6
K026	Pyridine[b]	A	6	6	6	6	6	6	6	6	6	6	6	6
Stripping		s	5	5	3	3	3	3	1	1	2	2	0	0
tails from		G	9	7	9	7	9	7	9	7	7	5	7	5
methyl ethyl	Phenol	A	7	7	7	7	6	6	6	6	5	5	5	5
production		s	7	7	5	5	5	5	3	3	4	4	2	2
		G	11	9	11	9	11	9	11	9	10	8	10	8
K025	*2,4* Dinitrotoluene[b]	A	6	6	6	6	6	6	6	6	6	6	6	6
Still bottoms		s	6	6	4	4	4	4	2	2	3	3	1	1
from nitrobenzene		G	10	8	10	8	10	8	10	8	9	7	9	7
production	Nitrobenzenec	A	6	6	6	6	6	6	6	6	6	6	6	6
		s	4	4	2	2	2	2	0	0	1	1	–1	–1
		G	9	7	9	7	9	7	9	7	7	5	7	5
KO02, 3, 5	Lead	A	9	9	9	9	9	9	9	9	9	9	9	9
Mixed metal		s	9	9	7	7	9	9	7	7	9	9	7	7
sludges from		G	9	9	9	9	8	8	8	8	5	5	5	5
paint production	Mercury[b]A		9	9	9	9	9	9	9	9	9	9	9	9
		s	9	9	7	7	9	9	7	7	9	9	7	7
		G	7	7	7	7	6	6	6	6	3	3	3	3
	Thallium	A	9	9	9	9	9	9	9	9	9	9	9	9
		s	7	7	5	5	5	5	3	3	4	4	2	2
		G	7	7	7	7	6	6	6	6	3	3	3	3
KO11, 13, 14	Acrylonitrile[b]	A	8	8	8	8	8	8	8	8	8	8	8	8
Still bottoms from		s	7	7	5	5	5	5	3	3	4	4	2	2
acrylonitrile		G	13	11	13	11	13	11	13	11	12	10	12	10
production	Cyanide	A	11	11	11	11	11	11	11	11	11	11	11	11
		s	6	6	4	4	4	4	2	2	3	3	1	1
		G	12	10	12	10	12	10	12	10	11	9	11	9
	Acetonitrile	A	8	8	8	8	8	8	8	8	8	8	8	8
		s	4	4	2	2	2	2	0	0	1	1	-1	-1
		G	10	8	10	8	10	8	10	8	9	7	9	7

Table 7B.4.—Differences in Risk Scores for Twelve Environmental Settings With Example Waste Streams—Continued

			Risk scores by environmental setting[a]											
EPA No.	Constituents	Media	1	2	3	4	5	6	7	8	9	10	11	12
K009, 10 distillation residues from acetaldehyde	Chloroacetaldehyde	A	7	7	7	7	7	7	7	7	7	7	7	7
		S	6	6	4	4	4	2	2	3	3	1	1	
		G	11	9	11	9	11	9	11	9	10	8	10	8
	Formaldehyde	A	8	8	8	8	8	8	8	8	8	8	8	8
		S	7	7	5	5	5	5	3	3	4	4	2	2
		G	13	11	13	11	13	11	13	11	12	10	12	10
	Chloroform	A	8	8	8	8	8	8	8	8	8	8	8	8
		G	10	8	10	8	10	8	10	8	9	7	9	7
	Acetaldehyde[b]	A	5	5	5	5	4	4	4	4	3	3	3	3
		S	4	4	2	2	2	2	0	0	1	1	−1	−1
		G	10	8	10	8	10	8	10	8	9	7	9	7
K065 Mixed metal sludges from nonferrous metal production	Lead[b]	A	9	9	9	9	9	9	9	9	9	9	9	9
		S	9	9	7	7	9	9	7	7	9	9	7	7
		G	9	9	9	9	8	8	8	8	5	5	5	5
	Cadmium	A	9	9	9	9	9	9	9	9	9	9	9	9
		S	12	12	10	10	12	12	10	10	12	12	10	10
		G	12	10	12	10	12	10	12	10	10	8	10	8
K041 Sludge from the production of toxaphene	Toxaphene	A	7	7	7	7	7	7	7	7	7	7	7	7
		S	6	6	4	4	4	4	2	2	3	3	1	1
		G	10	8	10	8	10	8	10	8	8	6	8	6

A—Air
S—Surfacewater
G—Groundwater

[a]Environmental settings:
1—high population density
low assimilative capacity
high contamination potential
2—high population density
low assimilative capacity
low contamination potential
3—high population density
high assimilative capacity
high contamination potential
4—high population density
high assimilative capacity
low contamination potential
5—medium population density
low assimilative capacity
high contamination potential
6—medium population density
low assimilative capacity
low contamination potential
7—medium population density
high assimilative capacity
high contamination potential
8—medium population density
high assimilative capacity
low contamination potential
9—low population density
low assimilative capacity
high contamination potential
10—low population density
low assimilative capacity
low contamination potential
11—low population density
high assimilative capacity
high contamination potential
12—low population density
high assimilative capacity
low contamination potential

[b]Constituent selected for use in model based on highest concentration in waste stream

[c]Constituents having greatest concentration can vary among waste streams, this constituent often has highest concentration

SOURCE: Off Ice of Technology Assessment

drinking water is drawn from rapid-flowing streams or that fish from such a stream serve as food for the population; thus, the **actual** risk for chemical B might be greater than chemical A, The fate of chemicals in the environment have important consequences when assessing risks and these are not addressed by the Risk/Cost Policy model. In addition, the effects on human health may not be represented by the relative risk scores. Chemical A may result in a skin disorder and chemical B may reduce the fecundity of females,

In many cases, the total volume of a given constituent can partition among all environmental media and exposure could result from more than one route—e. g., it could be in drinking water and in food sources. The dose received could be greater for a given constituent than indicated by this model and thus, the probability of observing an adverse effect could be greatly increased.

A second outcome of this model is that costs associated with technologies appear to be biased toward land disposal. Because long-term costs (monitoring costs and liability insurance fees) are not reflected in a realistic manner, disposal on land without any prior treatment may prove to be the least expensive for all wastes. Thus, regardless of the waste and selected environmental setting, a major outcome of this model may be that those W-E-T combinations with the lowest risk/cost results will be those associated with low population densities and disposal in landfills.

A major difficulty in applying this Risk/Cost Policy Model is that EPA has blurred distinctions between roles of policy maker, regulator, and industry

in the management of hazardous waste, RCRA policy was established by Congress—i. e., EPA was charged with protecting human health and the environment from adverse effects that might result through mismanagement of hazardous materials. Because of the statutory language, **EPA is constrained from balancing risk and costs. The use of this model in changing or developing new policy appears to be a violation of the congressional intent of RCRA.**

Finally, EPA is attempting to determine which technologies should be used to manage hazardous waste and in assessing costs and risks for each possible waste and technology combination. This perhaps is a task more suited for industry than a regulatory agency, If the Agency were to set goals for levels of acceptable risk or hazard by establishing some type of standard for industry to meet, it could then be left to individual companies to determine: 1) which technology is to be used to meet the standard, and 2) at what cost. For EPA to do an adequate determination of the W-E-T combinations and evaluate them for risk and costs requires enormous commitments of time and money on the part of the Federal Government. If each industrial entity were to do its own specific assessment, the cost could be internalized within the industry and not be a drain on limited governmental resources,