United States
Environmental Protection
Agency

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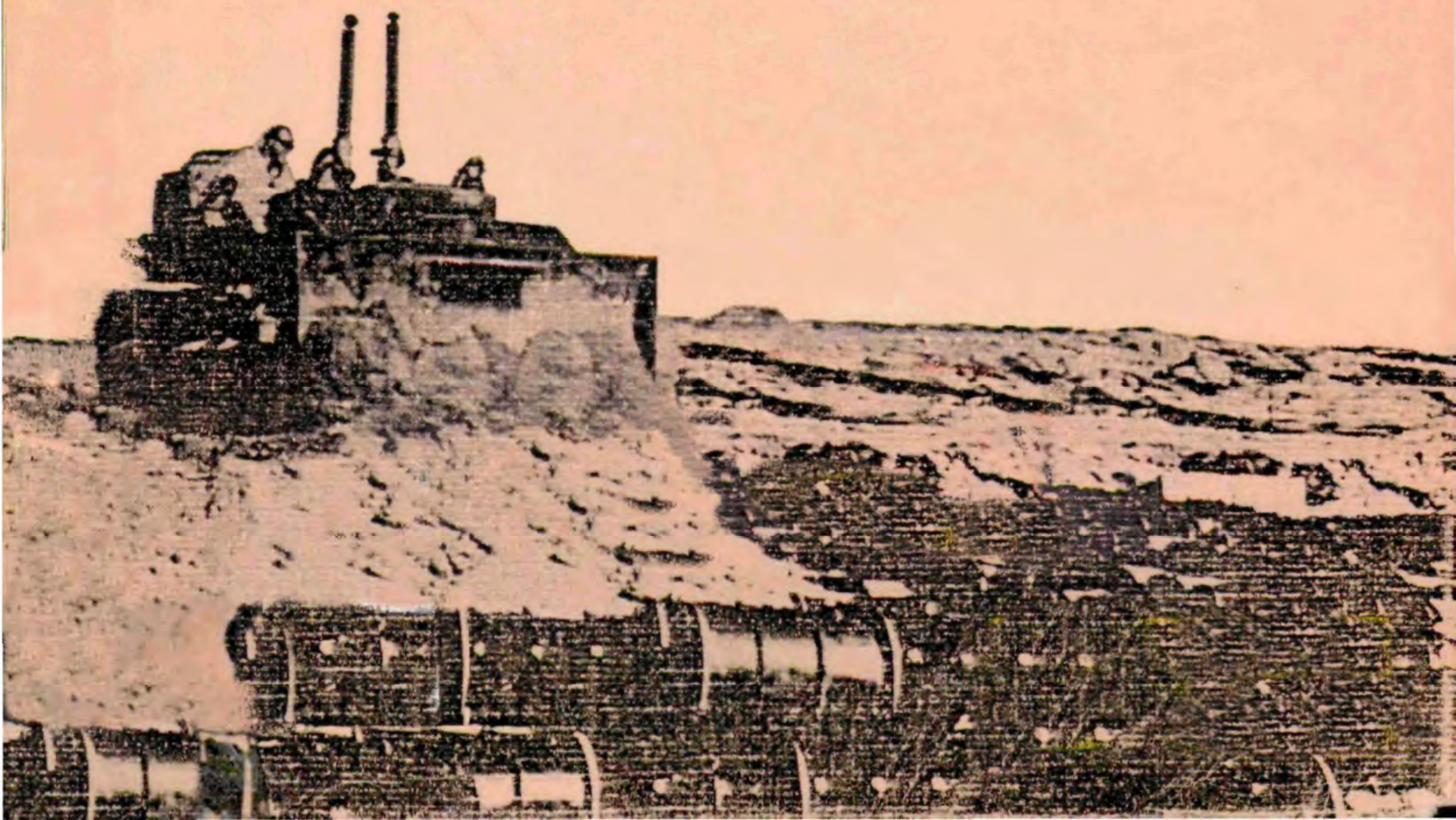
Solid Waste

EPA

Subtitle C, Resource Conservation and Recovery Act of 1976

Final Environmental Impact Statement—Part I



Notice

The attached document was prepared by one or more contractors under the guidance of EPA. It is printed here largely as received from the contractor; the Agency has not yet completed reviewing it.

Because of the lead time necessary to produce this study, it was necessary to base it on a preliminary draft of the final regulations. There were some changes made later to the regulations. Thus this document unavoidably does not completely correspond to the regulations finally promulgated. The Agency is currently analyzing the effect of the late regulatory changes on the findings of this study.

DRAFT

FINAL
ENVIRONMENTAL IMPACT STATEMENT
PART I

FOR
SUBTITLE C, RESOURCE CONSERVATION
AND RECOVERY ACT OF 1976 (RCRA)

PREPARED BY
OFFICE OF SOLID WASTE
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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FOR SOLID WASTE

APRIL 1980

SUMMARY SHEET

PART I
FINAL ENVIRONMENTAL IMPACT STATEMENT FOR
SUBTITLE C, RESOURCE CONSERVATION AND RECOVERY
ACT OF 1976 (RCRA)

Environmental Protection Agency
Office of Solid Waste

1. Type of Action

Administrative Action (Regulatory)

2. Brief Description of Action

The Resource Conservation and Recovery Act of 1976 (RCRA) Subtitle C, provides EPA with the authority to regulate the generation, transportation, treatment, storage, and disposal of hazardous waste in a manner that protects human health and the environment. RCRA also authorizes States to implement their own program for the management of hazardous waste if it is, at a minimum, equivalent to the Federal regulations. Compliance with the proposed regulations is mandatory; non-compliance is subject to penalty of law.

3. Summary of Beneficial and Adverse Environmental Effects

Promulgation of the final Subtitle C regulations will lead to reduced releases of air, water, and soil contaminants from the management of hazardous wastes and to resultant beneficial impacts to air quality, water quality, public health, and ecological systems. The regulations will increase the cost of generating and managing hazardous wastes and could lead to some industrial plant closings and to increased administrative and paperwork requirements. Many existing facilities would have to change their current hazardous waste management practices and some could close due, at least in part, to increased costs and more stringent requirements.

4. Alternatives Considered

a. Baseline Action
b. No Action
c. Phasing of Generators
d. Enhanced Public Health and Environmental Protection
e. Lesser Degree of Public Health and Environmental Protection
f. Phase I

5. Federal, State, and Local Agencies From Which Comments Have Been Received

The proposed Subtitle C regulations and the Draft EIS were distributed to hundreds of individuals and organizations representing all sectors of our society. Over 1200 written comments were received on the proposed regulations. The following is a list of individuals and organizations who submitted written comments directly pertaining to the EIS:

American Petroleum Institute
American Textile Manufacturers Institute, Inc.
Department of Health, Education, and Welfare, Public Health Service
Dow Chemical U.S.A.
Mobil Oil Corporation
The Utility Solid Waste Activities Group and The Edison Electric Institute
United States Department of Commerce

6. Date Available To The Public

The Part I Final Environmental Impact Statement has been provided to the Office of Environmental Review, EPA, for the purpose of publishing an official public notice of availability in the Federal Register. The Economic Impact Analysis for Subtitle C has also been provided to the Office of Environmental Review, EPA. The notice of availability of these documents is anticipated on April 30, 1980.

These documents may be obtained by writing: Mr. Edward Cox, Solid Waste Information Office, U.S. Environmental Protection Agency, 26 West St. Clair, Cincinnati, Ohio 45260. The documents may be viewed at the library of all EPA Regional Offices.

ACKNOWLEDGEMENT

This voluntary Environmental Impact Statement was prepared by the U.S. Environmental Protection Agency (EPA) with the assistance of the MITRE Corporation under EPA Contract Number 68-01-4641. The Project Officer was Ellen O'Boyle, Office of Solid Waste.

PREFACE

The Part I - Final Environmental Impact Statement (EIS) for Subtitle C of RCRA presents an analysis of the Phase I Subtitle C regulations as drafted in February 1980, as well as an analysis of other alternatives to the baseline regulations that were considered in the Draft Environmental Impact Statement. It was necessary to analyze the February 1980 version of the Phase I regulations due to time constraints involved in preparing the regulations and conducting an environmental impact analysis of them.

As a result of numerous comments subsequent to the proposal of RCRA Section 3004 regulations in December 1978, the Agency has concluded that more study and analysis will be required to develop and support many of the national "technical" standards which will prescribe the design and construction of facilities. The Agency has chosen therefore to promulgate the Section 3004 regulations covering waste management facilities on a phased basis. Phase I, to be promulgated April 30, 1980, includes primarily the requirements which are incumbent upon facilities during the Interim Status period (the time between the effective date of the regulations and final action on a permit), plus most of the administrative requirements for permitted facilities. This EIS covers these Phase I Interim Status Standards.

Since the general technical standards will not be included in Phase I, it will not be possible to grant permits until Phase II of the regulations for waste management facilities are issued later this year. The Phase II regulations will contain a great deal of flexibility for the Regional Administrator to use his judgment in deciding the environmental adequacy of a facility. The Phase II regulations will be sufficiently comprehensive to allow the permitting process to commence, but will not contain many of the specific technical requirements which the Agency hopes to promulgate over the next several years as more information is developed. A Part II - Final EIS will be issued at the time Phase II of the regulations is promulgated. This promulgation is anticipated for the fall of 1980.

Phase III will involve reproposing and ultimately promulgating more definite technical standards as the technical issues are resolved. The Phase III regulations will not be included within the scope of this EIS.

A separate economic impact analysis has been prepared for the final Subtitle C regulations. The report entitled "Economic Impact Analysis for Subtitle C Resource Conservation and Recovery Act of 1976" is to be available April 30, 1980.

Several major revisions with respect to the Draft Environmental Impact Statement have been incorporated into this Part I - Final Environmental Impact Statement. These revisions are based upon comments received on the Draft Environmental Impact Statement and upon standards considered for pomulgation under Phase I of the regulations. An additional alternative, the Phase I Alternative, has been assessed in Chapter 8. The number of generators required to comply with the baseline regulations has been modified to consider the effects of the Transfer of Liability Contract. The Assessment of energy use impacts in Chapter 7 and 8 has been expanded to consider impacts to energy production. The assessment of impacts to hazardous waste management facility capacity has been modified to clarify the potential for localized capacity shortfalls. The Summary Chapter has been modified, as necessary, based upon changes to the rest of the Environmental Impact Statement.

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S.0 SUMMARY

S.1 Introduction

The objectives of the Resource Conservation and Recovery Act of 1976 (RCRA) are to promote the protection of health and the environment and to conserve valuable material and energy resources. Subtitle C of RCRA provides the U.S. Environmental Protection Agency (EPA) with the authority to regulate the generation, transportation, storage, treatment, and disposal of hazardous wastes in a manner consistent with these objectives. Subtitle C also authorizes states to implement their own hazardous waste management programs pursuant to Subtitle C and directs EPA to promulgate guidelines to assist states in the development of such authorized programs.

S.2 Description of the Baseline Action

The baseline action is the set of regulations and guidelines initially developed by the EPA in response to the mandate of the following Sections of Subtitle C:

- Identification and Listing of Hazardous Waste (Section 3001);
- Standards Applicable to Generators of Hazardous Wastes (Section 3002);
- Standards Applicable to Transporters of Hazardous Wastes (Section 3003);
- Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Section 3004);
- Permits for Treatment, Storage, or Disposal of Hazardous Waste (Section 3005);

- Authorized State Hazardous Waste Programs (Section 3006);
- Preliminary Notification of Hazardous Waste Activities (Section 3010);

This Environmental Impact Statement (EIS) examines the potential impacts that could result both from promulgation of the baseline regulations and guidelines and from five regulatory alternatives. The specific regulations and guidelines being assessed in this EIS are summarized below, and the five regulatory alternatives are summarized in the following section.

S.2.1 Identification and Listing of Hazardous Waste (Section 3001). The Section 3001 baseline regulations define those wastes that are to be considered hazardous and, therefore, subject to the other Subtitle C regulations. Two mechanisms are provided for determining those wastes that are hazardous: identifying characteristics and lists of specific hazardous wastes and processes generating hazardous wastes. Four identifying characteristics are specified for determining whether a waste is hazardous: ignitability, corrosivity, reactivity, and toxicity. Any waste which exhibits any of these characteristics or which is listed (see Appendix B, Subpart A), would be considered hazardous and would have to be managed pursuant to the Subtitle C regulations.

S.2.2 Standards Applicable to Generators of Hazardous Wastes (Section 3002). The Section 3002 baseline regulations establish standards for manifesting and keeping records of hazardous wastes shipped off the site of generation; for containerization of hazardous wastes; for labeling, placarding, and marking of hazardous waste shipments; and for reporting the disposition of hazardous wastes. These standards would apply to those persons or Federal agencies, except households, who generate and dispose more than 100 kilograms (about 220 pounds) per month of wastes identified as hazardous under the Section 3001 regulations. Any person or Federal agency producing and disposing 100 kilograms or less per month would not be required to comply with the generator regulations. Also any generator engaged solely in retail trade or principally in farming would have to comply with the regulations only with regard to waste automotive oil; however, any person (e.g., a transporter) could assume a waste automotive oil generator's total liability for compliance with the Section 3002 requirements, providing a written transfer of Liability Contract is in effect. Generators excluded from compliance with the Subtitle C regulations would, however, still be obligated to dispose their hazardous wastes in an acceptable manner, e.g., in a landfill that meets RCRA Subtitle D criteria.

S.2.3 Standards Applicable to Transporters of Hazardous Wastes (Section 3003). The Section 3003 baseline regulations establish standards for the acceptance, loading, and stowing of hazardous wastes; for compliance with the manifest system; for marking and placarding of transport vehicles; for delivery of hazardous wastes; and for reporting and cleaning up spills. These standards would apply to any person or Federal agency transporting, within the United States, hazardous wastes that require a manifest under the generator regulations and also apply to any transporter importing a shipment of hazardous wastes from abroad. Portions of the standards would also apply to any transporter who consolidates and transports hazardous wastes not requiring a manifest. The transporter regulations would not apply to persons or Federal agencies transporting hazardous wastes solely on the site of generation or solely on the site of a permitted hazardous waste management facility.

S.2.4 Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Section 3004). The Section 3004 baseline regulations establish standards for protection of air quality, groundwater quality, and surface water quality; for general facility practices and procedures including site selection, financial requirements, training, emergency preparedness, monitoring, recordkeeping, reporting, and closure; for storage operations; for treatment/disposal operations including landfills, incinerators, surface impoundments, and landfarms; and for management of 'special wastes' (i.e., cement kiln dusts, utility wastes, oil drilling muds/ brines, phosphate rock mining and processing wastes, uranium mining wastes, and other mining wastes).

These standards apply to owners and operators of any facility that treats, stores, or disposes any quantity of any waste identified as hazardous under the Section 3001 regulations, except 'special wastes'. All owners and operators of facilities that treat, store, or dispose 'special wastes', and no other hazardous waste, would have to comply only with specified general facility standards. The Section 3004 standards do not apply to on-site waste accumulation by generators who store their own wastes for less than 90 days prior to subsequent transport off-site, but do apply to any such on-site storage which lasts for 90 days or longer.

Certain practices that are controlled under other Federal acts are not regulated under the treatment, storage, and disposal standards. These practices include underground (deep-well) injection, ocean dumping, discharges to municipal sewer systems, surface discharges under a National Pollution Discharge Elimination System (NPDES) permit, and all treatment, storage and disposal activities at Publicly Owned Treatment Works (POTW) or by ocean dumping barges and vessels. However the treatment, storage, and disposal regulations would apply to above ground storage or treatment of hazardous wastes prior to underground injection, on-shore facilities associated with ocean dumping activities, and surface impoundments associated with NPDES permitted industrial wastewater treatment facilities and hazardous sludges from such facilities.

S.2.5 Permits for Treatment, Storage, or Disposal of Hazardous Waste (Section 3005). The Section 3005 baseline regulations require that all owners or operators of facilities treating, storing, or disposing hazardous wastes obtain a permit prior to facility construction, modification, or operation. The regulations establish standards for permit applications, permit issuance, and permit revocation. Permits would be issued for the projected life of the facility. The owners/ operators of new facilities would be required to obtain permits prior to construction, and would have to certify that construction was performed in compliance with the permit before commencing operation. Special permits would be available for experimental facilities, qualified hospital and medical care facilities, POTW's, and ocean dumping barges and vessels. Standards would be established for including public participation in the permit review process.

S.2.6 <u>Authorized State Hazardous Waste Programs (Section 3006).</u> Section 3006 provides that states are to be encouraged to apply for authorization to administer and enforce their own hazardous waste program pursuant to Subtitle C. Under the baseline regulations there would be three types of authorization for which states could apply: full authorization, partial authorization, or interim authorization.

Full authorization would allow a state to carry out a hazardous waste program in lieu of the Federal program under Subtitle C. Partial authorization would allow a state to administer and enforce selected components of a hazardous waste regulatory program established pursuant to Subtitle C. EPA would retain responsibility for the remaining components of the program. States would be considered for partial authorization only if state legislative authority did not exist for all required program components. In all cases, the combination of the state and Federal program would have to meet the requirements of a fully authorized program. Partial authorization would be granted for a period not to exceed 5 years, but could be renewed.

Interim authorization would allow a state to carry out a hazardous waste program in lieu of the Federal Program under Subtitle C for a period not to exceed 24 months, beginning on the date 6 months after the date of promulgation of regulations under Section 3001. The purpose of interim authorization is to allow the state to make an orderly transition from its present program to a program eligible for full authorization.

S.2.7 Preliminary Notification of Hazardous Waste Activities (Section 3010). The Section 3010 baseline regulations require that any person generating or transporting hazardous wastes or owning or operating a facility for treatment, storage, or disposal of hazardous wastes notify the EPA Administrator of such activity not later than 90 days after promulgation of regulations under Section 3001. Section 3010 specifies in detail who would have to file notification of hazardous waste activity, when and where such notification would have to be filed, and the information that would have to be supplied in the notification.

S.3 Description of the Reasonable Alternatives

During the overall development of both the proposed regulations and the final Phase I regulations, numerous alternative regulations and regulatory approaches have been considered. Both the baseline regulations and subsequent versions of the regulations were selected from among the many options initially considered based upon technical, environmental, institutional, economic, and legal considerations. Because of the enormous number of ways in which these various options could be structured into alternative sets of regulations, the approach taken in this EIS is to select and to develop a manageable set of meaningful alternatives that reasonably bracket the overall objectives and the resultant impacts anticipated from the regulations that are ultimately to be promulgated under Subtitle C. With this approach it is possible to show the types of potential impacts that could result under various alternatives without having to explicitly consider the almost infinite variety of options for accomplishing the same or intermediate objectives.

Five different sets of alternatives, with respect to the baseline regulations, have been selected and structured to reasonably bracket the potential impacts that could be expected to result. These alternatives are as follows:

- No Action;
- Phasing of Generators;
- Enhanced Public Health and Environmental Protection;
- Lesser Degree of Public Health and Environmental Protection;
- Phase I Alternative.

S.3.1 <u>No Action.</u> The No Action alternative has been selected for the purpose of analyzing the potential impacts that could result from taking no action, i.e., not promulgating regulations for Subtitle C. For reasons discussed in Chapter 4, the No Action alternative assumes that no part of RCRA, including Subtitle C, is to be implemented and that hazardous waste management would continue as currently practiced.

S.3.2 Phasing of Generators. The Phasing of Generators alternative has been selected for the purpose of analyzing the potential changes in impacts that could result from the phasing of levels for standards and criteria established by the regulations to their proposed values over a period of time, rather than from initially setting them at their proposed values. For purposes of analysis, a five-year time frame measured from the initial implementation date, is assumed for the phasing of the more stringent levels.

While there are many different ways in which the more stringent levels for promulgated standards and criteria could be phased in, most would have essentially the same effect--a gradual expansion of the total quantity of hazardous wastes being controlled by the hazardous waste program. For purposes of analysis, the method selected emphasizes increasing the quantity of wastes controlled during the first 5 years following promulgation of the regulations by gradually expanding the number of generators brought under control. With this approach, the level of the generator limit established under Section 3002 of the baseline regulations is to be reduced annually over a five-year period of time in order to bring the larger generators into the program first and the smaller generators into the program later. Furthermore, the generator limit is to be reduced so that equal amounts of hazardous wastes are annually brought under the programs's control over the five-year period, i.e., 20 percent of the total industrial hazardous wastes per year.

S.3.3 Enhanced Public Health and Environmental Protection. The Enhanced Public Health and Environmental Protection alternative has been selected for the purpose of analyzing the potential change in impacts that could result from modifications to the baseline Subtitle C regulations designed to further increase public health and environmental protection even above that level afforded by the baseline regulations.

The basic strategy of this alternative is to expand the definition of hazardous waste in order to bring additional wastes under control of the program; to remove exclusions provided for hazardous waste generators; to apply even more stringent design and operational requirements for storers, treaters, and disposers; to eliminate the special standards for 'special wastes'; to reduce reporting intervals for storers, treaters, and disposers; to eliminate the use of delivery documents in lieu of manifests; and to decrease the life of permits and impose additional restrictions on obtaining permits.

S.3.4 Lesser Degree of Public Health and Environmental Protection. The Lesser Degree of Public Health and Enviornmental Protection alternative has been selected for the purpose of analyzing the potential changes in impacts that could result from modifications to the baseline Subtitle C regulations designed to provide a lesser degree of public health and environmental protection than that afforded by the baseline regulations.

The basic strategy of this alternative is to contract the definition of hazardous wastes in order to bring fewer wastes under the control of the program; to increase exclusions provided for hazardous waste generators; to reduce manifest requirements; to apply less stringent design and operational requirements for storers, treaters, and disposers; to eliminate any regulation of 'special wastes'; to decrease recordkeeping times for generators, transporters, storers, treaters, and disposers; to increase the length of permit exclusions for generators who store prior to off-site disposal; to eliminate restrictions on interim authorization; and to ease restrictions on full and partial authorization.

S.3.5 Phase I Alternative. The Phase I alternative contains the set of non-technical modifications that are being considered for inclusion in the final Phase I Subtitle C regulations. The Phase I Alternative has been included for the purpose of analyzing the potential change in impacts that could result from modifications to the baseline Subtitle C regulations which incorporate this specific set of non-technical changes.

Under this alternative, revisions have been made in the mechanisms for identifying whether a waste is hazardous under Section 3001; exclusions for hazardous waste generators have been modified; special standards for 'special wastes' have been eliminated; Interim Status standards have been added; permit requirements have been modified; reporting and recordkeeping requirements have been changed; General

Facility Standards have been extensively revised; and human health and environmental standards have been eliminated.

S.4 Impacts of the Baseline Regulations

The potential impacts, both beneficial and adverse, that could result from implementation of the baseline Subtitle C regulations are summarized in this section. Two major types of impacts are identified: primary impacts and secondary impacts. Primary impacts include those effects that would be directly attributable to the implementation of the baseline regulations. Secondary impacts include those effects that would be indirectly attributable to the implementation of the baseline regulations. In some cases, secondary impacts might not be observed until years, or even decades, after implementation of the regulations.

Potential impacts are analyzed for two separate years: 1980, the year of expected implementation of the regulations, and 1984, the year by which the full effects of the regulations are expected to become established. For the reasons discussed in Chapter 7, it is anticipated that at least five years would be required for such effects and resultant impacts to become fully established.

The impact analysis is both generic in scope and conducted on a national level due to the extreme waste-specific, process-specific, and site-specific nature of most impacts, and due to the data limitations noted in the text. Because most available data relate to manufacturing industries, the emphasis of the impact analysis is necessarily directed toward manufacturing industries.

Over 300 reported incidents of damage from the improper management of hazardous wastes were reviewed to assist in identifying the potential for beneficial impacts resulting from promulgation of the proposed regulations. From the way in which most of the incidents have come to light, it is very likely that the vast majority of such incidents go unreported, especially human health incidents which may require many years of exposure and for which direct causative relationships are difficult to trace or establish. The reported incidents indicate that there is often a considerable time interval between the occurrence of those events which lead to damage and the time when the damage becomes evident. Since virtually all of the reported incidents were discovered only after damage had already occurred, there is, nationally, a very significant potential for many similar damage incidents to be detected in the future from wastes that have already been improperly transported, stored, treated, or disposed.

S.4.1 <u>Potential Primary Impacts.</u> The potential primary impacts from implementation of the baseline regulations fall into the following areas:

- Hazardous wastes to be regulated;
- Changes to existing generation, transport, storage, treatment, and disposal practices and procedures;
- Administrative changes;

- Air impacts;
- Water impacts;
- Public health impacts.

S.4.1.1 Hazardous Wastes to be Regulated. Approximately 35 million metric tons of hazardous manufacturing wastes could be controlled under the baseline Subtitle C regulations in 1980, and approximately 40 million metric tons of hazardous wastes could be controlled in 1984. The wastes regulated would constitute slightly over 10 percent of the total manufacturing wastes (hazardous and non-hazardous) generated annually in the U.S. The generator limit of 100 kilograms per month could exclude about 29,000 metric tons per year of hazardous manufacturing wastes from regulation. The excluded wastes would represent less than 0.1 percent of the total hazardous manufacturing wastes; approximately 26 percent of manufacturing establishments generating hazardous wastes would be excluded, by this generator limit, from complying with the generator regulations. In addition to manufacturing wastes, an indeterminate portion of other large volume wastes, such as waste automotive oil, coal ash, oil drilling muds and brines, cement kiln dusts, phosphate mining and processing wastes, and uranium mining wastes, could be more substantially controlled under the regulations.

S.4.1.2 Changes to Existing Generation, Transport, Storage, Treatment, and Disposal Practices and Procedures. The baseline Subtitle C regulations would lead to a number of major changes in existing practices and procedures. The changes would be caused by the enactment of more stringent environmental requirements than those that currently exist, resultant increases in treatment and disposal costs, and specific procedural and operational requirements imposed by the regulations.

Generation. The regulations would result in procedural changes in the methods used by regulated generators for tracking and reporting hazardous waste shipments and for preparing such shipments for transport. Every generator would be required to provide a manifest for each off-site hazardous waste shipment--intrastate, interstate, and international--sent to a facility not owned by the generator and to file annual reports and keep records on such shipments. Generators designating hazardous waste for an off-site facility owned by the generator and located in the same state as the generator would have to provide a manifest, but would not have to comply with the reporting or recordkeeping requirements (although the facility itself would be subject to reporting and recordkeeping requirements under Section 3004); shipments to generator-owned facilities in other states would have to comply with the manifesting, recordkeeping, and reporting requirements. On-site shipments would not have to be manifested, but would have to be sent to permitted on-site facilities and would have to be reported to appropriate Federal or state authorities. All such hazardous waste shipments would have to be containerized, labeled, and placarded in accordance with Department of

Transportation (DOT) regulations. Currently, very few shipments of hazardous wastes are subject to such requirements.

In addition, since one major result of the regulations would be to increase costs to generators and costs associated with hazardous waste storage, treatment, and disposal, generators would have an incentive to modify processes so as to reduce and/or change the types and amounts of hazardous wastes generated, and to enable the increased recycling of hazardous wastes as process feedstocks.

Transport. There are numerous reported instances of hazardous waste transporters dumping wastes surreptitiously, rather than delivering the wastes to an environmentally acceptable storage, treatment, or disposal facility. The manifest and reporting requirements should significantly reduce, if not eliminate, such practices. Furthermore, the regulations would impose requirements that all transportation-related spills of hazardous wastes be reported immediately and be cleaned up by the transporter. Requirements for accepting, loading, and stowing hazardous waste shipments would potentially lead to fewer accidents and spills from hazardous waste transport. However, the average distance over which hazardous wastes are transported would likely increase as a result of the regulations. Increased transport distances would increase the potential for vehicular accidents. Increased transport distances would also increase the potential for spills, and this could off-set some of the benefits indicated above.

Storage, Treatment, and Disposal. A major impact resulting from the Subtitle C regulations would be the closing of those hazardous waste management facilities (both off-site and on-site) that could not or would not comply with the storage, treatment, or disposal requirements. It would also lead to the modification of other hazardous waste management facilities to enable compliance. It is expected that a large portion of existing facilities would require modification in order to comply with the regulations.

Those existing hazardous waste storage, treatment, and disposal practices that are environmentally unacceptable according to the baseline Subtitle C regulations would also be prohibited or restricted or would have to be modified; some practices could be replaced by other, more environmentally acceptable practices.

Existing practices that are likely to be prohibited or severely restricted by the baseline Subtitle C regulations include: open burning; uncontrolled incineration; road application of hazardous waste oil; the use of landfills without leachate collection systems and groundwater monitoring systems; the use of surface impoundments without leachate detection systems and groundwater monitoring systems; landfarming of highly volatile wastes; the location of landfills, surface impoundments, and landfarms within 150 meters (500 feet) of functioning public or private water supplies or livestock water supplies; and the mixing of incompatible wastes in surface impoundments and basins, except for the purpose of treatment. In addition, the Subtitle C regulations specifically prohibit such existing practices as open dumping; the placing of reactive wastes, ignitable wastes, and highly volatile wastes in landfills, surface impoundments, or basins; the mixing of incompatible wastes in landfills and landfarms; the use of waste application practices that allow the zone of incorporation of landfarms to become anaerobic; and the use of continuous feed treatment facilities without automatic waste feed cut-offs or by-pass systems that are activated when a malfunction occurs.

The baseline Subtitle C regulations also impose specific requirements for the closure of treatment/disposal facilities. For example, at the time of closure, all disposal operations would have to be completed and all wastes removed from storage and treatment facilities for disposal in accordance with the regulations. Hazardous wastes and hazardous waste residue would also have to be removed from all surface impoundments that do not meet the standards for landfills and would have to be disposed in accordance with the regulations. Contaminated soil-filter medium at landfarms could also have to be removed and disposed according to the regulations. Monitoring and maintenance care would have to be provided for a period that need not exceed 20 years from closure.

The baseline Subtitle C regulations would likely lead to changes in the portion of hazardous wastes treated/disposed on-site by generators and off-site by the waste management industry. For reasons discussed in Chapter 7, it is not possible to accurately determine the extent of any shift that could occur under the baseline Subtitle C regulations. For purposes of analysis, a range of 13 to 25 percent off-site treatment/disposal of hazardous manufacturing wastes in 1984 is used to assess potential impacts of a shift in off-site disposal.

S.4.1.3 Administrative Changes. Implementation of the baseline Subtitle C regulations would necessitate a widesweeping series of administrative changes that would affect industry, state governments, and the Federal government.

State Administration of Programs. EPA staff estimates are that approximately 34 states and territories could qualify for interim authorization under the Subtitle C regulations. No states are believed to be currently able to qualify for full authorization. No states would be able to qualify for partial authorization before the end of the interim authorization period.

Although RCRA encourages states to administer their own authorized hazardous waste program in lieu of the Federal program, states are not required to administer such programs. If a state does not choose to administer a program under Subtitle C of RCRA, there would be a Federally run program in that state. RCRA, however, does not prohibit states without authorized programs from enacting and enforcing their own more stringent or non-consistent hazardous waste program to be run in the state in addition to the Federal program. At this time, it is not known if any state would run such a program in addition to the Federal program, or what regulations would be promulgated under any such overlapping program. Such additional state programs, if enacted, would have the potential for creating various impacts, including the imposition of conflicting and/or duplicative requirements on hazardous waste generators, transporters, storers, treaters, and disposers.

Number of Generators Required to Comply with the Regulations. It is estimated that on the order of 270,000 to 300,000 manufacturing establishments, automotive service stations, hospitals, medical laboratories, and research facilities could have to comply with the generator regulations. An indeterminable number of other potential generators (e.g., 'special waste' generators) could also have to comply.

Number of Storers, Treaters, and Disposers Required to Obtain Permits. It is estimated that on the order of 29,000 manufacturing establishments, hospitals, Federal installations, and hazardous waste management service industry facilities could be required to obtain permits. An indeterminable number of other storers, treaters, and disposers could also be required to obtain permits.

Paperwork Requirement Under the Regulations. The potential generators and permitters identified above would initially have to file about 270,000 to 300,000 notifications, under Section 3010, with EPA or authorized states. An indeterminable number of transporters and other potential generators and permittees would also have to file such notifications. These permittees would also have to submit approximately 29,000 permit applications and additional supplemental material.

It is estimated that there could be between 350,000 and 690,000 off-site shipments of hazardous industrial wastes annually by 1984, necessitating industrial generators to prepare between 350,000 and 690,000 manifests annually. The aggregated generators, transporters, and owners/operators of hazardous waste management facilities would each have to keep between 1.0 and 2.1 million manifests in storage on an annual basis. Most transporters currently keep at least 3 years worth of delivery documents in storage due to various company, state, and Federal requirements. To the extent that transporters use acceptable delivery documents in lieu of manifests, or use manifests in lieu of existing delivery documents, this recordkeeping requirement would not constitute an additional burden on transporters. Each owner/operator of a permitted hazardous waste management facility would also have to keep an operating log for the life of the facility, plus 3 years worth of specified records.

It is estimated that generators and hazardous waste management facilities could prepare upwards of 387,000 to 417,000 reports annually for submittal to permitting authorities. Transporters could have to file between 140 to 270 spill reports annually; some spill reports are presently being filed by transporters under other acts.

Most of this recordkeeping and reporting would represent additional requirements on generators and owners/operators of hazardous waste management facilities, based upon the existing state regulations.

S.4.1.4 Air Quality. Current hazardous waste generation, transport, storage, treatment, and disposal practices involve a variety of activities, each of which has the potential for releasing air pollutants to the environment. The potential for the release of air pollutants by each of these activities would be affected in different ways by the baseline Subtitle C regulations. For the most part, the regulations would lead to reduction in the release of air contaminants and to resultant improvements in air quality.

Generation. Subtitle C regulations would not have a direct effect on air emissions resulting from activities generating hazardous wastes. However, to the extent that the regulations change the economics of disposal or treatment and, thus, result in process modifications engineered to recycle hazardous wastes or to reduce or alter the quantity and/or types of hazardous wastes generated, Subtitle C could indirectly result in changes in process air emissions.

Transport. Current practices in the transport of hazardous wastes have the potential to release air emissions in three major ways:

- Through fugitive emissions resulting from improperly covered, sealed, or containerized wastes;
- Through emissions resulting from spills or other accidental releases of hazardous wastes;

- Through emissions resulting from the operation of the transport vehicle.

Containerization requirements applied to both intrastate and interstate shipments of hazardous wastes would reduce the potential for fugitive emissions from the transport of hazardous wastes. Requirements for the acceptance, loading, and stowing of hazardous wastes, especially incompatible wastes or leaking containers, would greatly reduce the potential for explosions and spills to occur from hazardous waste transport. Requirements for spill clean-up would reduce the potential for the release of air emissions following spills. Increased transport distances could result in increased vehicular emissions; however, any such increase in emissions would be extremely small compared to total national vehicular emissions. Increased transport distances would also increase the potential for spills, and this could off-set some of the benefits indicated above.

Storage. Current practices in the storage of hazardous wastes can lead to the release of air pollutants in three major ways:

- Through fugitive emissions resulting from improper storage of hazardous wastes;
- Through emissions resulting from spills, fires, explosions, and other accidental releases of hazardous wastes and/or their constituents;
- Through emissions occurring as the result of storage becoming the ultimate form of disposal of hazardous wastes.

The regulations contain provisions that would reduce the potential for the release of air emissions from each of these sources.

Hazardous waste storage operations would have to be conducted in such a manner that no discharge occurs; these storage operations would also have to be monitored and inspected to detect any potential discharge. Hazardous wastes which, if stored in an open manner, could release air emissions that could adversely affect human health or environment would be required to be stored in tanks or other closed containers. Restrictions would be placed on the storage of incompatible, explosive, ignitable, or highly reactive wastes to reduce the potential for accidental releases to occur from improper storage. Required spill containment measures and contingency plans could further reduce the potential for accidental releases and the time necessary to clean up any such accidental releases. Hazardous wastes would have to be removed from storage operations during facility closure and be disposed in accordance with the regulations.

Treatment/Disposal. The major sources of air emissions from current hazardous waste treatment/disposal practices are as follows:

- Fugitive emissions from land-based treatment/disposal activities, such as landfills, landfarms, and surface impoundments;
- Emissions generated by explosions, fires, and other accidents;
- Residuals from the combustion of hazardous wastes by incineration or open burning;
- Fugitive emissions from other treatment facilities.

The baseline Subtitle C regulations contain requirements that should reduce the potential for fugitive emissions from the land-based treatment/disposal of hazardous wastes. For example, volatile wastes--those with a true vapor pressure greater than 78 mm mercury at 25 C--would not be allowed to be treated/disposed in landfills, surface impoundments, or basins; such wastes could be landfarmed only if the facility owner/operator could demonstrate, before landfarming the wastes, that the specified air contaminant levels would not be violated. With regard to wastes that are land-filled, cover material would have to be applied daily on active hazardous waste landfill cells. At facility closure, a final cover would have to be provided. Where gases are generated, a gas collection and control system would have to be installed in most instances to control the vertical and horizontal escape of gases.

The baseline Subtitle C regulations contain provisions that should, to a large degree, reduce the potential for fires, explosions, and other accidents at hazardous waste treatment/disposal facilities. The primary cause of most explosions and fires has been the mixing of incompatible wastes and the improper treatment/disposal of ignitable or reactive wastes. The manifesting, labeling, waste analysis, and training requirements would reduce the potential for the improper management of such wastes. Restrictions on the treatment/disposal of incompatible, highly reactive, or ignitable wastes and requirements for contingency plans and spill containment measures would further reduce the potential for the release of air emissions.

The baseline Subtitle C regulations contain provisions that should reduce the potential for the release of air contaminants from the combustion of hazardous wastes. The regulations would require the use of controls for almost all combustion of hazardous wastes and would set design and operational standards. Open burning of hazardous wastes would be prohibited in most instances. All facilities would also be required to comply with all applicable standards of the Clean Air Act, as amended, in order to maintain their permits.

The regulations would also set specific standards for the incineration of hazardous wastes. Incinerators would also have to be designed, constructed, and operated such that fugitive emissions of unburned hazardous wastes and combustion products are controlled and such that waste feed is automatically cut-off if significant changes occur in flame, combustion zone temperature, excess air, or scrubber water pressure.

The baseline Subtitle C regulations contain provisions that should reduce the potential for fugitive emissions from other hazardous waste treatment facilities (e.g., biological, physical, and chemical treatment facilities). Fugitive emissions would be controlled, for the most part, by the regulatory provisions previously discussed.

To the extent that the baseline Subtitle C regulations result in modifications to or construction of additional hazardous waste storage, transportation, disposal, or treatment facilities, there would be an increase in construction-related air emissions. The major emissions would include exhaust from motor vehicles, including construction equipment, and fugitive dust raised by such construction activities as grading, excavation, and movement of equipment.

It should be noted, however, that there would likely be some shift in the types of methods used to store, treat, or dispose these additional wastes under the regulations as compared to the unregulated current practices. Such shifts would change both the types and quantities of air emissions generated from the management of specific wastes. For example, a shift from landfilling to incineration of a particular waste would result in the increased release of combustion products and the reduced release of particulate matter and/or volatile gases. Such shifts could, to an indeterminable extent, either enhance or reduce the potential for indicated reductions in specific air emissions. Furthermore, the construction of new facilities could lead to increased releases of air emissions in the vicinity of the facility and along any transport routes. Closure of existing facilities could lead to reduced releases of air emissions in the vicinity of the facility and along transport routes. The net result could be both a localized and/or nationwide reduction in the releases of many air contaminants from hazardous waste management, and a localized and/or nationwide increase in the releases of other air contaminants. Thus, while there would most likely be improvements in air quality under the regulations, there could also be some localized degradation of air quality. All emissions and any localized degradation of air quality would, however, have to be in compliance with all applicable requirements (e.g., Clean Air Act, OSHA standards, state standards, and Subtitle C standards).

S.4.1.5 Water Quality. Surface water may be contaminated by current hazardous waste management practices through spills; runoff from storage, treatment, or disposal areas; discharges from generating or treatment facilities; or through discharges of contaminated groundwaters. Groundwater contamination may result from infiltration of spilled materials or wastes stored or disposed on permeable surfaces, from percolation of leachate or runoff which has been in contact with hazardous wastes, from leakage or infiltration of fluids, from poorly sealed or unlined waste impoundments, or from injection of wastes into aquifers.

The baseline Subtitle C regulations would potentially result in a decrease in the number and size of spills of hazardous wastes, primarily through containerization requirements. However, any shift to off-site treatment or disposal would necessitate more handling and farther transportation distances, and could tend to off-set some of the potential for a decrease in hazardous spills. Similarly, any increases in the quantity of hazardous waste transported by barge could increase the potential for spills directly into surface waters. The regulations would, however, provide for more rapid notification of authorities and for rapid initiation of clean-up procedures following spills.

The baseline Subtitle C regulations would result in a considerable reduction in other surface releases of hazardous wastes. The regulations would require all generators to store, treat, and dispose their hazardous wastes in permitted facilities. All owners/operators of such facilities would be required to construct and maintain diversion structures to prevent surface runoff from entering active portions of facilities and to collect any runoff or other discharges originating on the active portions. All discharges from the facilities would have to be confined to point sources which comply with the regulations promulgated under the Clean Water Act. Storage facilities would be prohibited from making any discharges. These regulations would constitute a substantial improvement over the present unregulated situation and should produce a decrease in the number of surface water pollution incidents resulting from hazardous wastes.

Since there are no estimates of the extent of existing groundwater contamination due to hazardous wastes, it is not possible to quantify the improvements that would result from the regulations. However, numerous incidents of severe groundwater contamination have occurred as a result of actions which would be prohibited by these regulations. Although the regulations would not address the closure and clean-up of existing abandoned sites, they would institute siting, construction, operation, maintenance, and closure requirements designed to ensure that no contamination of any underground drinking water source occurs as a result of any facility in operation after the regulations are promulgated.

It should be noted, however, that there could be shifts in the types of methods used to treat/dispose the wastes brought under regulation by this alternative. As previously discussed, such shifts could result in localized changes in the release of specific water contaminants and, thus, could result in localized changes in water quality.

S.4.1.6 Public Health. Appendix J summarizes over 300 reported incidents that have resulted from the improper management of hazardous wastes. This improper management resulted in 49 separate instances of traceable public health impacts, including death, and 84 instances of drinking water contamination, including contamination of major aquifers. From the way in which most of the reported incidents have come to light, it is very likely that the vast majority of such incidents go unreported, especially human health incidents which may require many years of exposure, and for which direct causative relationships are difficult to trace or establish. The reported incidents indicate that there is often a considerable time lag between the occurrence of those events which lead to public health impacts and the time when the impact becomes evident. Since virtually all of the reported incidents were discovered only after damage had already occurred, there is, nationally, a very significant potential for many similar public health impacts to be detected from wastes that have already been, or currently are being improperly transported, stored, treated, or disposed.

The baseline Subtitle C regulations should significantly reduce the potential for such public health impacts to occur from future management of hazardous wastes. The regulations would reduce the potential for the release of air, water, and soil contaminants from hazardous waste management and, thus, for resultant public health impacts. Furthermore, requirement for recording where hazardous wastes are disposed and prohibitions against using such sites for residential or agricultural purposes could prevent future public health catastrophes, such as that which occurred at Love Canal in Niagara Falls, New York (see Section 7.1.6).

S.4.2 Potential Secondary Impacts. The potential secondary impacts from implementation of the proposed regulations include impacts to the following areas:

- Physiography and soils;
- Biological environment;
- Water use;
- Hazardous waste management facility capacity;
- Land use;
- Social impacts;
- Resource conservation and recovery;
- Energy use;
- Special interest points.

S.4.2.1 Physiography and Soils. The principal areas of environmental concern regarding physiography and soils are soil contamination, alterations of topography, and loss and physical disruption of soils. At present, impacts to soils from hazardous wastes are widespread, primarily as a result of spills and unregulated dumping. The manifest system and permit requirements would eliminate most irresponsible disposal of these wastes. The closure of existing sites which do not meet the proposed standards would result in additional impacts to both physiography and soils. In some cases, significant volumes of clayey soils would have to be acquired and placed at new disposal sites. Excavation of the clays would result in alterations of topography. Creation of new disposal sites could result in contamination of additional soils; however, any such contamination would occur in a controlled manner and would be localized in relatively few places, as compared to the present situation.

S.4.2.2 Biological Environment. The major routes of hazardous waste transport to, and subsequent impact upon biological systems are by: groundwater contamination via leaching, surface water contamination via runoff, air pollution, poisoning via direct contact, poisoning via the food chain, and fires and explosion. The proposed regulations would substantially reduce improper transport, storage, treatment, and disposal of hazardous wastes, and would result in the containment and long-term separation of these wastes from biological systems. Although the impact of the regulations cannot be quantified, many of the types of incidents of contamination and associated biological effects which have been observed in the past would be prevented by promulgation of the regulations. In general, biological impacts due to contact with regulated wastes or from fires or explosions involving regulated wastes would be greatly reduced, while other impacts would be reduced in proportion to the reduction of air, water, and soil contamination. Creation of new disposal sites would necessitate the pre-emption of land from existing uses. Although siting restrictions would protect wetlands and critical habitats of endangered species, construction of disposal facilities in remote areas could impact other habitat types that may be of value to wild or domesticated animals.

S.4.2.3 Social Impacts.

Demographic Impacts. Promulgation of the Subtitle C regulations would likely cause some plant closings and job losses in a few segments of some industrial categories (e.g., textile industry, inorganic chemicals industry, organic chemicals industry, metals smelting and refining industry, electroplating and metal finishing industry). Such plant closings and job losses would have the potential to cause relocations of some of the affected workers and their families. There would be a potential for some out-migrations from communities or areas for which plants being closed constituted the primary source of employment.

Operational requirements for hazardous waste management, under the baseline Subtitle C regulations, would likely result in additional workers being required to track the hazardous wastes; to transport the wastes; and to store, treat, or dispose the wastes both off-site and on-site. Additional workers would also be required to administer and enforce the regulations at both the state and Federal levels. Construction workers would also be required for necessary modifications to existing facilities or construction of new facilities. It is estimated that a total of at least 20,000 workers could be required nationally, by 1984, to store, treat, or dispose hazardous wastes. Data are not available to estimate how many of these would be new workers due to the Subtitle C regulations.

Some populations shifts could occur if the required number of workers was not available where needed, particularly in the case of treatment/disposal sites being located in rural or undeveloped areas. Any such shifts in population are expected to be relatively small on a national scale; however, there could be localized instances of a relatively large influx of workers.

Social Conditions. Impacts to existing social conditions could result from changes in the siting and operation of hazardous waste management facilities and from any population shifts caused by the regulations. The increased public health protection that would be derived from the regulations would provide significant social benefits. Many of the social costs related to the exposure of workers and the general public to hazardous wastes and their residuals, under current practices, would be reduced or eliminated.

The regulations, while not applying to household wastes, could also focus more public attention on the problems associated with the improper treatment/disposal of hazardous wastes, and could result in increased care in the disposal of hazardous wastes and a further reduction in public health impacts from such disposal.

On the other hand, an increased public awareness of problems that have been associated with improper disposal of hazardous wastes could, in the short-term, add to the opposition to local siting of hazardous waste management facilities. However, in the long-term, promulgation of the regulations, accompanied by increased public participation in the facility siting process and specific demonstrations that the objectives of the regulations can be achieved, could also serve to lessen such opposition in the future and could lead to more effective siting of facilities.

Social impacts could also result from the expansion of construction of hazardous waste management facilities and from any increase off-site transport of hazardous wastes. The construction and operation of new facilities, especially off-site facilities, would have aesthetic impacts and could result in localized noise impacts, both in the vicinity of the facility and along any transportation routes.

Shifts in population that may result from the baseline Subtitle C regulations would have the potential to cause social impacts. The magnitude of any such impacts would be site-specific and would depend upon such factors as the size of the shift relative to the size of the existing population in affected areas, the rate of the shift, the existing infrastructure in the affected areas, and the adequacy of advanced planning.

S.4.2.4 Hazardous Waste Management Facility Capacity. It is estimated that there would potentially be sufficient process capacity, on a nationwide basis, to manage hazardous industrial wastes shipped off-site in 1980. In the case of 13 percent off-site shipment, there would potentially be sufficient process capacity on a nationwide basis to manage hazardous industrial wastes shipped off-site in 1984. In the case of 25 percent off-site shipment, there would potentially be a nationwide shortfall of 2.6 million metric tons of environmentally adequate off-site capacity for treating/disposing hazardous industrial wastes in 1984; without any growth in existing, environmentally adequate, capacity, this nationwide shortfall could be 4.9 million metric tons. Approximately 45 additional off-site facilities could be required to handle hazardous industrial waste by 1984 in the former case and approximately 80 additional off-site facilities could be required in the latter case. Data are not available to estimate if there would be any potential shortfall in environmentally adequate, on-site, hazardous waste management process capacity under the Subtitle C regulations.

Even in those instances where sufficient capacity is estimated to be available on a nationwide basis, regional, statewide, or localized shortfalls of capacity would be very likely to occur as discussed in Chapter 7. Furthermore, treatment/disposal of hazardous non-manufacturing wastes could create shortfalls or exacerbate existing shortfalls.

S.4.2.5 Land Use Impacts. More total land, off-site plus on-site, would be required for environmentally adequate hazardous waste management under the baseline Subtitle C regulations than for hazardous waste management under current practices. The additional land necessary for the environmentally adequate management of hazardous waste would be required, both for the construction of permitted facilities necessary to meet any additional capacity shortfalls that could occur under the Subtitle C regulations, and for such conjunctive developments as construction of roads, power lines, and pipelines. However, while more total land would be required, in the case of 13 percent off-site shipment, there could be less off-site land use and more on-site land use for hazardous industrial wastes by 1984 than under current practices. In the case of 25 percent off-site shipment, there could be more off-site land use and less on-site land use for hazardous industrial waste by 1984 than under current practices.

Existing land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management areas. Following closure of the hazardous waste management facility and rehabilitation of the site according to the closure plans, the land would be available for limited new uses or, in some cases, previously existing uses. Sites from which hazardous wastes have not been removed would be precluded from residential and agricultural uses, and may be precluded from some recreational and grazing uses following closure. Any activity requiring excavation would also be prohibited at sites where wastes are not removed. Further, since the regulations would require records to be kept of the location and types of all hazardous wastes remaining at the site, the potential for incidents, such as that which occurred at Love Canal in Niagara Falls, New York, would be reduced.

To the extent that the regulations would prevent other lands from being contaminated by improper disposal, dumping, storage, or treatment under current practices and regulations, there would be a potential for offsetting land use benefits.

S.4.2.6 Water Use Impacts. The potential for the degradation of both groundwater and surface water would be reduced under the regulations. To the extent that degradation of water quality would have resulted in a decreased supply of surface water or groundwater being available to some or all consumers in the water use area, there would be an additional supply of groundwater or surface water potentially available to such consumers and fewer restrictions on the productive use of such surface water and groundwater supplies. New facilities would, however, be additional consumers of water.

S.4.2.7 Resource Conservation and Recovery. Since one of the major impacts of the regulations would be to increase generator's costs and the costs associated with hazardous waste transport, storage, treatment, and disposal, the regulations would provide an incentive for generators to modify processes so as to enable increased recycling of hazardous wastes as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to alter the nature of the wastes generated. Any changes would be extremely waste stream and process-specific. Furthermore, since the regulations prohibit the placing of ignitable wastes in landfills, landfarms, surface impoundments, and basins, the potential for increased incineration of such wastes, with possible energy recovery, would be greatly enhanced.

S.4.2.8 Energy Use. The facility modification and construction that would be necessary under the regulations would result in increased energy use. More energy would also be used for the construction of new facilities under the regulations than would have otherwise been needed due to requirements directed toward making these facilities more environmentally secure. Increased energy use would also result from required changes in storage, treatment, and disposal operations under the regulations (e.g., higher incineration temperatures and longer retention times). While any increase in resource recovery would also likely require the initial input of additional energy, energy savings from increase energy recovery, from further reduction in the quantities of wastes requiring storage, treatment, or disposal, and from materials recovery and reuse, could result in an overall energy savings from resource recovery operations.

The changes in energy use from the transport of hazardous wastes would depend upon such factors as shifts in the portion of wastes managed on-site and off-site and changes in transport distances. The estimated change in annual energy use in 1984 ranges from a decrease equivalent to about 20,000 barrels of crude oil for an average 100-mile round-trip distance with 13 percent off-site treatment/disposal, to an increase equivalent to about 2.2 million barrels of crude oil for an average 1,000-mile round-trip distance with 25 percent off-site treatment/disposal.

The regulations could also potentially have an impact on energy production. The requirements and their resultant costs could potentially result in the closure of or reduced production at some energy producing operations. The regulations could also potentially lead some facilities to change the fuels they use so as to reduce or eliminate the generation of hazardous waste.

S.4.2.9 Impacts to Special Interest Points. The baseline Subtitle C regulations contain provisions which, while not applying specifically to the protection of special interest points, would provide indirect benefits to special interest points and to the human enjoyment of such features. For example, restrictions on the siting of hazardous waste management facilities in wetlands and critical habitats would reduce the potential for adverse impacts to such areas. Furthermore, provisions that would potentially reduce the release of air, water, and soil contaminants from hazardous wastes management activities would reduce the potential for these contaminants to infringe upon special interest points and would increase, or at least maintain, the opportunity for human enjoyment of such special interest points. However, to the extent that additional lands would be disturbed by facility construction and operation and by conjunctive developments, there would be an increased potential for some infringement upon other special interest points.

S.5 Impacts of the Alternatives

This section summarizes the potential changes in impacts, relative to those of the baseline action, that could result from implementation of each alternative. Impacts that would be substantially the same as those of the baseline regulations are not presented in order to avoid duplication.

S.5.1 No Action Alternative. Since implementation of RCRA is mandated by an act of Congress, implementation of this alternative is not considered to be feasible without an additional act of Congress repealing RCRA. However, if implemented, this alternative would result in a continuation of current hazardous waste management practices, modified by the requirements of any further legislation enacted by individual states.

The overall control of hazardous wastes would be much less effective than with a national program. The public health and environmental problems previously discussed would continue to occur, though they could be mitigated by the enactment of more stringent state regulations than those that currently exist. In any state with significantly less stringent regulations than it would have under the Federal program, there could be a significant increase in public health and environmental problems relative to those that would occur under the Subtitle C regulations. Impacts could also extend to neighboring states.

S.5.2 Phasing of Generators Alternative. Under this alternative, a total of approximately 74 million metric tons of hazardous industrial wastes could be excluded from regulation during the first four years following implementation of the Subtitle C regulations. This would be about a 50 percent reduction in regulated hazardous industrial wastes during this period, as compared to the baseline regulations. There would be no change in wastes regulated after the first four years.

During the first year, regulatory control would essentially be limited to industries in SIC Codes 26 (Paper and Allied Products), 28 (Chemicals and Allied Products), 29 (Petroleum and Coal Products), and 33 (Primary Metal Industries), with about 75 percent of the controlled wastes being generated within SIC Code 28. While wastes would be regulated within all EPA Regions, Regions III, IV, and V would generate about 65 percent of the regulated wastes. Approximately 230 manufacturing establishments could be regulated nationwide.

During the second year, regulatory control would be extended to SIC Codes 31 (Leather and Leather Products), 32 (Stone, Clay, and Glass Products), 34 (Fabricated Metal Products), and 35 (Machinery, Except Electrical), with about 60 percent of the controlled wastes being generated within SIC Code 28. Control efforts would be more pronounced in EPA Regions III, IV, and V, though their overall share of regulated wastes could decrease to about 61 percent, with one-half of that being in Region V. Approximately 1,500 manufacturing establishments would be regulated nationwide.

During the third year, regulatory control would be extended to industries in SIC Codes 25 (Furniture and Fixtures), 30 (Rubber and Miscellaneous Plastic Products), 37 (Transportation Equipment), and 39 (Miscellaneous Manufacturing Industries). EPA Region V would generate about 29 percent of the regulated wastes, while Regions II, III, IV, and V would each generate between 10 and 16 percent. About 4,300 manufacturing establishments would be regulated nationwide.

During the fourth year, regulatory control would be extended to establishments in all SIC Codes except 23 (Apparel and Other Textile Products), 24 (Lumber and Wood Products), and 27 (Printing and Publishing). The distribution of regulated wastes among the EPA regions would remain essentially the same as in the previous year.

Approximately 15,500 manufacturing establishments could be regulated nationwide.

A major benefit resulting from this alternative would be the gradual expansion of administrative requirements, rather than the abrupt imposition of such requirements. Administrative requirements, primarily paperwork, would be reduced during the first four years following implementation of the regulations. There could be a 50 percent reduction in manifests and over a 97 percent reduction in the submittal of annual reports during this period, compared to the baseline regulations. Reduction in administrative requirements could also encourage additional states to apply for interim or full authorization. The longer transition period would also provide an increased opportunity for planning and instituting measures to mitigate the potential impacts of any population shifts or of any shortfalls in hazardous waste management facility capacity.

To the extent that the 74 million metric tons of hazardous industrial wastes excluded from the generator regulations, under this alternative, were not to be managed in a manner equivalent to that required under the baseline Subtitle C regulations, there would be an increased potential for the release of air, water, and soil contaminants from these wastes.* Changes in public health and

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*It should be noted that as discussed in Section 7.1.2, it is expected that at least 5 years would be necessary to act upon and to issue all permits under the proposed regulations. Thus, some indeterminable portion of the 74 million metric tons of hazardous waste excluded under this alternative might not be managed under the baseline regulations as adequately as would be required following issuance of a permit.

environmental effects would be directly related to changes in the release of air, water, and soil contaminants. To the extent that increased releases were to occur, there would be an increased potential for the occurrence of adverse public health and environmental impacts. Both chronic health effects, related to long-term, low-level exposure to such contaminants, and water quality impacts could continue for many years following improper disposal of such wastes.

S.5.3 Enhanced Public Health and Environmental Protection Alternative. Table S-1 indicates some of the changes under this alternative, compared to the baseline regulations. These and other major changes are discussed below.

S.5.3.1 Primary Impacts.

Hazardous Wastes to be Regulated. It is estimated that approximately 57 and 65 million metric tons of hazardous manufacturing wastes would be controlled, under this alternative, in 1980 and 1984, respectively. This would represent about a 63 percent increase in the hazardous industrial wastes controlled in both these years. There would also be an indeterminable, but possibly quite large, increase in hazardous non-manufacturing wastes regulated under this alternative.

Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Additional changes to generation, transport, storage, treatment, and disposal practices, similar to those discussed for the baseline regulations, would be likely to occur under this alternative

TABLE S-1

COMPARISON OF POTENTIAL IMPACTS OF THE BASELINE REGULATIONS AND THE PHASE I AND THE ENHANCED AND THE LESSER DEGREE OF PUBLIC HEALTH AND ENVIRONMENTAL PROTECTION ALTERNATIVES*

Impact area	Baseline regulations	Enhanced protection alternative	Lesser degree of protection alternative	Phase I alternative
Regulated manufacturing wastes - 1984	40 million metric tons	65 million metric tons	24 million metric tons	~40 million metric tons
Regulated non-manufacturing wastes	Potentially large quantities	Potentially large quantities	Potentially small quantities	Potentially large quantities§
Number of identifiable regulated generators	270,000-300,000	~2.2 million	110,000-140,000	¶
Number of identifiable regulated storers, treaters, and disposers	29,000	not determinable	not determinable	~29,000
Number of manifests prepared annually - 1984	350,000-690,000	580,000-1,100,000	200,000-420,000	‡
Number of reports submitted annually	390,000-420,000	8.9 million	140,000-170,000	250,000-280,000
Number of workers required to store, treat, or dispose regulated manufacturing wastes - 1984	20,000	33,000	12,000	†
Off-site process capacity shortfall on nationwide basis for hazardous manufacturing wastes				
1980	—	2.7 million metric tons (approximately 45 additional facilities)	—	—
1984				
13% off-site shipment	—	0.9 million metric tons (no additional facilities)	—	—
25% off-site shipment	2.6 million metric tons (approximately 45 additional facilities)	9.6 million metric tons (approximately 160 additional facilities)	—	‡
Change in annual off-site landfill requirements for regulated manufacturing wastes after 1984†				
13% off-site shipment	-160 to -320 acres	-260 to -520 acres	-95 to -190 acres	‡
25% off-site shipment	800 to 1,600 acres	1,300 to 2,600 acres	500 to 1,000 acres	‡

*Based upon methodologies and assumptions described in Chapters 7 and 8.

†There would be commensurate changes in on-site landfill requirements.

‡Not determinable, but expected to be on the order of the quantity estimated for the baseline regulations.

§Most special wastes subject to full set of regulations.

¶110,000-140,000 for first 2 to 5 years; then 220,000-250,000.

due to the additional wastes being regulated; due to the additional generators, transporters, and owners/operators of hazardous waste management facilities being regulated; due to the enactment of more stringent environmental requirements; due to resultant increases in storage, treatment, and disposal costs; and due to the imposition of additional procedural and operational requirements.

Administrative Changes. Several changes in the administration of hazardous waste management programs would result from promulgation of the regulations within this alternative. It is likely that fewer states would apply for authorization under this alternative because expansion of both the quantity of hazardous wastes and the number of generators, transporters, storers, treaters, and disposers being regulated, plus the increases in reporting frequencies, would lead to increased administrative and manpower requirements for authorized states.

It is estimated that on the order of 2.2 million manufacturing establishments, automotive service stations, hospitals, medical laboratories, research facilities, farmers, and dry cleaning establishments could have to comply with the generator regulations under this alternative. This would represent over a 700 percent increase in the number of generators being regulated, compared to the baseline regulations. It is expected, however, that there would be only a relatively small increase in the number of permittees under this alternative.

It is estimated that the industrial generators could have to prepare between 580,000 and 1.1 million manifests annually by 1984. Based upon this number of manifests, the aggregated generators, transporters, and hazardous waste management facility owner/operators could each have to keep between 1.7 million and 3.4 million manifests in storage on an annual basis. This would represent over a 60 percent increase in both requirements, as compared to the proposed regulations. It is estimated that generators and permittees could prepare upward of 8.9 million quarterly reports on an annual basis--over a 2,100 percent increase.

The identified generators and permittees would have to file over 2.2 million notifications under Section 3010--about a 700 percent increase. Furthermore, since potential permittees would have to renew permits every 5 years, rather than being issued one permit good for the projected life of the facility as under the proposed regulations, there could be up to a six-fold increase (in the case of a 30-year facility site life) in the paperwork associated with obtaining permits. These potential permittees would also have to prepare approximately 29,000 Supplemental Environmental Analyses as part of the initial permit review procedure; these Supplemental Environmental Analyses would not be required under the baseline regulations.

Air and Water Quality. The regulations under this alternative would have the potential to cause further changes, primarily reductions, in the release of air emissions and water effluents from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations. To the extent that the requirements under this alternative would cause further changes in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be a greater potential for generators to make process modifications designed to further increase hazardous waste recycling and to reduce the quantity and/or types of hazardous wastes generated; any such process modifications would likely lead to changes in air emissions and water effluents released by processes generating hazardous wastes. Furthermore, to the extent that additional generators would be brought under control of the program through the expanded definition of hazardous wastes and the elimination of exclusions, the potential for such process modifications and resultant changes in air emissions and water effluents would be increased.

The additional 25 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) estimated to be brought under control of the regulations in 1984, by this alternative, would now have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Since most of these wastes would otherwise have been transported, stored, treated, or disposed by methods that are not likely to be environmentally acceptable under the Subtitle C regulations, the overall potential for the release of hazardous air emissions or water effluents from the management of such additional wastes would be reduced.

Additional requirements imposed by this alternative would further reduce the potential for the release of air and water contaminants from the management of both the additional 25 million metric tons of hazardous industrial wastes controlled under this alternative, and the 40 million metric tons also controlled under the baseline regulations. The major impact, with regard to air quality, would result from changing the application of the Threshold Limit Values (TLV) from an air human health and environmental standard to a mandatory standard with which facilities must always be in compliance, and the imposition of the TLV's as a maximum concentration not to be exceeded at any time, rather than as a time-weighted average not to be exceeded over an 8-hour day and 40-hour week. The major impact, with regard to water quality, would result from requiring lower permeabilities for soil liners for landfills and surface impoundments.

To the extent that additional storage, treatment, or disposal facilities would have to be modified or would have to be constructed under this alternative, there would be an increase in fugitive dust, vehicular emissions, and runoff from such construction activities.

It should be noted, however, that there could be shifts in the types of methods used to treat/dispose the additional wastes regulated under this alternative, compared to the unregulated methods that would have been used under the baseline regulations. As previously discussed, the net result could be both a localized and/or nationwide reduction in the releases of many air and water contaminants from hazardous waste management, and a localized and/or nationwide increase in the total releases of other air and water contaminants. Thus, while there would most likely be improvements in air and water quality due to this alternative, there could also be some localized degradation of air and water quality. All releases and any localized degradation of air or water quality would, however, have to be in compliance with all applicable requirements (e.g., Clean Air Act, Clean Water Act, OSHA standards, state standards, and Subtitle C standards).

Public Health. The regulations under this alternative would have the potential for further increasing the public health benefits to be derived from the control of hazardous wastes. The regulations would reduce the potential for the release of air, water, and soil contaminants from hazardous waste management and, thus, for resultant public health impacts. Furthermore, since most of the additional wastes to be regulated under this alternative would be potentially toxic organic wastes, there could be a much greater potential for significant reductions in chronic health effects related to long-term, low-level exposure to residuals resulting from the improper disposal of such wastes.

S.5.3.2 Secondary Impacts. The major changes in secondary impacts that could occur, as a result of implementation of this alternative, would result from the control of an additional 25 million metric tons of potentially hazardous industrial wastes, plus other hazardous wastes; the enactment of more stringent environmental requirements with regard to transport, storage, treatment, and disposal of hazardous wastes; and resultant increases in hazardous wastes storage, treatment, and disposal costs. To the extent that these changes result in reductions in the release of air, water, and soil contaminants, there would be further beneficial impacts to the biological environment, soils, water use, land use, and special interest points, as compared to the baseline regulations.

The above changes would also provide increased incentives for generators to modify processes so as to enable increased recycling of hazardous waste as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to change the nature of wastes generated. Energy use could, however, be increased by the additional facility modification and construction required under this alternative, by required changes in facility operation and closure, and by any increases in hazardous waste transport. Changes in resource recovery could lead to other changes in energy use, including additional savings in energy use. There could also be increased reductions in energy production due to increased costs of waste disposal and to the elimination of special standards for 'special wastes'; many 'special wastes' are generated by energy production activities.

Additional industrial plant closings or relocations due to the increased costs, under this alternative, could lead to additional population shifts and resultant impacts. Additional workers would also be required to manage hazardous wastes, to construct facilities, and to administer and enforce the regulations. It is estimated that, under this alternative, at least 33,000 workers could be required nationally, by 1984, to store, treat, or dispose hazardous wastes; this would represent over a 60 percent increase in this requirement, compared to the baseline regulations. Additional population shifts could occur in response to the increased personnel requirements; any such shifts would be expected to be small on a national scale, though there could be localized instances of a relatively large influx or outflux of workers.

It is estimated that, under this alternative, there could potentially be a nationwide shortfall of 2.7 million metric tons of environmentally adequate off-site capacity for hazardous industrial wastes in 1980; without any growth in existing, environmentally adequate, off-site capacity, this nationwide shortfall could be 4.2 metric tons. Approximately 45 additional permitted off-site facilities could be required to handle hazardous industrial waste in 1980 in the former case and approximately 70 additional permitted off-site facilities could be required in the latter case, compared to the baseline regulations. In the case of 13 percent off-site shipment, there could potentially be a nationwide shortfall of 0.9 million metric tons of environmentally adequate off-site capacity for hazardous industrial waste in 1984; without any growth in existing, environmentally adequate, off-site capacity, this nationwide shortfall could be 3.2 million metric tons. Since less capacity would be required in 1984 than in 1980 in the case of 13 percent off-site shipment, no additional permitted off-site facilities could be required to handle hazardous industrial wastes in 1984. In the case of 25 percent off-site shipment, there could potentially be a nationwide shortfall of 9.6 million metric tons of environmentally adequate off-site capacity for hazardous industrial wastes in 1984; without any growth in existing, environmentally adequate, off-site capacity, this nationwide shortfall could be 11.9 million metric tons. Approximately 160 additional permitted off-site facilities could be required to handle hazardous industrial waste in 1984 in the former case and approximately 200 additional permitted off-site facilities could be required in the latter case. Based upon the estimated shortfall under the baseline regulations, only 115 of the necessary permitted facilities would be attributable to this alternative in the former case and only 120 would be attributable to this alternative in the latter case. Data are not available to estimate potential shortfalls in environmentally adequate on-site process capacity. Treatment disposal of hazardous non-manufacturing waste could exacerbate these shortfalls, as could other factors discussed under the baseline regulations.

More total land, off-site plus on-site, would be required for environmentally adequate hazardous waste management under this alternative than under the baseline regulations. This land would be required both for the construction of the permitted facilities necessary for the storage, treatment, and disposal of the additional wastes regulated under this alternative, and for such conjunctive developments as construction of roads, power lines, and pipelines. However, while more total land would be required under this alternative, in the case of 13 percent off-site shipment, there could be less off-site land use and more on-site land use for hazardous industrial wastes by 1984, compared to the baseline regulations. In the case of 25 percent off-site shipment, there could be more off-site land use and less on-site land use for hazardous industrial wastes by 1984, compared to the baseline regulations.

Existing land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Existing animal habitats would also be disturbed on all such lands. Following closure of the hazardous waste management facility and any rehabilitation of the site, according to the closure and long-term care plans, the land would be available for new or, in some cases, previously existing uses. The biological community on disturbed areas could differ in species composition and diversity following site rehabilitation.

The construction and operation of the required facilities, especially off-site facilities, would cause additional aesthetic impacts and could result in additional instances of localized noise impacts. Public opposition to the siting and construction of hazardous waste management facilities could be further exacerbated by the increased requirements for such facilities under this alternative. However, this opposition could be somewhat mitigated by the more stringent environmental requirements under this alternative, by the requirement for the preparation of a Supplementary Environmental Analysis as part of the permit review process, and by the requirement for permits to be renewed every 5 years, rather than not at all.

S.5.4 Lesser Degree of Public Health and Environmental Protection Alternative. Table S-1 indicates some of the changes under this alternative, compared to the baseline regulations. These and other major changes are discussed below.

S.5.4.1 Primary Impacts.

Hazardous Wastes to be Regulated. It is estimated that approximately 20 and 24 million metric tons of hazardous manufacturing wastes would be controlled under this alternative in 1980 and 1984, respectively. This would represent about a 40 percent decrease in the hazardous industrial wastes controlled in both these years. There would also be an indeterminable, but possibly quite large, decrease in hazardous non-manufacturing wastes regulated under this alternative.

Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Fewer changes of the type discussed for the baseline regulations would be likely to occur to existing generation, transport, storage, treatment, and disposal practices under this alternative due to the lesser amount of wastes being regulated; due to the reduced number of generators, transporters, and owners/operators of hazardous waste management facilities being regulated; due to the enactment of less stringent environmental requirements; due to resultant reductions in storage, treatment, and dispoal costs; and due to the imposition of fewer procedural and operational requirements.

Administrative Changes. Several changes in the administration of hazardous waste management programs would result from promulgation of the regulations within this alternative. Additional states could consider applying for full, partial, or interim authorization due to elimination of almost all restriction on granting of interim authorization, elimination of restrictions on granting of full or partial authorization to states with more stringent standards, and reductions in administrative and manpower requirements. However, the elimination of the toxicity characteristic could also off-set such a potential for increases in state authorization. If enough states felt that the regulations were not adequate without the inclusion of toxic wastes, there could be an overall reduction in authorized states under this alternative. Furthermore, the less stringent standards and reduced amount of hazardous waste controlled under this alternative could increase the potential benefits to, and, thus, the likelihood of, a state enacting a more stringent, independent, hazardous waste program.

It is estimated that on the order of 110,000 to 140,000 manufacturing establishments, hospitals, and medical laboratories could have to comply with the generator regulations under this alternative. This would represent nearly a 60 percent reduction in the number of generators being regulated, compared to the baseline regulations. Data are not available to estimate the reductions in the number of transporters and owners/operators of hazardous waste management facilities to be regulated.

It is estimated that the industrial generators could have to prepare between 200,000 and 420,000 manifests annually by 1984. Based upon this number of manifests, the aggregated generators, transporters, and hazardous waste management facility owners/operators could each have to keep between 200,000 nd 420,000 manifests in storage on an annual basis. This would represent approximately an 80 percent decrease in both requirements, as compared to the baseline regulations. It is estimated that generators and permittees could prepare between 140,000 and 170,000 reports on an annual basis--a reduction of approximately 60 percent. The identified generators and permittees could have to file between 110,000 and 140,000 notifications under Section 3010--a reduction of nearly 60 percent.

Air and Water Quality. The regulations under this alternative would have the potential to cause fewer changes affecting the release of air and water contaminants from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations. The primary result would be fewer beneficial changes in air quality and water quality. To the extent that the requirements under this alternative would cause fewer changes in the economics of storage, treatment, or disposal relative to those of baseline regulations, there would be less of a potential for generators to make process modifications designed to further increase hazardous waste recycling and to reduce the quantity and/or types of hazardous wastes generated; any such reductions in process modifications would likely lead to fewer changes in the release of air and water contaminants by processes generating hazardous wastes. Furthermore, to the extent that fewer generators would be brought under control of the program, the potential for such process modifications and resultant changes in the release of air and water contaminants would be further decreased.

The 16 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) estimated to be removed from regulation in 1984, by this alternative, would not have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Since most of these wastes would not likely be transported, stored, treated, or disposed by methods that are environmentally acceptable under the Subtitle C regulations, the overall potential for the release of hazardous air emissions or water effluents from the management of such additional wastes would be increased.

With regard to the estimated 24 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) that would still be regulated under this alternative in 1984, the less stringent requirements under this alternative would have the potential for increasing the release of air contaminants from the management of these wastes, as compared to their management under the baseline regulations. The major impact, with regard to air quality, would result from less stringent incineration requirements and from allowing volatile wastes to be placed in landfills, landfarms, surface impoundments, or storage tanks vented directly to the atmosphere. The application of the Threshold Limit Values (TLV's) as a time-weighted average for a 24-hour day, rather than as a time-weighted average for an 8-hour day and a 40-hour week, would further allow an increase in air emissions from such non-point sources as landfills, landfarms, surface impoundments, and storage areas. The major impact, with regard to water quality, would result from allowing higher permeabilities for soil liners for landfills and surface impoundments.

To the extent that fewer storage, treatment, or disposal facilities would have to be modified or would have to be constructed under this alternative, there would be a decrease in fugitive dust, vehicular emissions, and runoff from such construction activities.

It should be noted, however, that there would likely be some shift in the types of methods used to store, treat, or dispose both the regulated wastes and the wastes excluded from regulation under this alternative, compared to the methods that would have been used to manage these wastes under the baseline regulations. As previously discussed, the net result could be both localized and/or nationwide increases in the release of many air and water contaminants from hazardous waste management, and localized and/or nationwide decreases in the release of other air and water contaminants relative to the proposed regulations. The likely result would be increased localized degradation of air and water quality, along with some localized improvement in air and water quality. All releases and any localized degradation of air or water quality would have to be in compliance with all applicable requirements (e.g., Clean Air Act standards, Clean Water Act standards, OSHA standards, state standards).

Public Health. The regulations under this alternative would have the potential for reducing the public health benefits to be derived from the control of hazardous wastes. As discussed elsewhere, the regulations would increase (relative to the proposed regulations) the potential for the release of air, water, and soil contaminants from hazardous waste management and, thus, for resultant public health impacts. Furthermore, since most of the wastes to be removed from regulations under this alternative would be potentially toxic wastes, there could be a much greater potential for significant increases in acute and chronic health effects to result from the improper disposal of such wastes.

S.5.4.2 Secondary Impacts. The major changes in secondary impacts (relative to the proposed regulations) that could occur, as a result of implementation of this alternative, would result primarily from the removal of approximately 16 million metric tons of hazardous industrial wastes (plus other hazardous wastes) from regulation annually by 1984; the enactment of less stringent environmental requirements with regard to the transport, storage, treatment, and disposal of hazardous wastes; and potentially lower increases in storage, treatment, and disposal costs as a result of these less stringent regulations. To the extent that these changes result in increases in the release of air, water, and soil contaminants, there would be fewer beneficial impacts to the biological environment, soils, water use, land use, and special interest points, as compared to the baseline regulations.

The above changes would also provide less of an incentive for generators to modify processes so as to enable increased recycling of hazardous waste as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to change the nature of wastes produced. Energy use could, however, be decreased by the lesser amount of facility modification and construction required under this alternative, by less stringent requirements for facility operation and closure, and by any resultant decreases in hazardous waste transport. Changes in resource recovery could lead to fewer changes in energy use, including less recovery of energy. There could also be fewer reductions in energy production due to the reduced costs associated with management of wastes from such activities and due to the exclusion of hazardous 'special wastes' from regulation; many 'special wastes' are generated by energy production activities.

Fewer industrial plant closings or relocations, due to the reduced costs under this alternative, could lead to fewer population shifts and resultant impacts. Fewer workers would also be required to manage hazardous wastes, to construct facilities, and to administer and enforce the regulations. It is estimated that, under this alternative, at least 12,000 workers could be required nationally, by 1984, to store, treat, or dispose hazardous wastes; this would represent approximately a 40 percent decrease in this requirement, compared to the baseline regulations. Fewer population shifts could occur in response to the reduced personnel requirements; any shifts would be expected to be small on a national scale, though there could still be localized instances of a relatively large influx or outflux of workers.

It is estimated that, under this alternative, there could potentially be sufficient, environmentally adequate, off-site capacity on a nationwide basis to handle all hazardous industrial wastes sent off-site in 1980 and 1984. However, without any growth in existing, environmentally adequate, off-site capacity, there could potentially be a nationwide shortfall of 0.5 million metric tons in such capacity in 1984 in the case of 25 percent off-site shipment. In this case, approximately 72 fewer permitted off-site facilities could be required to handle hazardous industrial waste, as compared to the baseline regulations. Data are not available to estimate any potential shortfalls in environmentally adequate on-site capacity; however, there would be less of a potential for any shortfalls to occur. Even in those instances where sufficient capacity is estimated to be available on a nationwide basis, regional, statewide, or localized shortages would be likely to occur, as discussed under the baseline regulations.

Less total land, off-site plus on-site, would be required for the construction of any storage, treatment, and disposal facilities needed under this alternative, and for such conjunctive developments as construction of roads, power lines, and pipelines. Less additional land would be required since fewer wastes would have to be sent to permitted facilities; the wastes removed from regulation could use existing facilities or other facilities that were not adequate under the baseline regulations. However, while less total land would be required under this alternative, in the case of 13 percent off-site shipment, there could be more off-site land use and less on-site land use for hazardous industrial wastes by 1984, compared to the baseline regulations. In the case of 25 percent off-site shipment, there could be less off-site land use and more on-site land use for hazardous industrial wastes by 1984, compared to the baseline regulations.

Existing land uses would not change on lands excluded from hazardous waste management under this alternative; however, there could be localized changes in land use from any additional shifts to off-site management from on-site management, or to on-site management from off-site management, as discussed above. There would be fewer disruptions of ecological communities as a result of the lesser land disturbances.

The construction and operation of fewer facilities, especially off-site facilities, would cause fewer aesthetic impacts and could result in fewer instances of localized noise impacts. While public opposition to the siting and construction of hazardous waste management facilities could be reduced by the need for fewer facilities under this alternative, any opposition that occurs could be exacerbated by the less stringent requirements under this alternative.

S.5.5 <u>Phase I Alternative.</u> Table S-1 indicates some of the changes under this alternative, compared to the baseline regulations. These and other major changes are discussed below.

S.5.5.1 <u>Primary Impacts.</u>

<u>Hazardous Wastes to be Regulated.</u> Various modifications under this alternative would exclude from regulation some wastes that would

have been regulated under this baseline regulation and would subject to regulation additional wastes that would not have been regulated under the baseline regulations. While data are not available to determine the specific changes in the quantity of waste that would be regulated, it is estimated that the net effect of all the modifications would likely be a slight decrease in the total quantity of waste regulated under this alternative. There would likely be a net decrease in the quantity of both manufacturing and non-manufacturing wastes being regulated. While there would also be a net decrease in the quantity of 'special waste' being regulated, much 'special waste' would be subject to the full set of regulations rather than just to a limited portion of the regulations. During the first 2 to 5 years following implementation of the regulations, less total waste would be subject to regulation in the period that follows due to indicated changes in the generator limit.

Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Changes to generation, transport, storage, treatment and disposal practices would likely occur under this alternative due to the changes in wastes being regulated; due to implementation of the Interim Status Standards*; due to revisions in procedural

*The Interim Status Standards represent the minimum requirements with which an existing treatment, storage, or disposal facility must comply until administrative disposition of the facility's permit application is made. The Interim Status Standards would apply to all activities affecting any hazardous waste handled at such a facility after the effective date of the regulations. Under the baseline regulations, existing facilities would not be required to modify their present practices until after being issued a permit.

and operational requirements; and due to resultant changes in storage, treatment, and disposal costs.

In general, there would be some significant differences between those changes related to the generation and management of hazardous 'special wastes' and those changes related to the generation and management of all other hazardous wastes. These differences would be the result of the requirement that most hazardous 'special wastes' comply with the full set of Subtitle C standards under this alternative, rather than the limited set of standards specified under the baseline regulations. All other hazardous wastes would already be required to comply with the full set of baseline regulations.

With regard to all hazardous wastes other than 'special wastes', fewer changes of the types discussed for the baseline regulations would be likely to occur to existing generation, transport, storage, treatment, and disposal practices under this alternative. However, those changes that do occur would take place sooner due to the requirements of the Interim Status Standards. Generators, transporters, and waste management facilities would also have to make some additional modifications to comply with the additional requirements discussed in Section 8.5.1.2. These include increased requirements for tracking of waste shipments and for post-closure care at disposal facilities.

With regard to hazardous 'special wastes', many additional changes to generation, transport, storage, treatment, and disposal practices would be likely to occur under this alternative. Most of these changes would be essentially equivalent to those discussed under the baseline regulation. These changes would occur sooner than under the baseline regulations, however, due to the Interim Status Standards.

Administrative Changes. Several changes in the administration of the hazardous waste management program would result from promulgation of the regulations within this alternative.

Little or no change is expected to occur in the number of states applying for interim or full authorization. However, partial authorization of state program would be eliminated under this alternative. This could increase the potential for a few states to enact one or more components of an independent, hazardous waste program.

It is estimated that during the initial 2 to 5 years following implementation of the regulations, on the order of 110,000 to 140,000 manufacturing establishments, hospitals, and medical laboratories could have to comply with the generator regulations under this alternative. This would represent nearly a 60 percent reduction in the number of generators identified as being subject to the Section 3002 requirements under the baseline regulation during this period. Following this initial 2 to 5 year period, on the order of 220,000 to 250,000 generators could be required to comply. This would represent over a 15 percent reduction, as compared to the baseline regulations. There would also be an indeterminable reduction in the total number of other generators (e.g., hazardous 'special waste' generators) who would be required to comply with the regulations.

It is estimated that there would also be a slight reduction in the number of permittees under this alternative; fewer facilities would, however, require permits during the initial 2 to 5 year period than in the period which follows. Facilities managing hazardous 'special wastes' would be subject to more stringent permit requirements under this alternative.

Information required on manifests would be reduced under this alternative. Generators of hazardous 'special wastes' could have to prepare an indeterminable number of additional manifests under this alternative. The aggregated generators, transporters, and hazardous waste management facility owners/operators handling these wastes would also have to keep the additional manifests in storage for 3 years. There would, however, likely be a net reduction in the number of manifests that would be prepared by generators of other hazardous wastes. The aggregated generators, transporters and hazardous waste management facility owners/operators handling these latter wastes would thus have to keep fewer manifests in storage. The total number of manifests prepared and stored would be less during the first 2 to 5 years than in the following years.

It is estimated that the identified generators and permittees could prepare between 250,000 and 280,000 reports on annual basis after the initial 2 to 5 year period -- a reduction of over 40 percent. Fewer reports would be prepared during the initial 2 to 5 year period. However, other additional reporting, recordkeeping, and administrative requirements would be imposed for generators and permittees under this alternative. For example, generators would have to prepare outlines of programs for assessment of groundwater damage and for implementing corrective actions. The identified generators and permittees could have to file on the order of 110,000 to 140,000 notifications under Section 3010 -- a reduction of nearly 60 percent. While the total number of permit applications would likely decrease, permits would be reviewed at least once every 5 years rather than being issued for the projected life of the facility. Consolidation of requirements for obtaining RCRA permits, National Pollution Discharge Elimination System permits, Underground Inspection Control permits, and permits under Section 404 of the Clean Water Act would reduce the total administrative requirements associated with these permits.

Air and Water Quality. The regulations under this alternative would have the potential to cause changes affecting the release of air and water contaminants from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations. As discussed below, this would lead to instances of both localized improvements in air and water quality and localized degradation of air and water quality.

For those generators of hazardous wastes other than 'special wastes', to the extent that the requirements under this alternative would cause lesser changes in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be less of a potential for these generators to make process modifications designed to increase hazardous waste recycling and to reduce the quantity and/or type of hazardous wastes generated; any such reductions in process modifications would likely lead to fewer changes in the release of air and water contaminants by processes generating hazardous waste. For generators of 'special wastes', to the extent that the requirements under this alternative would cause further increases in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be greater potential for generators of these wastes to make process or operational modifications designed to reduce the quantity and/or types of hazardous wastes generated; any such modifications could lead to increased changes in the release of air and water contaminants by processes generating hazardous wastes. Furthermore, to the extent that fewer generators would be brought under control of the program in both instances, the potential for any such process modifications and resultant changes in the release of air and water contaminants would be accordingly reduced.

Slightly less waste would likely be regulated under this alternative than under the baseline regulations. As a result, those hazardous wastes excluded from regulation would not have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Since it is likely that many of these wastes would not be managed by methods that are environmentally acceptable under the regulations, the overall potential for the release of hazardous air and water contaminants from the management of such wastes would be increased.

With regard to the hazardous waste that would still be regulated under this alternative, the requirements under this alternative would have the potential for affecting the release of air and water contaminants from the management of these wastes in various ways. Some of the requirements would result in an increase in the potential for the release of such contaminants while others would result in a decrease. Changes that could potentially have significant affects on the release of contaminants are discussed below.

Reductions in the release of air and water contaminants would result from the more stringnet requirements being placed on the management of hazardous wastes at existing facilities during the Interim Status period. These requirements include restrictions on treating and/or disposing wastes in surface impoundments, incinerators, landfarms, landfills, and basins. They also impose requirements for monitoring, inspections, remedial actions, facility closure, and post-closure care. Following the Interim Status period, other changes would further reduce the potential for the release of air and water contaminants. These include subjecting hazardous 'special wastes' to the full set of Section 3004 requirements; reducing time requirements for completing closure activities; extending time requirements for post-closure care; and adding requirements for preparing groundwater damage assessment and corrective action programs, for conducting groundwater monitoring at landfarms, for including provisions for controlling spills and unplanned non-sudden discharges in contingency plans, and for performing necessary repairs or remedial actions.

Increases in the release of air and water contaminants from regulated wastes would result primarily from the elimination of the human health and environmental standards. This would increase the potential for the release of air and water contaminants from non-point sources (e.g., surface impoundments, landfills, storage areas) at permitted facilities. The elimination of leachate monitoring requirements could increase the potential for degradation of water quality; however, other changes related to siting of groundwater monitoring wells and to implementing groundwater damage assessment and corrective action programs would tend to off-set this. The elimination of spill response information from manifests could increase the potential for air and water quality impacts to result from spills during transport. Any increased off-site transport of hazardous 'special wastes' could also increase the potential for transportation related impacts.

To the extent that additional storage, treatment, or disposal facilities for hazardous 'special wastes' would have to be modified or constructed, there would be an increase in fugitive dust, vehicular emissions, and runoff from such construction activities. To the extent that fewer facilities for other hazardous wastes would have to be modified or constructed, there would be a decrease in fugitive dust, vehicular emissions, and runoffs.

It should be noted that there would likely be some shift in the types of methods used to store, treat, or dispose both regulated wastes and the wastes excluded from regulation under this alternative compared to the methods that would have been used to manage these wastes under the baseline regulations. Such shifts would change both the types and quantities of air and water contaminants produced by the management of specific wastes. Such shifts could either enhance or reduce the potential for this alternative to cause the indicated increases or decreases in the release of specific air or water contaminants in any given locality. Furthermore, the construction of new facilities could lead to increased releases of air and water contaminants in the vicinity of the facility and along any transport routes. Closure of existing facilities could lead to reduced releases of air and water contaminants in the vicinity of the facility and along any transport routes. All emissions and any localized degradation of air quality would have to be in compliance with all applicable requirements (e.g., Clean Air Act standards, OSHA standards, state standards).

Public Health. The regulations under this alternative would have the potential for increasing some of the public health benefits to be derived from the control of hazardous wastes through the baseline regulations and would also have the potential for reducing other public health benefits to be derived from the baseline regulations. As discussed, the regulations would both increase and decrease (relative to the baseline regulations) the potential for the release of air, water, and soil contaminants from hazardous waste management and, thus, for resultant public health impacts.

Additional public health benefits could be derived from the requirements for turning over to the local land authority records on where wastes are disposed and for notations to be recorded on the property deed (or equivalent instruments) to, in perpetuity, notify any potential purchaser both that the land has been used to manage hazardous waste and that the land is subject to use restrictions. This could help prevent future public health catastrophes such as that which occurred at Love Canal in Niagara Falls, New York (see Section 7.1.6). Additional restrictions on the disposal of hazardous uranium and phosphate surface mining and beneficiation wastes would also lead to increased public health benefits. Review of permits at least once every five years, rather than no review as under the baseline regulations, would also reduce the potential for adverse public health impacts.

Elimination of the requirement that contingency plans must include an outline of a program for familiarizing employees with emergency procedures and for drills on these procedures could increase the potential for public health impacts to occur in the event of an emergency situation at the facility; however, this would be off-set by other indicated changes in contingency plans. Elimination of the requirement that the contingency plan must be implemented when there is a discharge that threatens human health only within the facility would increase the potential for adverse impacts to facility employees. The exclusion of some infectious wastes from regulation could also lead to some increased instances of adverse public health impacts.

S.5.5.2 Secondary Impacts. The major changes in secondary impacts (relative to the baseline regulations) that could occur, as a result of implementation of this alternative, would result primarily from the net reduction in the quantity of waste that would be subject to regulation; the enactment of more stringent environmental requirements with regard to the storage, treatment, and disposal of hazardous wastes during the Interim Status period; the modification of some requirements for managing wastes following the Interim Status period; the enactment of more stringent requirements for tracking manifested waste shipments; the enactment of more stringent environmental requirements with regard to the storage, treatment, and disposal of hazardous 'special wastes'; and from modified costs to generators and costs associated with hazardous waste transport, storage, treatment, and disposal as a result of these revised requirements. To the extent that these changes result in indicated increases or decreases in the release of air, water, and soil contaminants, there would be commensurate impacts to the biological environment, soils, water use, land use, and special interest points, as compared to the baseline regulations.

The changes described above would, as previously indicated, also affect the potential for generators to modify processes and operations so as to enable increased recycling of hazardous waste as process feedstocks, to reduce the quantities of hazardous wastes generated, or to change the nature of wastes produced. In addition, this alternative would provide a further incentive for all generators to recycle, re-use, or recover hazardous waste materials. All hazardous waste materials that are used, re-used, or processed for energy recovery or that are stored for such purposes would be excluded from regulation under this alternative. Similarly, all hazardous waste materials, except waste oils, that are used or re-used in a manner constituting disposal or that are being stored for such purposes would be excluded from regulation.

Energy use, with regard to the management of hazardous 'special wastes', would be increased by the additional facility modification and construction required under this alternative, by required changes in facility operation and closure, and by any increases in hazardous waste transport. Furthermore, many 'special waste' generators are energy producers (e.g., oil and gas drilling operations). Due to the more stringent requirements and increased costs associated with the management of these wastes, there could be some increased reductions in energy production.

Energy use, with regard to the management of other hazardous wastes, would be reduced by the lesser amount of facility modification and construction and by any reductions in hazardous waste transport. The requirements of the Interim Status Standards along with the lengthened post-closure care period could off-set some of this decrease in energy use.

With regard to generators of hazardous 'special wastes', increased costs under this alternative could lead to some additional closings or relocations of plants and operations, and this could lead to additional population shifts and resultant impacts. In addition, additional workers could also be required to manage these wastes and to construct or modify facilities managing these wastes. With regard to generators of other hazardous wastes, lesser increases in costs under this alternative could lead to fewer plant closings or relocations, and this could lead to fewer population shifts and resultant impacts. Fewer workers could also be required to manage these wastes and to construct or modify facilities managing these wastes. There could also be an overall decrease in the number of personnel required to administer and enforce the regulations. Population shifts could occur in response to changed personnel requirements. Any such shifts would be expected to be small on a national scale; however, there could still be localized instances of a relatively large influx or outflux of workers. Due to the Interim Status Standards, plant closings and changes in personnel requirements could occur earlier under this alternative than under the baseline regulations.

It is estimated that under this alternative there would potentially be sufficient off-site capacity on a nationwide basis to treat/dispose regulated hazardous manufacturing wastes shipped off-site in 1980. There would also potentially be sufficient off-site capacity nationwide in 1984 in the case of 13 percent off-site shipment. As compared to the baseline regulations, there would be a reduction in the potential shortfall in nationwide off-site capacity estimated to occur in 1984, in the case of 25 percent off-site shipment. As a result, fewer permitted off-site facilities could be required in this latter case under this alternative as compared to the baseline regulations. Similarly, under this alternative, there would also be reductions in the potential for any shortfall in the on-site capacity necessary for treating/disposing regulated hazardous manufacturing wastes.

With regard to hazardous 'special waste', there would be an increased potential for shortfalls in both environmentally adequate on-site and off-site capacity in 1980 and 1984. The increased potential for shortfalls in on-site capacity would result from increased facility closings due to the requirement that facilities managing 'special wastes' comply with all Section 3004 requirements rather than a limited portion of such requirements. The increased potential for shortfalls in off-site capacity would result from likely increases in the quantity of wastes being sent off-site; however, any increases in off-site shipments would also off-set some of the potential for an increase in the shortfall of on-site capacity.

Other factors discussed under the baseline regulations could either lead to shortfalls or exacerbate the size of any estimated shortfalls in both on-site and off-site process capacity, especially on a localized basis.

With regard to hazardous wastes other than 'special wastes', less total land, off-site plus on-site, would be required than under the baseline regulations. Lesser land requirements would result since fewer wastes would have to be sent to permitted facilities; the waste removed from regulation could use existing facilities or other facilities that were not adequate under the baseline regulations. However, while less total land would be required, in the case of 13 percent off-site shipment, there could be more off-site land use and less on-site land use for hazardous manufacturing wastes. In the case of 25 percent off-site shipment, there could be less off-site land use and more on-site land use.

With regard to hazardous 'special wastes', more total land could be required under this alternative for the management of all (regulated and unregulated) hazardous special wastes. There would likely be more off-site land use and less on-site land use for regulated special wastes.

With regard to all hazardous wastes, existing land uses would not change on any lands excluded from hazardous waste management under this alternative; however, there could be localized changes in land use from any additional shifts to off-site management from on-site management or to on-site management from off-site management. Existing biological communities would not be disturbed on lands excluded from hazardous waste management activities. To the extent that the management of wastes excluded from regulation under this alternative would result in additional land being contaminated through inadequate practices, there would be off-setting adverse impacts to existing land uses.

Existing land uses would, however, cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Existing biological communities would also be disturbed on all such lands. Following closure of hazardous waste management facilities and necessary post-closure care, the land used for the facility could be available for new or, in some cases, previously existing uses. The biological community on disturbed areas could differ in species composition and diversity following site rehabilitation. Less land could be available for future use than under the baseline regulations since this alternative eliminates the requirement that all facilities must be designed such that the land is amenable to some acceptable use so that perpetual isolation and care to maintain isolation are not required. This alternative would also affect future use of the land by requiring that a notation be recorded on the property deed (or equivalent instruments) to notify, in perpetuity, any potential purchaser both that the land has been used to manage hazardous waste and that the land is subject to use restrictions.

Indicated changes in the construction and operation of facilities, especially off-site facilities, would cause commensurate changes in aesthetic impacts and localized noise impacts. Public opposition to the siting and construction of hazardous waste management facilities could be reduced by the requirement for permits to be reviewed at least once every 5 years rather than not at all and by the lengthening of the period specified for post-closure care. With regard to facilities managing hazardous wastes other than 'special wastes', public opposition to such facilities could be further reduced by the need for fewer of thse facilities. With regard to facilities managing hazardous 'special wastes', public opposition to such facilities could be reduced by the more stringent environmental requirements under this alternative. However, any opposition that occurs could be exacerbated by possible increases in the number of these facilities required. The addition of the Interim Status Standards could also reduce opposition to some existing facilities.

1.0 INTRODUCTION

This document is Part I of the final Environmental Impact Statement (EIS) addressing the potential effects of implementing regulations under Subtitle C of the Resource Conservation and Recovery Act of 1976 (RCRA). Specifically, the regulations addressed in this document are those being developed under the mandate of the following Sections of Subtitle C:

- Section 3001-- Identification and listing of hazardous waste;
- Section 3002-- Standards applicable to generators of hazardous waste;
- Section 3003-- Standards applicable to transporters of hazardous waste;
- Section 3004-- Standards applicable to owners and operators of hazardous waste treatment, storage, and disposal facilities;
- Section 3005-- Permit system for treatment, storage, and disposal of hazardous wastes;
- Section 3006-- Guidelines for state hazardous waste programs;
- Section 3010-- Preliminary notification of hazardous waste activities.

In addition, the Environmental Protection Agency (EPA) has responded to the mandate of all other Sections of Subtitle C, namely:

- Section 3007 -- Inspections;
- Section 3008 -- Federal enforcement;
- Section 3009 -- Retention of state authority;
- Section 3011 -- Authorization of assistance to the states.

A summary of the major aspects of these sections is presented in Chapter 2 of this document. Chapter 3 summarizes the baseline

Subtitle C regulations that are the subject of this EIS (see Appendix B for a detailed description of these regulations). Chapter 4 summarizes the set of alternatives selected and developed for analysis in relation to these baseline regulations.

The development of regulations under Subtitle C has been and is continuing to be a dynamic, changing process. In the event of major changes to the regulations following their promulgation, and/or in the event of additional regulations affecting specific wastes, such as the large volume special wastes identified under the proposed Subtitle C regulations (i.e., cement kiln dusts, utility wastes, oil drilling muds/brines, phosphate rock mining and processing wastes, uranium mining wastes, and other mining wastes), a supplemental Environmental Impact Statement would be prepared if necessary.

The scope of this EIS includes all hazardous wastes within the definition of the baseline regulations and the alternatives. However, the regulations, and thus the EIS, do not address those wastes specifically.excluded by the Act or by Congressional intent, namely:

- Solid or dissolved material in domestic sewage;
- Solid or dissolved material in irrigation return flows;
- Industrial discharges which are point discharges subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880);
- Source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923);
- Household wastes.

2.0 LEGISLATIVE BACKGROUND

2.1 Federal Legislation Leading to RCRA

The first Federal legislation relating to solid waste disposal was the Refuse Act comprising Section 13 of the River and Harbor Act of 1899 (30 Stat. 1152). This Act states that:

> ...it shall not be lawful to throw, discharge, or deposit, or cause, suffer or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any tributary of any navigable water from which the same shall float or be washed into such navigable water; and it shall not be lawful to deposit, or cause, suffer, or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed into such navigable water, either by ordinary or high tides, or by storms or floods, or otherwise, whereby navigation shall or may be impeded or obstructed: Provided, that nothing herein contained shall extend to, apply to, or prohibit the operations in connection with the improvement of navigable waters or construction of public works, considered necessary and proper by the United States officers supervising such improvement or public work: and provided further, that the Secretary of War, whenever in the judgment of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material; and whenever any permit is so granted the conditions thereof shall be strictly complied with, and any violation thereof shall be unlawful.

Although the original intent of this Act was to prevent obstructions to navigation, it did represent the first Federal regulation of open dumping and is still in effect.

The Solid Waste Disposal Act, passed in 1965, was the first Act of Congress dealing directly with the solid waste problem and was primarily aimed at establishing a national research and development program for new and improved methods of proper and economic disposal of solid waste. It authorized the Secretary of Health, Education and Welfare to make grants to state and interstate agencies to conduct surveys of solid waste disposal practices and associated problems.

In 1970, the Solid Waste Disposal Act was amended by the Resource Recovery Act, which shifted its objectives to include the promotion of resource recovery programs and added provisions for grants to these programs. It also required the Secretary of Health, Education and Welfare to submit to Congress a report on the feasibility of a system of national disposal sites for the storage and disposal of hazardous wastes. That report (Office of Solid Waste Management Programs, 1974c) was an important step in dealing with the problems of hazardous waste management. The Solid Waste Disposal Act has since expired.

The Environmental Protection Agency proposed the Hazardous Waste Management Act (S.1086) early in 1973. Although never enacted, this Bill led directly to the Resource Conservation and Recovery Act of 1976 (RCRA). There are several important differences between these two pieces of legislation. The objectives of the Hazardous Waste Management Act included Federal regulation of certain hazardous wastes and Federal guidelines for state regulation of others, while

RCRA aims to provide Federal assistance to state and local solid waste management programs, thus giving the states more authority and placing the Environmental Protection Agency in an advisory capacity.

The definition of hazardous waste in the Hazardous Waste Management Act was:

> Any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature or because they can be biologically magnified, or because they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects.

In the RCRA the definition was expanded to:

> A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

Other changes involve the definition of storage, treatment, and disposal. Under the Hazardous Waste Management Act, storage for more than two years is considered disposal. Under RCRA, storage may be either temporary or for a period of years, but is not to constitute disposal. The definition of treatment was altered considerably from "any activity or processing designed to change the physical form or chemical composition of waste so as to render such materials nonhazardous" in the Hazardous Waste Management Act to RCRA's "any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste or so as to render waste non-hazardous, safer for transport, amenable for recovery, amenable for storage, or reduced in volume." Under the Hazardous Waste Management Act, disposal refers only to land disposal, while RCRA considers disposal into or on any land or water, including groundwaters. RCRA also deals individually with generators, transporters, treaters, storers, and disposers of hazardous wastes, whereas the Hazardous Waste Management Act considered them all together.

On October 21, 1976, the Resource Conservation and Recovery Act of 1976 (Public Law 94-580) was signed by the President and became law.

2.2 RCRA and Subtitle C

RCRA has as its objectives the protection of health and the environment and the conservation of valuable material and energy resources. These objectives are to be met by:

- Providing technical and financial assistance to state and local governments and interstate agencies for the development of solid waste management plans (including resource recovery and resource conservation systems) which will promote improved solid waste management techniques (including more effective organizational arrangements), new and improved methods of collection, separation, and recovery of solid waste, and the environmentally safe disposal of nonrecoverable residues;

- Providing training grants in occupations involving the design, operation, and maintenance of solid waste disposal systems;

- Prohibiting future open dumping on the land and requiring the conversion of existing open dumps to facilities which do not pose a danger to the environment or to health;

- Regulating the treatment, storage, transportation, and disposal of hazardous wastes which have adverse effects on health and the environment;

- Providing for the promulgation of guidelines for solid waste collection, transport, separation, recovery, and disposal practices and systems;

- Promoting a national research and development program for improved solid waste management and resource conservation techniques, more effective organizational arrangements, and new and improved methods of collection, separation, and recovery, and recycling of solid wastes and environmentally safe disposal of nonrecoverable residues;

- Promoting the demonstration, construction, and application of solid waste management, resource recovery, and resource conservation systems which preserve and enhance the quality of air, water, and land resources;

- Establishing a cooperative effort among the Federal, state, and local governments and private enterprise in order to recover valuable materials and energy from solid waste.

In addressing these objectives, Title II of RCRA, the Solid Waste Disposal Act (the Act), is divided into eight subtitles:

- Subtitle A - General Provisions

- Subtitle B - Office of Solid Waste; Authorities of the Administrator

- Subtitle C - Hazardous Waste Management

- Subtitle D - State or Regional Solid Waste Plans

- Subtitle E - Duties of the Secretary of Commerce in Resource and Recovery

- Subtitle F - Federal Responsibilities

- Subtitle G - Miscellaneous Provisions

- Subtitle H - Research, Development, Demonstration, and Information

Subtitle C of the Solid Waste Disposal Act calls for regulatory action and guidelines within 11 separate categories as follows:

- Section 3001 - Identification and Listing of Hazardous Waste
- Section 3002 - Standards Applicable to Generators of Hazardous Wastes
- Section 3003 - Standards Applicable to Transporters of Hazardous Wastes
- Section 3004 - Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
- Section 3005 - Permits for Treatment, Storage or Disposal of Hazardous Waste
- Section 3006 - Authorized State Hazardous Waste Programs
- Section 3007 - Inspections
- Section 3008 - Federal Enforcement
- Section 3009 - Retention of State Authority
- Section 3010 - Effective Date
- Section 3011 - Authorization of Assistance to States

2.2.1 Definitions Relevant to Subtitle C. Several definitions listed in Section 1004 of the Act are particularly important to an understanding of the scope of Subtitle C and the mandate of each of the Sections 3001 through 3011. These definitions, not detailed elsewhere in the regulations, are:

- Disposal--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.

- Hazardous waste--solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

  (1) Cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

  (2) Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

- Hazardous Waste Generation--the act or process of producing hazardous waste.

- Hazardous Waste Management--the systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of hazardous wastes.

- Resource Recovery--the recovery of materials or energy from solid waste.

- Solid Waste--any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities but does not include solid or dissolved material in domestic sewage or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

- Storage--the containment of hazardous waste, either on a temporary basis or for a period of years, in such a manner as not to constitute disposal of such hazardous waste.

- Treatment--any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste or so as to render such wastes nonhazardous, safer for transport, amenable for recovery, amenable for storage, or reduced in volume.

2.2.2 Section 3001 of Subtitle C. Section 3001 of Subtitle C, Identification and Listing of Hazardous Waste, requires:

- The development and promulgation of criteria for identifying the characteristics of hazardous waste and for listing hazardous waste, taking into account toxicity, persistence, degradability in nature, potential for accumulation in tissue, flammability, corrosiveness, and other hazardous characteristics;

- The promulgation of regulations identifying the characteristics of hazardous waste and listing particular hazardous wastes which are subject to the provisions of Subtitle C, based on the above criteria;

- The ability of the Governor of any state to petition the Administrator of the Environmental Protection Agency to identify or list a material as a hazardous waste.

2.2.3 Section 3002 of Subtitle C. Section 3002 requires the promulgation of regulations establishing standards applicable to generators of hazardous waste. These standards must establish requirements respecting:

- Recordkeeping practices that accurately identify the quantities of such hazardous waste generated, the constituents thereof which are significant in quantity or in potential harm to human health or the environment, and the disposition of such wastes;

- Labeling practices for any containers used for the storage, transport or disposal of such hazardous waste such as will identify accurately such waste;

- Use of appropriate containers for such hazardous waste;

- Furnishing of information on the general chemical composition of such hazardous waste to persons transporting, treating, storing, or disposing of such wastes;

- Use of a manifest system to assure that all such hazardous waste generated is designated for treatment, storage, or disposal in treatment, storage, or disposal facilities (other than facilities on the premises where the waste is generated) for which a permit has been issued as provided in this subtitle;

- Submission of reports setting out:

  (1) The quantities of hazardous waste identified or listed under this subtitle that have been generated during a particular time period;

  (2) The disposition of all hazardous waste reported above.

2.2.4 Section 3003 of Subtitle C. Section 3003 requires the promulgation of standards applicable to transporters of hazardous waste. These standards must include, but need not be limited to, requirements respecting:

- Recordkeeping concerning such hazardous waste transported, and their source and delivery points;
- Transportation of such waste only if properly labeled;
- Compliance with the manifest system referred to in Section 3002;
- Transportation of all such hazardous waste only to the hazardous waste treatment, storage, or disposal facilities which the shipper designates on the manifest form to be a facility holding a permit issued under this subtitle.

These standards must be coordinated with regulations of the Secretary of Transportation regarding the transport of hazardous wastes that are subject to the Hazardous Materials Transportation Act (88 Stat. 2156; 49 U.S.C. 1801 and following).

2.2.5 Section 3004 of Subtitle C. Section 3004 requires the establishment of such performance standards, applicable to owners and operators of facilities for the treatment, storage, or disposal of hazardous waste identified or listed under Subtitle C, as may be necessary to protect human health and the environment. These standards must include, but are not necessarily limited to, requirements respecting:

- Maintaining records of all hazardous wastes identified or listed under this title which are treated, stored, or disposed of, and the manner in which such wastes were treated, stored, or disposed of;

- Satisfactory reporting, monitoring, and inspection and compliance with the manifest system referred to in Section 3002;

- Treatment, storage, or disposal of all such waste received by the facility pursuant to such operating methods, techniques and practices as may be satisfactory to the Administrator;

- The location, design, and construction of such hazardous waste treatment, disposal, or storage facilities;

- Contingency plans for effective action to minimize unanticipated damage from any treatment, storage, or disposal of any such hazardous waste;

- The maintenance and operation of such facilities and requiring such additional qualification as to ownership, continuity of operation, training for personnel and financial responsibility as may be necessary or desirable;

- Compliance with the requirements of Section 3005 respecting permits for treatment, storage, or disposal.

2.2.6 Section 3005 of Subtitle C. Section 3005 of Subtitle C which deals with permits for the treatment, storage, or disposal of hazardous waste requires:

- The promulgation of regulations requiring each person owning or operating a facility for the treatment, storage, or disposal of hazardous waste to have a permit;

- The promulgation of regulations requiring certain information to be contained in permit applications, including:

(1) Estimates with respect to the composition, quantities, and concentrations of any hazardous waste identified or listed under Subtitle C, or combinations of any such hazardous waste and any other solid waste, proposed to be disposed of, treated, transported, or stored, and the time, frequency, or rate of which such waste is proposed to be disposed of, treated, transported, or stored;

(2) The site at which such hazardous waste or the products of treatment of such hazardous waste will be disposed of, treated, transported to, or stored.

Section 3005 also discusses permit issuance, permit revocation, and interim status for persons who have filed applications for permits for existing facilities.

2.2.7 Section 3006 of Subtitle C. Section 3006 pertains to the authorization of state hazardous waste programs. It requires the promulgation of guidelines to assist states in the development of such programs. Procedures are given for any state to apply for authorization of its hazardous waste program and provides for interim authorization of state programs which exist before the date 90 days after the date required for promulgation of regulations under Sections 3002, 3003, 3004, and 3005. Any action taken by a state under an authorized program is given the same force and effect as action taken by the EPA Administrator under Subtitle C. Procedures are also established for withdrawal of authorization by the Administrator.

2.2.8 Section 3007 of Subtitle C. Section 3007 requires any person who generates, stores, treats, transports, disposes, or otherwise handles hazardous wastes to allow access to records relating to these wastes to any officer or employee of the Environmental Protection Agency designated by the Administrator or any duly designated officer or employee of a state having an authorized hazardous waste program. Such officers or employees are authorized:

- To enter at reasonable times any establishment or other place maintained by any person where hazardous wastes are generated, stored, treated, or disposed;
- To inspect and obtain samples from any person of any such wastes and samples of any containers or labeling for such wastes.

Procedures are given for conducting such inspections. In addition, provisions are made for the public to obtain records, reports, or information.

2.2.9 Section 3008 of Subtitle C. Section 3008 deals with Federal enforcement of Subtitle C. Procedures are given for the issuance of a compliance order and the commencement of a civil action in the event the Administrator determines that any person is in violation of any requirement of Subtitle C. A public hearing may be requested by the person or persons named in the order or permit revocation. Any compliance order shall specify the nature of the violation and a time limit for compliance. Provision is made for criminal penalties for violations of Subtitle C.

2.2.10 Section 3009 of Subtitle C. Under Section 3009, Retention of State Authority, no state may impose any requirements less stringent than those authorized under Subtitle C, except that if application of a regulation under Subtitle C is postponed or enjoined by the action of any court, a state may not be prohibited from acting on the matter until the regulation takes effect.

2.2.11 Section 3010 of Subtitle C. Section 3010 requires any person generating or transporting hazardous wastes or owning or operating any facility for treatment, storage, or disposal of hazardous wastes to file a notification with the Administrator within 90 days of the promulgation or revision of regulations under Section 3001 identifying or listing such wastes as hazardous. The regulations under Subtitle C respecting requirements applicable to the generation, transportation, treatment, storage, or disposal of hazardous waste shall take effect six months after their date of promulgation.

2.2.12 Section 3011 of Subtitle C. Section 3011 authorizes to be appropriated $25 million for fiscal years 1978 and 1979 "to be used to make grants to the States for purposes of assisting the States in the development and implementation of authorized state hazardous waste programs," and provides for the allocation of the amounts authorized to be appropriated.

2.3 Related Federal Legislation

A number of other Federal Acts are specifically addressed within RCRA. Section 1006 of RCRA states that "nothing in this Act shall be construed to apply to...any activity or substance which is subject to the Federal Water Pollution Control Act (33 U.S.C. 1151 and following), the Safe Drinking Water Act (42 U.S.C. 300f and following), the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1401 and following), or the Atomic Energy Act of 1954 (42 U.S.C. and following), except to the extent that such application... is not inconsistent with the requirements of such Acts."

The Federal Water Pollution Control Act contains a number of sections which apply directly to the handling and disposal of hazardous wastes. Several of these sections are summarized below:

- Section 301, dealing with effluent limitations, prohibits the "discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste into the navigable waters."

- Section 304(f) requires EPA to publish guidelines for the pretreatment of pollutants which are determined not to be susceptible to treatment by publicly-owned treatment works. In accordance with the Clean Water Act of 1977, EPA is also directed to regulate the control of plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage which are associated with the industrial manufacturing or treatment process of the designated industries, which may contribute significant amounts of pollutants to navigable waters.

- Section 306 deals with new source performance standards for industrial point sources. EPA is authorized to determine the best available demonstrated control technology, and require its installation for specified categories of sources. If EPA determines that a zero-discharge standard is practicable, such a standard may be set.

- Under Section 307, the Administrator is directed to publish a list of toxic pollutants and effluent limitations. These limitations may constitute an absolute prohibition against discharging. Additionally, EPA must publish pretreatment standards requiring any industry discharging into a municipal sewage treatment plant to pretreat its effluent so that it does not interfere with the operation of the plant or pass through the plant untreated or without adequate treatment.

- Section 311 is designed to protect the navigable waters and shorelines from "hazardous substance" discharges.

- Under Section 402, each state government is responsible for issuing permits under the National Pollutant Discharge Elimination System. While EPA issues guidelines for state permit programs, it retains the right to review a state-issued permit affecting another state's water resources.

- Section 405 requires that a permit be issued by EPA for the disposal or relocation of sewage sludge that could affect the navigable waters. Such disposal is prohibited without a permit.

- Under Section 504, the EPA Administrator may bring suit against any person contributing to a pollution source causing an imminent and substantial endangerment to public health or welfare. In accordance with the 1977 amendments, EPA is also authorized to provide assistance in emergencies which may present an imminent and substantial danger to public health on welfare. EPA may authorize emergency assistance "to prevent, limit, or mitigate the emergency; when "there is an immediate significant risk to public health or welfare and the environment;" and when "such assistance will not otherwise be provided on a timely basis."

The Safe Drinking Water Act of 1974 authorizes EPA to regulate underground injection of wastes (and other substances) to protect underground sources of drinking water. It also authorizes the EPA Administrator to conduct a study of the impacts on underground water supplies of surface water disposal of wastes.

The Marine Protection, Research and Sanctuaries Act of 1972 prohibits the marine transport and disposal into U.S. territorial waters of any radiological, chemical, or biological warfare agents, high level radioactive wastes, or any other material, except as authorized by Federal permit. In the granting of permits for ocean dumping, EPA must consider "appropriate locations and methods of disposal or recycling, including land-based alternatives, and the associated impacts of such actions.

The Atomic Energy Act of 1954, as amended, authorizes botn the Atomic Energy Commission and private industry to regulate the disposal of byproduct, source, or special nuclear materials.

In addition to the four acts specifically referred to in Section 1006 of RCRA, several other Federal acts affect the management of hazardous wastes. Selected acts are summarized below.

The Toxic Substances Control Act of 1976 authorizes the regulation of hazardous substances before they become wastes. EPA is authorized to require that data be developed by manufacturers concerning the effects of chemical substances and mixtures on health and the environment when EPA feels that such chemicals present an unreasonable risk of injury to health or to the environment. EPA may also issue an order prohibiting or limiting the manufacture, processing, distribution, or disposal of specified substances.

The Clean Air Act of I970 (Section 112) and its amendments authorize the EPA to set standards for hazardous air pollutants at any level which provides an ample margin of safety to protect public health. In accordance with the 1977 amendments, the Administrator may instead promulgate design or equipment standards to protect public health with an ample margin of safety. The control strategy of standards and/or design plans is meant to protect the public health and welfare by placing the burden of standards compliance on the air polluter.

The Occupational Safety and Health Act of 1970 is designed to protect workers from occupational hazards, including hazards associated with contact of hazardous materials. Section 6(b)(5) deals specifically with toxic materials, requiring the Secretary of Labor to "set the standard which most adequately assures...that no employee will suffer material impairment of health or financial capacity" from regular exposure to such hazards.

The Federal Insecticide, Fungicide, and Rodenticide Act, as amended by the Federal Environmental Pesticide Control Act of 1972, requires EPA to establish procedures and regulations for the disposal or storage of packages, containers, and excess amounts of pesticides and to accept at convenient locations for safe disposal, those pesticides whose registration has been cancelled or suspended.

Under the authority of the Hazardous Materials Transportation Act of 1974, the Department of Transportation promulgated regulations listing hazardous materials and specifying procedures to be followed when transporting those materials. Furthermore, the responsibility for documentation, prevention, and containment of spills of oil and hazardous materials is divided between the Department of Transportation (including the U.S. Coast Guard) and the Environmental Protection Agency under the Hazardous Materials Transportation Act of 1974 and the Federal Water Pollution Control Act as amended by the Clean Water Act of 1977.

The Armed Forces Appropriating Authorizations of 1971 prohibits the disposal of any chemical or biological warfare agent "within or outside the United States unless such agent has been detoxified or made harmless to man and his environment unless immediate disposal is clearly necessary, to safeguard human life."

2.4 The Status of State Solid Waste and Hazardous Waste Legislation

Every state has addressed the hazardous waste problem to at least a limited degree, with the level of state control over hazardous waste presently ranging from essentially none to full and comprehensive programs. The majority of states exercise their legislative authority over hazardous wastes under their existing solid waste legislation, with authority extended under broadly-worded provisions that do not contain guidelines, criteria, or regulations specifically dealing with hazardous waste. As a result, enforcement and management are largely a matter of individual interpretation by state regulatory authorities, with most states exercising their legislative authority on a case-by-case basis. In some states, the principal regulatory control of hazardous wastes is divided between two agencies.

Table 2-1 presents a summary of the extent of authority and control exercised by each state and U.S. territory as of 1978, and the principal regulatory agency responsible for control within each state and territory. In accordance with the Solid Waste Disposal Act, all

TABLE 2-1

STATE REGULATION AND CONTROL AUTHORITY*

STATES	PRINCIPAL REGULATORY AGENCY	SOLID WASTE LEGISLATION	DATE OF ENACTMENT	DATE OF LATEST AMENDMENT	HAZARDOUS, SPECIAL OR INDUSTRIAL WASTE LEGISLATION	DATE OF ENACTMENT	PROPOSED LEGISLATION (BILL OR AMENDMENT)	HAZARDOUS WASTE REGULATIONS OR GUIDELINES	SOLID WASTE REGULATIONS WITH HAZARDOUS WASTE PROVISION: HAZARDOUS WASTE DEFINITION	ADDRESSED IN PART	ADDRESSED AS A SEPARATE SECTION	HAZARDOUS WASTE SURVEY-COMPLETED	HAZARDOUS WASTE SURVEY-IN PROGRESS
Alabama	Dept of Public Health	X	1969	1972	X	1978		proposed	X		X		
Alaska	Dept of Environ Conservation	X	1973						X				
Arizona	Dept of Health Services	X	1971					proposed	X				
Arkansas	Pollution Control & Ecology	X	1971	1973					X	X			
California	Dept of Public Health	X	1972	1977	X	1973		X	X		X		X
Colorado	Dept of Health	X	1971	1977					X				
Connecticut	Dept. of Environ. Protection	X	1971	1977					X				X
Delaware	Dept. of Nat Resources & Environ Control	X	1974	1975					X			X	
District of Columbia	Environ. Health Admin -Dept of Environ. Serv	X	1967	1971					X	X		X	
Florida	Dept. of Environ. Regulation	X	1974	1976			X		X	X		X	
Georgia	Dept of Nat. Resources	X	1972	1974				X	X		X		
Hawaii	Office of Environ. Quality Control	X	1972	1976				X	X		X		
Idaho	Dept. of Health & Welfare-Div. of Environ.	X	1970	1974					X			X	
Illinois	Ill. Environmental Protection Agency	X	1970	1973					X		X	X	
Indiana	Board of Health-Solid Waste Mgt Section	X	1965	1974					X		X		
Iowa	Dept. of Environ Quality	X	1971	1975			X		X	X		X	
Kansas	Dept of Health & Environment	X	1971	1977	X	1977		X	X		X	X	
Kentucky	Dept of Nat. Resources & Environ. Protection	X	1966	1975			X			X	X	X	
Louisiana	Dept. for Health & Human Resources	X	1950	1968			X		X	X			
Maine	Dept. of Environ Protection	X	1973	1975					X				
Maryland	Water Resources & Environ Health Admin.	X	1970		X	1976		X	X		X	X	
Massachusetts	Dept. of Environ. Quality	X	1969	1973				X	X	X		X	
Michigan	Dept. of Nat. Resources	X	1965	1973			X		X	X			
Minnesota	Minn Pollution Control Agency	X	1970	1973	X			proposed	X			X	
Mississippi	Board of Health	X	1974	1976					X		X		X
Missouri	Dept. of Nat Resources	X	1973	1976	X	1977		proposed	X		X	X	
Montana	Dept. of Health and Environ Sciences	X	1969	1977	X	1976		X	X	X		X	
Nebraska	Dept of Environ. Control	X	1971	1976				X	X		X	X	
Nevada	Dept. of Conservation & Nat. Resources	X	1971	1977			X		X		X	X	
New Hampshire	Dept of Health & Welfare	X	1971	1977			X					X	
New Jersey	Dept of Environ. Protection	X	1970	1977					X		X		
New Mexico	Environmental Improvement Agency	X	1974		X	1977		X	X				X
New York	Dept. of Environ. Conservation	X	1972	1977			X		X	X			X
North Carolina	Dept. of Human Resources	X	1969	1976			X		X	X			X
North Dakota	Dept of Health	X	1975	1976					X				
Ohio	Ohio Environmental Protection Agency	X	1967	1976			X		X		X	X	
Oklahoma	Dept of Health	X	1971	1978	X	1976		X	X		X	X	
Oregon	Dept of Environ. Quality	X	1969	1977	X	1976		X	X		X	X	
Pennsylvania	Dept of Environ Resources	X	1968	1977					X		X		
Rhode Island	Dept. of Health	X	1968	1977	X	1978		X	X		X	X	
South Carolina	Dept. of Health & Environ. Control	X	1972	1973	X	1978		X	X		X		X
South Dakota	Dept. of Environ Protection	X	1972	1974					X		X		
Tennessee	Dept of Public Health	X	1971	1977	X	1977			X		X	X	
Texas	Dept of Health; Dept of Water Resources	X	1969	1977				X	X		X	X	
Utah	Dept of Health	X	1974	1976				X	X		X	X	
Vermont	Agency for Environ. Conservation	X	1967	1977	X						X		
Virginia	Dept. of Health	X	1971	1974					X				X
Washington	Dept of Ecology; Health Dept	X	1971	1976	X	1976		X	X		X	X	
West Virginia	Dept. of Nat Resources, Dept of Health	X	1973	1974					X				X
Wisconsin	Dept of Nat. Resources	X	1967	1973					X	X			
Wyoming	Dept. of Water Quality	X	1973	1975					X		X		
U S. Territories+													
Guam	Guam Environmental Protection Agency	X								X			
Samoa	Environmental Quality Commission												
Pacific Islands	Trust Territory Environ. Protection Board												
Puerto Rico	Environmental Quality Board	X	1978						X				
Virgin Islands	Dept. of Public Works	X	1976				X		X		X		

* Bureau of National Affairs, Inc , 1977

+ Garretson et al , 1978

states currently have laws regulating the management of solid wastes. Even if no additional legislative action has been enacted within a particular state, the management of hazardous wastes could be regulated, to some extent, under this existing solid waste legislation. However, the effective regulation of hazardous wastes requires the application of significantly different management standards than does the regulation of conventional solid waste. Furthermore, solid waste legislation must often be interpreted broadly to be effectively extended to the control of hazardous waste. Also, while various aspects of hazardous waste management could be exercised under existing authority, few designated regulatory agencies currently have the resources or manpower necessary to run an adequate hazardous waste program.

Enabling solid waste legislation is often derived from early state environmental control laws through which the management of solid waste was first addressed. As indicated in Table 2-1, specific solid waste laws may date back many years, with updated versions incorporated as amendments. Many of the more recent amendments specifically address hazardous wastes, or mention hazardous wastes along with solid wastes. Almost every state so far has found it necessary to amend their current solid waste legislation at least once to meet the increased need for more control. Each state and territory now has at least one principal regulatory agency that has the enabling authority to control hazardous wastes. State authority to regulate hazardous waste is difficult to compare from one state to another because the legislation allows widely varying individual interpretation of the authority to be exercised.

Fifteen states have passed separate and specific laws governing the management of hazardous wastes as of 1978. In these cases, authority is clearly distinguished and hazardous wastes are defined for control purposes. Although the comprehensiveness of these laws varies among states, management plans and approaches generally follow the requirements given in RCRA. In addition to these 15 states, another 10 states and one territory have proposed legislation that, as of 1978, is pending approval of state legislatures. These proposed laws have been presented either as a bill, separate from any authority designated under a state's existing solid waste legislation, or have been presented as an amendment specifically governing hazardous wastes under a state's existing solid waste legislation. The remaining states use existing solid waste legislation to govern hazardous wastes.

Most states do not have specific regulations or guidelines for hazardous waste management. In those that do, the strength of promulgated regulations may be a matter of the interpretation given by the particular state. Regulations may take the form of an amendment to the existing solid or hazardous waste legislation, or may be a separate document generated and used by the principal state regulatory agency. In some states, the existing regulations may clearly distinguish between the designated levels of authority over hazardous wastes, with specific criteria and procedures described, while in other states the regulations may limit the scope of authority to a particular hazardous waste category, such as pesticide disposal. As shown in Table 2-1, as of 1978 16 states have promulgated specific regulations or guidelines for the management of hazardous wastes, and an additional four states have proposed such regulations. No attempt has been made to compare the equivalency of these regulations.

As indicated in Table 2-1, all but three of the states have addressed the identification of hazardous waste in the definition section of their general solid waste legislation or within a particular section of the solid waste legislation. The other three states have defined hazardous wastes under separate hazardous waste legislation that has been proposed or passed.

Collectively, as of 1978 at least 37 states and two territories have addressed the management of hazardous waste to a limited extent within their existing solid waste regulations. As illustrated in Table 2-1, hazardous wastes may be either addressed "in part" for the regulation of a particular activity, such as disposal procedures, or may be specifically addressed as a separate section within the general solid waste regulations. When regulated under the authority of existing solid waste laws, the management of hazardous wastes is usually handled on a case-by-case basis, with little systematic control on the various levels of hazardous waste management, particularly for on-site activities.

Most of the states have initiated an effort to identify the sources of hazardous waste generation within their boundaries by the means of a survey. In a few cases, a survey was not deemed necessary since such sources were previously identified for control through the use of state tax department listings or through industrial directories in conjunction with a working manifest system. As indicated in Table 2-1, as of 1978 at least 24 states have completed such a survey, and an additional nine states have surveys in progress. Of the remaining states, several have plans to conduct such a survey.

Tables 2-2 through 2-7 are directed to the various aspects of state hazardous waste management as they apply to generators, transporters, treaters, storers, and disposers, respectively. The specific control mechanisms included in the tables are some of those included in Sections 3002 through 3004 of RCRA, addressing standards applicable to each group involved in the hazardous waste management process. The tables should not be interpreted as a comparison of equivalency but, rather, are presented to illustrate the presence and form of the mechanisms by which hazardous wastes are being managed as of 1978. In four states, proposed regulations are far enough along the legal path to be included in these tables for discussion purposes. In many states, legislation is being drafted for future consideration; however, the majority of states are waiting for Federal regulations on hazardous wastes to be approved before issuing their own state regulations.

TABLE 2-2

STATE LEGISLATION APPLICABLE TO HAZARDOUS WASTE GENERATORS*

States	Manifest: Enabling authority	Manifest: Regulations or standards	Record-keeping: Enabling authority	Record-keeping: Regulations or standards	Reporting: Enabling authority	Reporting: Regulations or standards
Alabama (proposed)	X	X	X	X	X	X
Alaska						
Arizona	X		X		X	
Arkansas						
California	X	X	X	X	X	X
Colorado						
Connecticut						
Delaware						
District of Columbia						
Florida (proposed)	X		X		X	
Georgia				X		X
Hawaii	X		X		X	
Idaho						
Illinois	X	X			X	X
Indiana			X		X	
Iowa						
Kansas	X	X				
Kentucky			X		X	
Louisiana						
Maine						
Maryland	X	X	X		X	
Massachusetts						
Michigan						
Minnesota (proposed)	X	X	X	X	X	X
Mississippi						
Missouri	X		X		X	
Montana	X		X		X	
Nebraska	X		X		X	
Nevada						
New Hampshire						
New Jersey	X		X		X	
New Mexico	X	X	X	X	X	X
New York						
North Carolina (proposed)	X		X		X	
North Dakota						
Ohio	X					
Oklahoma	X	X	X	X	X	X
Oregon	X		X		X	
Pennsylvania						
Rhode Island	X		X		X	
South Carolina	X		X		X	
South Dakota						
Tennessee	X					
Texas	X	X	X	X	X	X
Utah	X					
Vermont						
Virginia						
Washington	X	X	X	X	X	X
West Virginia			X		X	
Wisconsin	X		X			
Wyoming						

*Information presented in this table was received in personal communication with representatives from the State offices listed in Table 2-1 and the Environmental Protection Agency.

TABLE 2-3

STATE LEGISLATION APPLICABLE TO HAZARDOUS WASTE TRANSPORTERS*

State	Permit†		Manifest		Record-keeping		Reporting		Inspection	
	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards
Alabama (proposed)	X		X						X	
Alaska										
Arizona			X		X		X		X	
Arkansas										
California	X	X	X	X	X	X			X	X
Colorado										
Connecticut	X				X	X	X	X	X	
Delaware									X	
District of Columbia	X									
Florida (proposed)			X		X		X		X	
Georgia	X	X			X	X	X	X	X	X
Hawaii			X		X		X			
Idaho										
Illinois	X	X	X	X					X	X
Indiana	X		X	X	X		X			
Iowa										
Kansas	X	X	X	X	X	X	X	X		
Kentucky	X									
Louisiana										
Maine										
Maryland	X		X	X	X	X	X			
Massachusetts	X	X			X	X	X	X	X	
Michigan										
Minnesota (proposed)	X	X	X	X	X	X	X	X		
Mississippi										
Missouri	X		X		X		X		X	
Montana	X		X		X				X	
Nebraska	X		X		X	X	X		X	
Nevada										
New Hampshire										
New Jersey			X		X					
New Mexico	X	X	X	X	X	X	X	X	X	X
New York										
North Carolina (proposed)										
North Dakota	X									
Ohio	X	X	X							
Oklahoma	X	X	X		X	X	X	X	X	
Oregon	X		X	X	X		X		X	
Pennsylvania										
Rhode Island	X	X	X		X		X		X	X
South Carolina	X		X	X	X		X		X	
South Dakota										
Tennessee			X							
Texas			X	X	X	X	X			
Utah	X		X							
Vermont										
Virginia										
Washington			X	X	X	X	X	X	X	
West Virginia										
Wisconsin			X		X					
Wyoming										

*Information presented in this table was received in personal communication with representatives from the State offices listed in Table 2-1 and the Environmental Protection Agency.
†Includes permit, registration, license, and certification.

TABLE 2-4

STATE LEGISLATION APPLICABLE TO HAZARDOUS WASTE TREATERS*

States	Permit		Manifest		Record-keeping		Reporting		Inspection	
	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards	Enabling authority	Regulations or standards
Alabama (proposed)	X		X		X		X		X	
Alaska										
Arizona	X		X		X		X		X	
Arkansas										
California	X	X	X	X	X	X	X	X	X	X
Colorado										
Connecticut	X								X	
Delaware									X	
District of Columbia	X									
Florida (proposed)	X		X		X		X		X	
Georgia	X	X	X	X	X	X	X	X	X	X
Hawaii	X		X		X		X		X	
Idaho										
Illinois	X		X	X	X	X	X	X	X	
Indiana										
Iowa										
Kansas	X	X	X	X	X		X		X	X
Kentucky					X		X			
Louisiana										
Maine										
Maryland	X	X	X	X	X	X	X		X	X
Massachusetts	X				X		X		X	
Michigan										
Minnesota (proposed)	X	X	X	X	X	X	X	X	X	X
Mississippi										
Missouri	X				X		X		X	
Montana	X		X		X				X	
Nebraska	X		X		X		X		X	
Nevada										
New Hampshire										
New Jersey										
New Mexico	X	X	X	X	X	X	X	X	X	X
New York	X									
North Carolina (proposed)			X		X		X			
North Dakota	X									
Ohio	X	X	X							
Oklahoma	X	X	X	X	X	X	X	X	X	X
Oregon			X						X	
Pennsylvania										
Rhode Island	X		X		X		X		X	
South Carolina	X		X		X		X		X	
South Dakota										
Tennessee			X							
Texas			X	X	X				X	
Utah	X		X				X		X	
Vermont										
Virginia										
Washington	X	X	X	X	X	X			X	
West Virginia										
Wisconsin										
Wyoming										

*Information presented in this table was received in personal communication with representatives from the State offices listed in Table 2-1 and the Environmental Protection Agency.

TABLE 2-5

STATE LEGISLATION APPLICABLE TO HAZARDOUS WASTE STORERS*

States	Permit: Enabling authority	Permit: Regulations or standards	Manifest: Enabling authority	Manifest: Regulations or standards	Record-keeping: Enabling authority	Record-keeping: Regulations or standards	Reporting: Enabling authority	Reporting: Regulations or standards	Inspection: Enabling authority	Inspection: Regulations or standards
Alabama (proposed)	X		X		X		X		X	
Alaska										
Arizona	X		X		X		X		X	
Arkansas										
California	X	X	X	X	X	X	X	X	X	X
Colorado										
Connecticut	X								X	
Delaware										
District of Columbia	X								X	
Florida (proposed)	X		X		X		X		X	
Georgia	X	X							X	
Hawaii	X		X		X		X		X	
Idaho										
Illinois	X		X	X	X	X	X	X	X	
Indiana										
Iowa										
Kansas	X	X	X†						X	X
Kentucky	X				X		X			
Louisiana										
Maine										
Maryland	X		X	X	X	X	X		X	
Massachusetts									X	
Michigan										
Minnesota (proposed)	X	X	X	X	X	X	X	X	X	X
Mississippi										
Missouri	X		X		X		X		X	
Montana	X		X		X				X	
Nebraska	X		X		X		X		X	
Nevada										
New Hampshire										
New Jersey										
New Mexico	X	X	X	X	X	X	X	X	X	X
New York										
North Carolina (proposed)			X							
North Dakota	X									
Ohio	X	X	X							
Oklahoma	X	X	X		X		X		X	
Oregon	X	X	X		X		X		X	
Pennsylvania										
Rhode Island	X		X		X		X		X	
South Carolina	X		X		X		X		X	
South Dakota										
Tennessee			X							
Texas	X	X	X	X	X	X	X	X	X	X
Utah	X								X	
Vermont										
Virginia										
Washington				X						
West Virginia										
Wisconsin										
Wyoming										

*Information presented in this table was received in personal communication with representatives from the State offices listed in Table 2-1 and Environmental Protection Agency.

†Applicable to off-site only

TABLE 2-6

STATE LEGISLATION APPLICABLE TO HAZARDOUS WASTE DISPOSERS*

States	Permit: Enabling authority	Permit: Regulations or standards	Manifest: Enabling authority	Manifest: Regulations or standards	Record-keeping: Enabling authority	Record-keeping: Regulations or standards	Reporting: Enabling authority	Reporting: Regulations or standards	Inspection: Enabling authority	Inspection: Regulations or standards
Alabama (proposed)	X	X	X	X	X	X	X	X	X	
Alaska										
Arizona	X		X		X		X		X	
Arkansas										
California	X	X	X	X	X	X	X	X	X	X
Colorado	X								X	
Connecticut	X								X	
Delaware										
District of Columbia	X								X	
Florida (proposed)	X†		X		X		X		X	
Georgia	X	X	X	X	X	X	X		X	X
Hawaii	X		X		X		X		X	
Idaho	X				X		X		X	
Illinois	X	X	X	X	X	X	X	X	X	X
Indiana					X	X	X	X	X	
Iowa	X				X		X		X	
Kansas	X	X	X	X	X	X	X	X	X	
Kentucky	X				X		X		X	
Louisiana									X	
Maine										
Maryland	X	X	X	X	X	X	X	X	X	X
Massachusetts	X	X			X		X		X	X
Michigan										
Minnesota (proposed)	X	X	X	X	X	X	X	X	X	X
Mississippi										
Missouri	X	X			X		X		X	X
Montana	X		X		X		X		X	
Nebraska	X		X		X		X		X	X
Nevada										
New Hampshire										
New Jersey	X		X		X		X		X	
New Mexico	X	X	X	X	X	X	X	X	X	X
New York	X	X			X		X		X	
North Carolina (proposed)	X		X						X	
North Dakota	X								X	
Ohio	X	X	X						X	
Oklahoma	X	X	X	X	X	X	X	X	X	X
Oregon	X	X	X		X	X	X	X	X	X
Pennsylvania	X				X				X	
Rhode Island	X		X	X	X	X	X	X	X	X
South Carolina	X	X	X		X		X		X	
South Dakota	X				X					
Tennessee			X		X					
Texas	X	X	X	X	X	X	X	X	X	X
Utah	X		X		X		X		X	X
Vermont	X								X	
Virginia										
Washington	X	X	X	X	X	X	X	X	X	X
West Virginia					X		X		X	
Wisconsin	X		X		X	X				
Wyoming	X				X				X	

*Information presented in this table were received in personal communication with representatives from the State offices listed in Table 2-1 and Environmental Protection Agency.

†Off-site only.

TABLE 2-7

STATE APPROACH TO HAZARDOUS WASTE DEFINITION, MONITORING, AND ENFORCEMENT*

State	Waste Definition		Monitoring		Enforcement	
	Criteria	List	Enabling authority	Standards or regulations	Enabling authority	Standards or regulations
Alabama (proposed)			X	X	X	
Alaska					X	
Arizona			X		X	X
Arkansas	X					
California	X	X	X	X	X	X
Colorado			X		X	
Connecticut			X		X	
Delaware					X	
District of Columbia					X	
Florida (proposed)			X		X	X
Georgia				X	X	X
Hawaii					X	
Idaho					X	
Illinois			X	X	X	X
Indiana					X	
Iowa			X		X	
Kansas	X	X	X	X	X	X
Kentucky					X	X
Louisiana	X		X		X	
Maine					X	
Maryland		X	X		X	X
Massachusetts	X	X	X		X	
Michigan					X	
Minnesota (proposed)	X		X	X	X	X
Mississippi					X	
Missouri			X		X	X
Montana	X	X	X		X	X
Nebraska			X		X	X
Nevada					X	
New Hampshire					X	
New Jersey			X			X
New Mexico	X	X	X	X	X	X
New York			X			X
North Carolina (proposed)			X			
North Dakota					X	
Ohio			X		X	X
Oklahoma	X	X	X	X		X
Oregon	X		X		X	X
Pennsylvania					X	
Rhode Island			X	X	X	X
South Carolina	X	X	X	X	X	X
South Dakota					X	
Tennessee					X	
Texas	X		X	X	X	X
Utah			X		X	
Vermont	X				X	
Virginia	X				X	
Washington	X	X	X	X	X	X
West Virginia			X	X†	X	X
Wisconsin			X			X
Wyoming					X	

* Information presented in this table was received in personal communications with representatives from the State offices listed in Table 2-1 and the Environmental Protection Agency.

† West Virginia - Standards for On-Site Only

The various regulatory criteria presented in Tables 2-2 through 2-7 relate to general enabling authority or to more detailed standards or regulations. In a relative sense, the enabling authority provides the formal power to regulate hazardous waste activities while standards and regulations provide specific requirements. Enabling authority usually indicates that the particular state has the power to control a particular acitivity. In the absence of specific standards or regulations, this authority may be exercised on a case-by-case basis, or it may extend to the regulation of only a particular management activity, such as disposal. In examining each of these tables, it should be remembered that the status of state legislation is in flux and that these tables are meant to present only a general view of the nationwide status of hazardous waste management.

Appendix A provides a description of the specific hazardous waste management regulations for selected states as summarized in Tables 2-2 through 2-7. These tables illustrate the general differences in existing regulatory approaches while the information in Appendix A provides more specific detail.

2.4.1 <u>The Status of State Regulatory Criteria Applicable to Generators of Hazardous Waste.</u> Table 2-2 illustrates the status of the regulatory criteria that are applicable to generators of hazardous waste as of 1978. (Additional regulatory criteria applicable to generators who treat, store, or dispose hazardous waste on-site are discussed in Sections 2.4.3, 2.4.4, and 2.4.5.) Twenty-five states currently have (or have proposed) the enabling authority over manifest-type requirements pertaining to generators of hazardous wastes; ten of these states have promulgated (or have proposed) standards for such manifests. Twenty-three states have (or have proposed) the enabling authority over recordkeeping requirements applicable to generators. Seven of these states have (or have proposed) recordkeeping standards for hazardous waste generators; one additional state also has recordkeeping standards. Twenty-three states currently have (or have proposed) a reporting requirement applicable to generators of hazardous waste. Eight of these states have (or have proposed) reporting standards that apply to these generators; one additional state also has reporting standards.

2.4.2 The Status of State Regulatory Criteria Applicable to Transporters of Hazardous Waste. Table 2-3 presents the status of the regulatory criteria that are applicable to transporters of hazardous waste as of 1978. Twenty-three states have (or have proposed) the enabling authority to require transporters of hazardous waste to be permitted, licensed, registered, or certified. Ten of these states have (or have proposed) standards for the permitting, licensing, registering, or certifying of hazardous waste transporters. Twenty-five states currently have (or have proposed) the authority to initiate a manifest system applicable to such transporters, eleven of these states have standards for manifests. Twenty-three states have (or have proposed) the enabling authority over recordkeeping requirements; twelve of these states have (or have proposed) recordkeeping standards. Nineteen states have (or have proposed) the authority to require reporting requirements; while eight of the states have (or have proposed) reporting standards. Eighteen states have (or have proposed) the enabling authority for inspection of transporters; five of these states have regulations or standards for inspection.

2.4.3 The Status of State Regulatory Criteria Applicable to Treaters of Hazardous Waste. Table 2-4 illustrates the status of the regulatory criteria that are applicable to on-site and off-site treaters of hazardous waste as of 1978. Twenty-five states have (or have proposed) the enabling authority to require such treaters of hazardous waste to be permitted; nine of these states have promulgated (or have proposed) permit standards. Twenty-three states have (or have proposed) the enabling authority to require treaters to comply with a manifest system; ten of these states have promulgated (or have proposed) manifest standards. Twenty-two states have (or have proposed) the enabling authority to regulate recordkeeping requirements; eight of these states have promulgated (or have proposed) recordkeeping standards for treaters. Twenty states (or have proposed) the enabling authority to require reports from hazardous waste treaters; six of these states have promulgated (or have proposed) reporting standards for such treaters. Twenty-four states have (or have proposed) the enabling authority to inspect hazardous waste treatment facilities; seven of these states have (or have proposed) inspection standards.

2.4.4 The Status of State Regulatory Criteria Applicable to Storers of Hazardous Waste. Table 2-5 shows the status of the regulatory criteria that are applicable to on-site and off-site storers of hazardous waste as of 1978. Twenty-five states have (or have proposed) the enabling authority to require permits of hazardous waste storers; nine of these states have enacted (or have proposed) permit standards for storage. Twenty-one states have (or have proposed) the enabling legislation to require compliance with the manifest system. Six of these states have promulgated (or have proposed) standards for manifest compliance; one additional state also has manifest standards. Eighteen states have (or have proposed) the enabling authority to require recordkeeping by the storer; six of these states have (or have proposed) recordkeeping standards. Seventeen states have (or have proposed) the enabling authority to require reporting by storers of hazardous waste; five of these states have (or have proposed) standards. Twenty-three states have indicated that they have (or have proposed) specified authority to inspect hazardous waste storage facilities; five of these states (or have proposed) have inspection standards.

2.4.5 The Status of State Regulatory Criteria Applicable to Disposers of Hazardous Waste. The issue of the disposal of hazardous waste has thus far received more legislative attention than has any other hazardous waste management activity. As of 1978 thirty-eight states have (or have proposed) the legal authority to require permits for the operation of on-site and/or off-site disposal facilities receiving hazardous wastes. Seventeen of these states have promulgated (or have proposed) standards specifically relating to the permitting of disposal facilities. Twenty-five states have (or have proposed) the enabling authority to require compliance with a manifest system; twelve of these states have promulgated (or have proposed) standards for manifest requirements. Thirty-four states have reported that they have (or have proposed) the authority to require recordkeeping practices from hazardous wastes disposers; fifteen of these states have (or have proposed) standards for the recordkeeping requirements. Twenty-nine states indicate that they have (or have proposed) enabling authority to require hazardous waste disposers to report on the materials being handled; thirteen of these states have promulgated (or have proposed) standards for reporting. Thirty-nine states have (or have proposed) legal capabilities to inspect hazardous waste disposal sites; fifteen of these states have (or have proposed) standards specifically relating to the inspection requirements of disposal sites.

2.4.6 The Status of State Hazardous Waste Definition, Monitoring, and Enforcement. Table 2-7 presents the status of state hazardous waste definition, monitoring practices, and enforcement capabilities as of 1978. While all of the states have a textual definition of hazardous waste, several states have developed a more specific definition of hazardous waste. Seven states presently define hazardous waste exclusively by the use of criteria; one additional state defines hazardous waste exclusively by a listing of particular substances; eight additional states employ the use of both criteria and a list.

Both monitoring and enforcement refer to authority that is generally exercised only over disposal activities; however, this authority can be extended to include other hazardous waste management activities. Thirty states report that they have (or have proposed) the enabling authority to control monitoring activities related to hazardous wastes; twelve of these states have promulgated (or have proposed) standards with regard to monitoring procedures and requirements. One additional state also has such standards.

Forty-five states have (or have proposed) some type of enabling enforcement capabilities over hazardous wastes; twenty-four of these states have (or have proposed) enforcement standards specifically relating to hazardous wastes. In most of the states, the enforcement power is interpreted as an extension of the authority vested through existing solid waste enforcement capabilities.

3.0 DESCRIPTION OF THE BASELINE ACTION

The baseline action is that set of regulations and guidelines initially developed by the U.S. Environmental Protection Agency in response to the mandate of Subtitle C of RCRA. Baseline regulations have been developed under the mandate of Sections 3001 through 3006 and 3010 of Subtitle C. These baseline regulations and guidelines fall within several broad areas, as follows:

- Identification of hazardous waste subject to regulation;
- Control of hazardous waste from generation to ultimate disposal;
- Guidelines for state hazardous waste programs.

Because of the extensive nature of the baseline regulations, a summary of the most relevant points is presented in the following sections. The specific baseline regulations being assessed in this EIS are described in Appendix B.

3.1 Criteria, Identification, and Listing of Hazardous Waste (Section 3001)

The Section 3001 baseline regulations delimit wastes that are to be considered hazardous and, therefore, to be brought under regulatory control. The regulatory approach taken is to use both identifying characteristics and lists of hazardous wastes, industrial processes, and sources to be brought under regulatory control.

The characteristics used to delimit hazardous waste are as follows:

- Ignitability;
- Corrosiveness;
- Reactivity;
- Toxicity.

Any waste which exhibits any of these characteristics or which is listed (see Appendix B, Subpart A), would be considered hazardous and would have to be managed pursuant to the Subtitle C regulations. The hazardous waste lists identify specific hazardous wastes (e.g., water-based paint wastes), sources generating hazardous waste (e.g., various departments of hospitals), and processes which generate hazardous waste (e.g., asbestos wastes from cell diaphrams in production of chlorine); and indicate for each listed waste or waste stream the reason for its is inclusion (e.g., ignitable, corrosive, reactive, toxic). A generator producing a listed waste may be exempted from regulation providing that he could demonstrate that the reason for listing that waste does not apply to his particular waste stream. The methods to be used for such a demonstration include the four identifying characteristics plus tests for low-level radioactivity, infectiousness, mutagenic activity, bioaccumulation potential, and toxicity.

3.2 Standards Applicable to Generators of Hazardous Waste (Section 3002)

The Section 3002 baseline regulations identify generators of hazardous waste who would be subject to regulation and specify the responsibilities of these generators. The generator requirements would apply to those persons or Federal agencies, except households, who produce and dispose more than 100 kilograms (about 220 pounds) per month of wastes identified as hazardous under the Section 3001 regulations. Any person or Federal agency producing and disposing 100 kilograms or less per month would not be required to comply with the generator regulations. Also any generator engaged solely in retail trade or principally in farming would have to comply with the regulations only with regard to waste automotive oil; however, any person (e.g., a transporter) could assume a waste automative oil generator's total liability for compliance with the Section 3002 requirements, providing a written transfer of liability contract is in effect. Generators excluded from compliance with the Subtitle C regulations would, however, still be obligated to dispose their hazardous wastes in an acceptable manner, e.g., in a landfill that meets RCRA Subtitle D criteria.

The requirements of the generators of hazardous waste fall within the following broad categories:

- Compliance with the manifest system;
- Reporting;
- Recordkeeping;
- Containerization;
- Labeling;
- Furnishing information on general chemical composition.

The key aspects of these regulations, and the greatest benefits to be derived, revolve around the development of a manifest system and periodic reporting requirements. The manifest system would require that detailed information regarding each off-site shipment of hazardous waste is recorded, accompanies the waste during transport, and serves as the basis for filing periodic reports. This system would serve to promote proper delivery and disposal of all hazardous wastes consigned by the generator. Other aspects of these regulations (e.g., containerization and labeling) have been developed to be consistent with existing Department of Transportation (DOT) regulations.

The full set of reporting and recordkeeping requirements under Section 3002 would be applicable only to generators designating hazardous wastes for off-site treatment, storage, or disposal in a facility not owned by the generator. These generators would have to submit both an annual report summarizing all hazardous waste shipments and a quarterly report for hazardous wastes which were shipped, but not received by a permitted facility (as evidenced by the failure to receive the signed original of the manifest or delivery document from the designated disposal facility). Generators designating hazardous wastes for disposal at an off-site facility owned by the generator and located within the same state as the generator would not have to comply with any of the reporting or recordkeeping requirements (although the facility itself would be subject to reporting and recordkeeping requirements under Section 3004).

Generators designating hazardous wastes for on-site treatment, storage, or disposal would be exempted from manifesting, containerization, and labeling requirements, though they would have to make an annual report, keep records, and comply with the Section 3004 regulations.

3.3 Standards Applicable to Transporters of Hazardous Waste (Section 3003)

The Section 3003 baseline regulations identify those transporters who are subject to regulation and specify requirements that fall within the following broad categories:

- Recordkeeping;
- Acceptance and transport of hazardous waste;
- Compliance with the manifest;
- Delivery of the hazardous waste to the designated, permitted facility;
- Emergency situations;
- Marking and placarding of vehicles.

Many of these controls are currently imposed upon some transporters of hazardous waste by regulations under the Hazardous Materials Transportation Act. Therefore, the baseline regulations within this section are designed to be consistent with current DOT regulatory practices. Further, the baseline regulations would extend the DOT regulations to intrastate, as well as interstate, transportation of hazardous wastes. The most significant additions to those existing regulations affecting hazardous waste transport are the manifest and delivery requirements that would assure that all hazardous wastes are delivered to the designated permitted facility. In the case of spills during transport, the transporter regulations would require the transporter to immediately notify the specified authority, to file a written report within 15 days, and to clean up all spilled hazardous waste or take such action as required so that the spilled hazardous waste no longer presents a hazard to human health or the environment.

The transporter regulations would apply to any person or Federal agency transporting, within the United States, hazardous wastes that require a manifest under the generator regulations and also apply to any transporter importing a shipment of hazardous wastes from abroad. Portions of the standards would also apply to any transporter who consolidates and transports hazardous wastes not requiring a manifest. The transporter regulations would not apply to persons or Federal agencies transporting hazardous wastes solely on the site of generation or solely on the site of a permitted hazardous waste management facility.

3.4 Standards For Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Section 3004)

The Section 3004 baseline regulations are intended to provide an adequate degree of environmental and public health protection during the treatment, storage, and ultimate disposal of hazardous wastes. These standards include requirements relating to the general aspects of facility operations (i.e., site selection, monitoring, training, security, emergency procedures, and contingency plans, inspections, closure, financial requirements, and recordkeeping/reporting) as well as standards applicable to specific types of treatment, storage, and disposal facilities (i.e., storage tanks, containers, landfarms, landfills, surface impoundments, basins, incinerators, and chemical, physical, and biological treatment facilities).

With the few exclusions noted below, these standards apply to owners and operators of any facility that treats, stores or disposes any quantity of waste identified as hazardous under the Section 3001 regulations, except 'special wastes'. All owners and operators of facilities that treat, store, or dispose 'special wastes', and no other hazardous waste, would have to comply only with selected general facility standards. The Section 3004 standards do not apply to on-site storage by generators who store their own wastes for less than 90 days prior to subsequent transport of-site, but do apply to any such on-site storage which lasts for 90 days or longer.

Certain practices that are controlled under other Federal acts are not regulated under the treatment, storage, and disposal standards. These practices include underground (deep-well) injection, ocean dumping, discharges to municipal sewer systems, surface discharges under a National Pollution Discharge Elimination System (NPDES) permit, and all treatment, storage, and disposal activities at Publicly Owned Treatment Works (POTW) or by ocean dumping barges and vessels. However, the treatment, storage, and disposal regulations would apply to above ground storage or treatment of hazardous wastes prior to underground injection, on-shore facilities associated with ocean dumping activities, and surface impoundments associated with NPDES permitted industrial wastewater treatment facilities and hazardous sludges from such facilities.

The Section 3004 baseline regulations have been divided into five major sections: Human Health and Environmental Standards, General Facility Standards, Storage Standards, Treatment and Disposal Standards, and Special Waste Standards. Some of the standards are accompanied by notes which either provide further explanation of the standard or specify a basis for permitting authorities to allow deviations from the standard. No deviation is allowed from standards which do not have accompanying notes.

There are overriding standards for human health and environmental protection: Groundwater, Surface Water, and Air. They establish criteria for human health and environmental protection and are intended to assure that the design, construction and operation of hazardous waste facilities does not adversely affect human health or the environment by degrading the groundwater, surface water, or air.

The human health and environmental standards are used by EPA in drafting and evaluating more specific standards and can be used in designing facilities. While human health and environmental standards would be legally binding, they are not intended to be directly enforced. They are designed to be used on a case-by-case basis only where there is reason to believe (e.g., a third party challenge) that the standards are insufficient for human health and environmental protection. In such cases, EPA may monitor to determine if the facility is in compliance with the human health and environmental standards at issue.

Furthermore, it is the burden of the government to show that a facility is in violation of a human health and environmental standard if the facility is in compliance with all other applicable standards. Therefore, if a facility is in compliance with all other applicable standards, but is, nevertheless, discovered to be violating a human health and environmental standard, no penalty would be assessed to the facility owner/operator for the period of time prior to that discovery, and a reasonable time would be allowed for the facility to be brought into compliance.

Specific standards which provide measurable criteria and a means to achieve the human health and environmental standards are necessary for practical implementation of these regulations, and are required by the statute. Thus, the general facility standards, the storage standards, and the treatment/disposal standards translate the human health and environmental standards into usefully enforceable requirements. The details of these standards are presented in Subpart D of Appendix B.

General facility standards apply to every type of hazardous waste management facility. They must be complied with at all times by all regulated facility owners/operators. If these standards are not complied with, the facility owner/operator would be considered to be in violation of these regulations and could be subject to enforcement action for the entire period of the violation. Unless exempted, the facility owner/operator has the burden of demonstrating that he/she is in compliance. Facility owners/operators may be required to monitor, report, and otherwise demonstrate compliance with the general facility standards.

In addition to the general facility standards, facilities which store hazardous waste must also comply with general storage standards as well as with standards which apply to storage tanks and storage containers. RCRA's definition of storage implies no discharge to groundwater, surface water, or air. The storage standards reflect this intent.

In addition to the general facility standards, facilities which treat or dispose of hazardous waste must also comply with the general treatment/disposal standards. Facilities with incinerators; landfills; surface impoundments; basins; landfarms; or chemical, physical, or biological treatment processes must comply with the standards prescribed under these subsections.

Several waste streams have been identified as being of special concern due to their unique characteristics and the techno-economic uncertainties regarding their disposal. These 'special wastes' are high volume wastes which are often disposed on-site by generators, for which traditional land disposal technology is techno-economically inappropriate, and whose environmental risk is ill-defined. These 'special waste' streams include: utility wastes (fly ash, bottom ash), oil drilling muds and brines, cement kiln dusts, phosphate rock mining and processing wastes, uranium mining wastes, and other mining wastes. In the event these wastes meet a hazardous characteristic or are listed, unique facility standards will be developed for them. However, these wastes would presently be subject only to general standards for recordkeeping, reporting, etc. EPA intends to develop control technology standards for these wastes as soon as possible.

3.5 Permit System for Treatment, Storage, or Disposal of Hazardous Wastes (Section 3005)

Section 3005(a) of RCRA requires "...each person owning or operating a facility for the treatment, storage or disposal of hazardous waste identified or listed under this subtitle to have a permit issued, pursuant to this section." In the baseline regulations as presented in Appendix B, Subpart E, a hazardous waste management facility is defined as any land and appurtenances thereto used for the treatment, storage, and/or disposal of hazardous waste. On the effective date of these regulations (i.e., 180 days after their promulgation), no such facility would be allowed to accept hazardous waste unless its owner or operator had applied for a permit. The purpose of such permits is to assure that facilities are constructed and/or operated in a manner consistent with the objectives of the Section 3004 standards.

The Section 3005 baseline regulations would require that all owners or operators of facilities treating, storing, or disposing hazardous wastes obtain a permit prior to facility construction, modification, or operation. The regulations establish standards for permit applications, permit issuance, and permit revocation. Permits would be issued for the projected life of the facility. The owners/operators of new facilities would be required to obtain permits prior to construction and would have to certify that construction was performed in compliance with the permit before commencing operation. Special permits would be available for experimental facilities, qualified hospital-medical care facilities, Publicly Owned Treatment Works, and ocean dumping barges and vessels.

The Section 3005 baseline regulations would also require the circulation of a public notice of any tenative determination to issue, deny, or modify a permit. Within 30 days of publication of the notice, any person would be able to request a public hearing on the determination. The Regional Administrator would decide whether such a hearing is appropriate at his discretion.

3.6 Guidelines for State Hazardous Waste Programs (Section 3006)

Section 3006 provides that states are to be encouraged to apply for authorization to administer and enforce their own hazardous waste program pursuant to Subtitle C. Under the baseline regulations there would be three types of authorization for which states could apply: full authorization, partial authorization, or interim authorization.

Full authorization would allow a state to carry out a hazardous waste program in lieu of the Federal program under Subtitle C. Partial authorization would allow a state to administer and enforce selected components of the program. States would be considered for partial authorization only if state legislative authority did not exist for all required program components. In all cases, the combination of the state and the Federal program would have to meet the requirements of a fully authorized program. Partial authorization would be granted for a period not to exceed five years, but could be renewed.

Interim authorization would allow a state to carry out a hazardous waste program in lieu of the Federal Program under Subtitle C for a period not to exceed twenty-four months, beginning on the date six months after the date of promulgation of regulations under Section 3001. The purpose of interim authorization is to allow the state to make an orderly transition from its present program to a program eligible for full authorization. The guidelines describe the substantive and procedural requirements for States applying for authorization, EPA's oversight of the State's hazardous waste program, and for the withdrawal of authorization pursuant to Section 3006(e) of Subtitle C. Specific guidelines are drafted with respect to equivalency of programs; consistency with the Federal program; oversight; application procedures; and withdrawal of authorization.

3.7 Preliminary Notification of Hazardous Waste Activities (Section 3010)

These baseline regulations (see Appendix B, Subpart G) define the administrative procedures under which states may be granted authority to receive notifications of hazardous waste activities (limited interim authorization) and specify the procedures for filing such notifications by persons generating or managing hazardous wastes.

These regulations would allow states to receive a limited, one-time authorization (expiring six months after promulgation of the Section 3001 regulations) to receive notifications of hazardous waste activities from generators, transporters, storers, treaters, and disposers. The states would not have authority to grant exceptions to the filing requirements and would have to maintain files of all receipts, making these files available to EPA at the request of the Regional Administrator.

The filing requirements would apply to every person conducting a hazardous waste activity at the time of promulgation of the Section 3001 regulations. Such notification would constitute one of the conditions for interim status for storers, treaters, and disposers to continue operations pending issuance of a facility permit. The baseline regulations would allow combination of notification requirements with application for an identification code by generators and transporters, and with application for facility permits for storers, treaters, and disposers.

4.0 IDENTIFICATION AND SELECTION OF REASONABLE ALTERNATIVES

Based upon the overall objectives of RCRA (see Chapter 2), the major objectives for Subtitle C are to promote public health and environmental protection in the generation and management of hazardous wastes, to enhance resource recovery from hazardous wastes, and to encourage state participation in the hazardous waste management program established under Subtitle C. The baseline Subtitle C regulations, summarized in Chapter 3, comprise the set of regulations initially developed to achieve these objectives in a feasible and enforceable manner.

During the overall development of both the proposed regulations and the final Phase I regulations, numerous alternative regulations and regulatory approaches have been considered. The baseline regulations and subsequent regulatory versions were selected from among the many alternatives based upon technical, environmental, institutional, economic, and legal considerations.* The various alternatives that were considered included changes in regulatory approaches (e.g., performance standards versus design and operating standards for hazardous waste storage, treatment and disposal facilities) and changes in the standards and criteria to be established by the regulations (e.g., the level of hazardous waste generation at which generators are designated for purposes of regulation under Section 3002).

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*Background documents prepared by EPA on the Subtitle C regulations provide a detailed discussion of the major issues raised and the major regulatory options considered during the development of the Subtitle C regulations.

Because of the enormous number of ways in which the overall objectives, regulations, and standards could be structured and developed the approach in this EIS is to select and develop a manageable set of meaningful alternatives that reasonably bracket the overall objectives and the resultant impacts anticipated from the regulations that are ultimately to be promulgated under Subtitle C.* The set of alternatives that have been developed is meaningful in the sense that each is considered to be technically, legally, economically, and institutionally feasible and enforceable, and each provides an assessable shift in the potential impacts that might result from the proposed regulations. Also, the alternatives selected fall within the scope of actions allowable under Subtitle C (e.g., tax incentives to promote resource recovery are not within the allowable scope of Subtitle C actions). By reasonably bracketing the overall objectives and the resultant impacts, it is possible to show the types of potential impacts that could result under various alternatives without having to explicitly consider the almost infinite variety of options for accomplishing the same or intermediate objectives.

It is not meant to be implied that the baseline regulations or any one of the alternatives selected and structured in this chapter would define the actual regulations promulgated under Subtitle C.

*Analyses of all the specific detailed alternatives and options considered are provided in the background documents for the Subtitle C regulations.

Rather, the set of alternatives should only be viewed as representative cases for purposes of analysis and as guidelines for assisting in the planning and development of the Subtitle C regulations.

Based upon the objectives of Subtitle C, five different sets of alternatives, with respect to the baseline regulations, have been selected and structured to reasonably bracket the potential impacts that could be expected to result. These alternatives are as follows:

- No Action;
- Phasing of Generators;
- Enhanced Public Health and Environmental Protection;
- Lesser Degree of Public Health and Environmental Protection;
- Phase I Alternative.

For each of these alternatives, the purpose and rationale for the selection and structure of the alternative are discussed in the following sections. To the extent practical, the major options that were not considered to be reasonable for inclusion are also indicated, and the rationale for their elimination is presented. In the discussion of the structure of each alternative, all components of the baseline Subtitle C regulations (see Appendix B) are assumed to be included under each alternative, except for those specific modifications that are indicated below.

4.1 No Action

This alternative has been selected for the purpose of analyzing the potential impacts that could result from taking no action, i.e., not promulgating regulations for Subtitle C. There are two ways in which the No Action alternative may be approached. One way is to assume that No Action involves not implementing any portion of RCRA, including Subtitle C. The other approach is to assume that No Action involves implementing all portions of RCRA, except Subtitle C.

Under the former approach, hazardous wastes would continue to be generated, stored, transported, treated, and disposed in essentially the same manner as is currently practiced. Under the latter approach, hazardous wastes would also continue to be generated, stored, transported, and treated in much the same manner as is currently practiced; however, disposal would be somewhat different due to the Subtitle D regulations. Open dumps would be prohibited and criteria would be established with which sanitary landfills would have to comply. However, Section 4003(2) of Subtitle D specifically exempts hazardous wastes from the requirement that solid wastes be utilized for resource recovery or disposed of in sanitary landfills or otherwise disposed of in an environmentally sound manner. Thus, it is uncertain how the implementation of Subtitle D would affect hazardous waste disposal if Subtitle C were not to be implemented.

It is not possible to prepare a meaningful assessment of the No Action alternative that assumes that all of RCRA, except Subtitle C, is to be implemented. This conclusion is based upon the unavailability of the state solid waste management plan required under Subtitle D, the recent promulgation of regulations and criteria under Subtitle

D for sanitary landfills, and the many significant uncertainties and lack of data about the ways Subtitle D and the rest of RCRA would affect hazardous waste generation, storage, transport, treatment and disposal. Therefore, the No Action alternative to be assessed in this report assumes that no part of RCRA, including Subtitle C, is to be implemented and that hazardous waste management would continue as currently practiced.

4.2 Phasing of Subtitle C Regulations

This alternative has been selected for the purpose of analyzing the potential change in impacts that could result from the promulgation of the baseline Subtitle C regulations on a phased basis, rather than from their total implementation at one time. For purposes of analysis, a five-year time frame measured from the proposed implementation date is assumed for the phasing of the regulations. The primary objectives of phased implementation are to ensure that resources (e.g., manpower, disposal sites, and capital) would not be stressed beyond their capacity to respond effectively to the baseline Subtitle C regulations.

There are two basic mechanisms for phasing the implementation of baseline Subtitle C regulations. First, the regulations within the different Sections of Subtitle C (i.e., Sections 3001 through 3006 and 3010) could be implemented over a significantly extended period of time (e.g., implementation of the 3001 regulations first, followed by the implementation of the 3002 regulations 6 months later; or implementation of a portion of the Section 3004 regulations, followed by implementation of the remainder of the Section 3004 regulations 6 months later). Second, the regulations for all the Sections of Subtitle C could be promulgated at the same time, and the levels for the standards and criteria established by the regulations could be phased to their proposed values over a period of time (e.g., the generator limit under Section 3002 could be set at 1,075 metric tons per month the first year, 303 metric tons per month the second year, ..., and 100 kilograms per month the fifth year).

The implementation of each and every individual Section of Subtitle C over a significantly extended period of time is not a feasible alternative, due both to the interdependence of the various Sections of Subtitle C and to court-imposed deadlines for the promulgation of various Sections. However, for reasons discussed in the Preface, the Section 3004 regulation is necessarily being promulgated in three phases. A Phase I Alternative, which is discussed in Section 4.5, has been developed for the purpose of analyzing the impacts associated with the regulations to be included in the first phase of this promulgation. As discussed in the Preface, a Phase II Alternative which relates to the second phase of this promulgation will be developed and analyzed in Part II of the EIS.

There are many different methods by which phasing could be implemented with regard to the second phasing mechanism discussed above (i.e., promulgation of all Subtitle C regulations at the same time and a gradual phasing in of more stringent levels for those standards and criteria that are established by the regulations). However, most methods would have essentially the same effect--a gradual expansion of the total quantity of hazardous wastes being controlled by the hazardous waste program. For purposes of analysis, the method selected emphasizes gradually increasing the quantity of wastes controlled by gradually expanding the number of generators brought under control. With this approach, the level of the generator limit established under Section 3002 of the baseline regulations is to be reduced annually over a five-year period of time in order to bring the larger generators into the program first and the smaller generators into the program later.* Furthermore, the generator limit is to be reduced so that equal amounts of hazardous wastes are annually brought under the program's control over the five-year period, i.e., 20 percent of the total industrial hazardous wastes per year.

A second method based on gradually increasing the quantity of wastes controlled through the mechanism of expanding the promulgated levels of the characteristics used to identify hazardous wastes has been determined not to be a reasonable alternative at the present time. While it is a simple matter to change the levels of the characteristics to include more wastes under the program's control, available data preclude the setting of characteristic levels (e.g., specific changes in the pH level) so as to increase the waste load

*The generator limit is the upper bound on the amount of hazardous wastes that can be produced and disposed monthly without being subject to the Subtitle C regulations.

annually by a specified amount. At the very least, such an alternative would result in difficult program management and enforcement problems.

A further approach to phasing which involves the gradual phasing in of more stringent levels for those performance standards promulgated under Section 3004 and the permit requirements promulgated under Section 3005 has also been determined not to be a reasonable alternative since no person can be reasonably expected to construct a hazardous waste facility to meet regulations that would be superseded by more stringent regulations in succeeding years.

Table 4-1 presents the specific changes to each section of the baseline Subtitle C regulations that are to be included under this alternative. All components of the baseline regulations discussed in Appendix B are assumed to be included under this alternative, except for those specific modifications that are indicated in Table 4-1. For ease in correlating the indicated modifications with the baseline regulations summarized in Appendix B, the appropriate section of Appendix B being modified is given immediately following the change presented in Table 4-1.

While this alternative emphasizes the phasing of generators to be regulated under the program, the modifications presented in Table 4-1 are not limited solely to this one change. Rather, two additional modifications have been included to assist in fulfilling the stated objectives of this phasing alternative. These additional modifications phase in the time limit that generators may accumulate hazardous

TABLE 4-1

PHASING OF GENERATORS

3001 Modifications (Subpart A)*

- No changes.

3002 Modifications (Subpart B)*

- Phase in the generator limit (250.21[6]).*
  1,075 metric tons per month during the first year;
  303 metric tons per month during the second year;
  125 metric tons per month during the third year;
  34 metric tons per month during the fourth year;
  100 kilograms per month during the fifth year.

- Phase in the 90-day exclusion for generators who temporarily accumulate hazardous wastes prior to off-site disposal (250.61[dd]).*
  - Twelve-month exclusion for the first two years, then decrease to 270 days, 180 days, and 90 days over the last three years.

3003 Modifications (Subpart C)*

- No changes.

3004 Modifications (Subpart D)*

- Phase in the time limit for reporting of unmanifested wastes delivered to permitted facilities (250.43-6(a)(4)).
  - No reporting during the first year;
  - Quarterly reporting during the second and third years;
  - Monthly reporting during the fourth year;
  - Immediate reporting during the fifth year.

3005 Modifications (Subpart E)*

- Phase in generator storage exemption as specified above under 3002 modifications (250.61[dd]).*

TABLE 4-1 (Concluded)

3006 Modifications (Subpart F)*

- No changes.

3010 Modifications (Subpart G)*

- No changes.

*Section of the baseline regulations in Appendix B that is being changed by this modification.

wastes prior to off-site disposal without being brought into the permit system and the time limit for reporting of unmanifested wastes.

Since the baseline regulations provide for the phasing of state participation into the program through both interim authorization and partial authorization, no additional modifications have been made to promote phasing of state authorized programs.

4.3 Enhanced Public Health and Environmental Protection

This alternative has been selected for the purpose of analyzing the potential change in impacts that could result from modification of the baseline Subtitle C regulations designed to further increase public health and environmental protection even above that level afforded by the baseline regulations.

The basic strategy of this alternative is to expand the definition of hazardous waste in order to bring additional wastes under control of the program; to remove exclusions provided for hazardous waste generators; to apply even more stringent design and operational requirements for storers, treaters, and disposers; to eliminate special waste standards; to reduce reporting intervals for storers, treaters, and disposers; to eliminate the use of delivery documents in lieu of manifests; and to decrease the life of permits and impose additional restrictions on obtaining permits.

Table 4-2 presents the specific changes to each section of the baseline regulations that are to be included under this alternative. As previously discussed, all components of the baseline regulations

TABLE 4-2

ENHANCED PUBLIC HEALTH AND ENVIRONMENTAL PROTECTION

3001 Modifications (Subpart A)*

- Add characteristics for identifying infectious wastes and radioactive wastes as hazardous wastes (250.13).*
  (1) A solid waste is an infectious waste if it is generated from the sources listed in Appendix B, Subpart A, 250.14(a)(2)(i), unless the waste does not contain microorganisms or helminths of CDC Classes 2 through 5 of the Etiologic Agents listed in Appendix B, Subpart A, Appendix IX.
  (2) A waste is a radioactive waste if it is not source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended, and if a representative sample of the waste has either of the properties listed in Appendix B, Subpart A, 250.14(b)(2)(F)(i and ii).

- Eliminate the toxic waste characteristic based upon the EPA Primary Drinking Water standards and replace with the following characteristic for identifying toxic wastes as hazardous (250.13[4]):*
  - A solid waste is a toxic waste if the extract obtained from applying the extraction procedure (EP) in Appendix B, Subpart A, 250.13(b)(4)(i) to a representative sample of the waste has any of the following properties:
    (1) Gives a positive response in any one of a set of required tests for a mutagenic activity, described in Appendix B, Subpart A, 250.14(b)(2)(G)(i).
    (2) Gives a positive result in the Bioaccumulation Potential Test, defined in Appendix B, Subpart A, Appendix XII.
    (3) Contains more than the specified concentration of any substance in Appendix B, Subpart A, Appendix XIII.
    (4) Exceeds any of the following thresholds, when applicable:
      (a) Has a concentration of a substance, for which an EPA Primary Drinking Water Standard has been established, greater than or equal to 10 times that criteria.
      (b) Contains any organic substance, which has a calculated human LD50 of less than 800 mg/kg, at a concentration in mg/l greater than or equal to 0.35 times its LD50 expressed in units of mg/kg.
      (c) Has a concentration of any substance listed below greater than that specified:

TABLE 4-2 (Continued)

Substance	Maximum Permissable EP Elutriate Concentration (mg/1)
Antimony	?
Beryllium	?
Copper	?
Dalapon	3.5
Dichobenil	10.
Diquat	50.
Fenac	1.0
Nickel	?
Picloram	0.1
Thallium	?
Zinc	?

3002 Modifications (Subpart B)*

- Eliminate the 100 kilograms per month generator limit (250.21[6]).*
  - Anyone, except households, generating any amount of the hazardous wastes identified under Section 3001 must comply with the Section 3002 regulations.
- Remove exclusion from Section 3002 regulations for generators engaged solely in retail trade or principally in farming (250.20[f]).*
  - Farmers and retail generators must comply with Section 3002 requirements for all hazardous wastes identified under Section 3001.
- Increase reporting frequency from annually to quarterly for all generators (250.23).*
  - All portions of the "previous" annual report are to be reported quarterly.
- Increase the reporting frequency for manifests not received by the designated facility from quarterly to monthly (250.23[a][2]).*
- Eliminate the use of a delivery document in lieu of a manifest (250.21[3]).*
  - All hazardous waste shipments must be accompanied by the manifest at all times.
- Eliminate the transfer of liability contract (250.20[i and j] and 250.29).*

TABLE 4-2 (Continued)

3003 Modifications (Subpart C)*

- Eliminate the use of a delivery document in lieu of a manifest (250.31[a]).*
  - All hazardous waste shipments must be accompanied by the manifest at all times.

3004 Modifications (Subpart D)*

- Eliminate special waste standards for cement kiln dust waste, utility wastes, phosphate rock mining and processing wastes, uranium mining wastes, and oil drilling muds/brines (250.46).*
  - These wastes, if hazardous under Section 3001, must comply with all Section 3004 standards.

- Change the application of the threshold limit value for air contaminents from non-point emission sources (250.42-3[b]).*
  (1) The threshold limit value is to be applied as a maximum concentration that is not to be exceeded at any time rather than as a time-weighted average for an 8-hour day and 40-hour week.
  (2) The threshold limit value is to be applied as a mandatory standard rather than a human health and environmental standard.

- Increase the minimum distance active portions of facilities must be located from the facility's property line from 200 feet to 400 feet (250.43-1[h]).*

- Increase the minimum distance surface impoundments, active portions of landfills, and treated areas of landfarms must be located from any functioning public or private water supply or livestock water supply from 150 meters (500 feet) to 300 meters (1000 feet) (250.45-2[a][3], 250.45-3[a][3], and 250.45-5[c][3]).*

- Increase the financial responsibility required of owner/operators of treatment, storage, or disposal facilities during site operation from a minimum of $5 million to a minimum of $10 million (250.43-2 [b]).*

TABLE 4-2 (Continued)

- Increase the time during which the owner/operator of a facility is to provide post close-out care from a period which need not exceed 20 years from closure to a period which need not exceed 40 years from closure (250.43-8[k][1]).*
    - The annual cash payment into the trust fund for post close-out monitoring and maintenance is to be adjusted based upon this 40-year period (250.43-2[a][2]).*

- Add a requirement that all inactive treatment, storage, and disposal facilities must comply with the Section 3004 regulations.†

- Add a requirement that all wastes be treated using the best practical technology (BPT) to reduce their waste solubility and overall toxicity before disposal.†

- For all landfills and surface impoundments, increase the required permeability of the soil liner and of the final cover from less than or equal to 1 x 10-7 cm/sec. to less than or equal to 1 x 10-8 cm/sec. (250.45-2[b][10], 250.45-2[b][12][ii], 250.45-2[b][12][v], 250.45-2[c][1], 250.45-3[c][2], and 250.45-3[c][9]).*

- Add the requirement that any landfarm that has the potential to discharge to groundwater must be monitored so as to detect any discharge (250.43-9).*
    - Such landfarms must comply with the groundwater and leachate monitoring standards.

- Reduce the maximum vapor pressure of wastes that may be treated, stored, or disposed as indicated below from 78 mm of Hg at 25 C (250.44-1[a][1], 250.45-2[b][5][iii], 250.45-3[b][1][v], 250.45-4[2][e], and 250.45-5[i][ii]).*
    - Wastes with a vapor pressure greater than 53 mm of Hg at 25 C may not be disposed in landfills, placed in surface impoundments or basins, landfarmed, nor put in storage tanks vented directly to the atmosphere.

- Increase reporting frequency for report based on manifest information from annually to quarterly (250.43-6[a][3]).*

- Add a requirement that for those hazardous wastes determined by the permitting agency to have a recovery potential within the reasonable forseeable future, any land disposal must be in a segregated manner.†

TABLE 4-2 (Continued)

3005 Modifications (Subpart E)*

- Reduce the duration of permits from the projected life of the facility to a period no longer than 5 years (250.62-5).*
  - Permits may be renewed for the maximum time period (5 years) an unlimited number of times.

- Eliminate special permits for experimental facilities, qualified hospital-medical care facilities, ocean dumping barges or vessels, and publicly owned treatment works (POTW) (250.62-6, 250.62-7, 250.62-8, and 250.62-9).*
  - All these facilities must submit both Part A and B of the permit application and a supplementary environmental analysis described below (250.62-6[b], 250.62-7[b], 250.62-8[b], and 250.62-9[b]).*
  - Experimental facilities and qualified hospital-medical care facilities must comply with all Section 3004 requirements (250.62-6[b] and 250.62-6[a][3]).*
  - POTW's and ocean dumping barges or vessels must comply with Section 3004 requirements applicable to storage of hazardous wastes (250.62-8[b] and 250.62-9[b]).*

- Owners/operators of facilities for the treatment, storage, or disposal of special wastes (e.g., cement kiln dust wastes) must apply for Section 3005 permits and comply with all Section 3005 permit application requirements.†

- All permit applicants must submit a Supplementary Environmental Analysis of the facility and its potential impacts. The Supplementary Environmental Analysis is to contain:†
  (1) An analysis of the impact of and methods proposed to comply with the following Federal statutes and published regulations where applicable: The Endangered Species Act; The National Historic Preservation Act; The Historic Sites, Buildings and Antiquities Act; The Fish and Wildlife Coordination Act; and The Coastal Zone Management Act.
  (2) A discussion of whether alternative methods for treatment, recovery, or recycling of wastes to be stored, treated, or disposed were considered, or whether the wastes will be treated prior to storage or disposal.
  (3) A description of how hazardous wastes will be transported to the facility, including a listing of the access routes.
  (4) The proximity of the site to population centers and size of the population centers.

TABLE 4-2 (Concluded)

(5) A description of any easements, pipelines, utilities, public roads, or rights-of-way located within the boundaries of the facility.
(6) A description of applicable local and state zoning or land use laws in effect.
(7) A description of adjacent land uses within one mile of the facility.
(8) A description of the methods proposed to minimize and control impacts of dust, odors, and noise associated with construction and operation of the facility.
(9) A listing of applications submitted or permits obtained under local state, or Federal acts involving toxic or hazardous wastes.

<u>3006 Modifications (Subpart F)*</u>

- No changes.

<u>3010 Modifications (Subpart G)*</u>

- Eliminate the exclusion for owners of inactive hazardous waste treatment, storage, and disposal facilities.†
    - The owner of inactive facilities must file a notification.

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*Section of the baseline regulations in Appendix B that is being changed by this modification.
†No equivalent regulation appears in the baseline regulations in Appendix B.

discussed in Appendix B are assumed to be included under this alternative, except for those specific modifications indicated in Table 4-2.

Under this alternative, the definition of hazardous wastes in Section 3001 has been expanded by adding characteristics for defining infectious wastes and radioactive wastes as hazardous. The characteristic for identifying toxic wastes has also been expanded to bring additional wastes under control of the regulations.

The exclusion from the Section 3002 regulations for generators who produce less than 100 kilograms per month of hazardous wastes has been eliminated. The exclusion for those generators engaged solely in retail trade or principally in farming for all hazardous wastes produced, except waste automotive oil, has also been eliminated. All hazardous wastes produced by such generators are to be managed in accordance with the Subtitle C regulations. The transfer of liability contract for waste automotive oil has been eliminated.

The use of delivery documents in lieu of manifests for hazardous waste transport has been eliminated. The reporting frequency for the generator report on manifests not received by the designated facility has been increased from quarterly to monthly. Other reporting frequencies for generators, storers, treaters, and disposers have been increased from annually to quarterly. A requirement has been added that owners of inactive treatment, storage, or disposal facilities comply with all Section 3004 regulations.

Special standards for 'special wastes' (i.e., cement kiln dust wastes, utility wastes, phosphate rock mining and processing wastes, uranium mining wastes, and oil drilling muds/brines) have been eliminated; such 'special wastes' must comply with all Section 3004 standards. Design and operating standards for facility location, non-point source air emission concentrations, post close-out care, soil liner permeabilities, groundwater monitoring, financial responsibilities, management of volatile wastes, and treatment and segregation of wastes before disposal have been made more stringent.

The duration of the permit life has been reduced from the projected life of a facility to a period not to exceed 5 years; permits may be renewed an unlimited number of times. Special permits for experimental facilities, qualified hospital-medical care facilities, ocean dumping barges or vessels, and publicly owned treatment works (POTW's) have been eliminated; the former two have to comply with all Section 3004 requirements, the latter two have to comply with Section 3004 storage requirements. A requirement has been added that all permit applicants submit a Supplementary Environmental Analysis.

4.4 Lesser Degree of Public Health and Environmental Protection

This alternative has been selected for the purpose of analyzing the potential change in impacts that could result from modifications to the baseline Subtitle C regulations designed to provide a lesser degree of public health and environmental protection than that afforded by the baseline regulations.

The basic strategy of this alternative is to contract the definition of hazardous wastes in order to bring fewer wastes under the control of the program; to increase exclusions provided for hazardous waste generators; to reduce manifest requirements; to apply less stringent design and operational requirements for storers, treaters, and disposers; to eliminate regulation of special wastes; to decrease recordkeeping times for generators, transporters, storers, treaters, and disposers; to increase the length of permit exclusions for generators who store prior to off-site disposal; to eliminate restrictions on interim authorization; and to ease restrictions on full and partial authorization.

Table 4-3 presents the specific changes to each section of the baseline regulations that are to be included under this alternative. As previously discussed, all components of the baseline regulations discussed in Appendix B are assumed to be included under this alternative, except for those specific modifications indicated in Table 4-3.

Under this alternative, the definition of hazardous wastes in Section 3001 has been modified to include fewer wastes by eliminating the characteristic for toxic wastes; listed wastes whose listing is based solely on the toxicity characteristic (including those listed based on the criterion of Administrator's Judgment) have also been removed from the Section 3001 lists. Special wastes (e.g., cement kiln dust wastes and utility wastes) have been specifically excluded from being identified as hazardous wastes under Section 3001.

TABLE 4-3

LESSER DEGREE OF PUBLIC HEALTH AND ENVIRONMENTAL PROTECTION

3001 Modifications (Subpart A)*

- Eliminate the characteristic for toxic wastes (250.13[4]).*
    - Eliminate the listed wastes whose listing is based solely on the toxicity characteristic or on the Administrator's judgment (250.14).*

- Exclude the following wastes from being identified as hazardous wastes under Section 3001: cement kiln dust wastes, utility wastes, phosphate rock mining and processing wastes, uranium mining wastes, and oil drilling muds/brines (250.14[a][2][ii]).*,†

3002 Modifications (Subpart B)*

- Increase the generator limit from 100 kilograms per month to 1000 kilograms per month (250.21[6]).*

- Increase the length of the permit exclusion for generators who temporarily accumulate hazardous waste prior to off-site disposal from 90 days to 1 year (250.61[dd]).*

- For off-site shipments of hazardous wastes by generators, replace the Section 3002 manifest requirements with a new manifest requirement that all such shipments (interstate and intrastate) must be accompanied by shipping paper/bill of lading which designates delivery to a permitted storage, treatment, or disposal facility and which meets the requirements of the DOT Hazardous Materials Regulations (250.21[3] and 250.22).*
    - For example, spill information need not be provided on the shipping paper/bill of lading, and the shipping paper/bill of lading need only be signed as required under the DOT Hazardous Materials Regulations (i.e., must be signed only by the generator shipping the wastes).

- Replace requirement for recordkeeping of manifest copy with a requirement for recordkeeping of shipping paper/bill of lading (250.24).*
    - Decrease recordkeeping time for shipping paper/bill of lading used in place of manifest from 3 years to 1 year.

TABLE 4-3 (Continued)

- Eliminate the reporting of shipping paper/bill of lading not received at designated facility (250.23[a][2]).*

<u>3003 Modifications (Subpart C)*</u>

- Replace the Section 3002 manifest requirements with a new manifest requirement that all shipments (interstate and intrastate) must be accompanied by shipping paper/bill of lading which designates delivery to a permitted storage, treatment, or disposal facility and which meets the requirements of the DOT Hazardous Materials Regulations (250.21[3] and 250.22).*
    - Eliminate need for signatures on shipping paper/bill of lading, except as required under the DOT Hazardous Materials Regulations (i.e., must be signed only by the generator shipping the wastes).

- Replace requirement for recordkeeping of manifest with a requirement for recordkeeping of shipping paper/bill of lading (250.33).*
    - Decrease recordkeeping time for shipping paper/bill of lading from 3 years to 1 year, except where DOT Hazardous Materials Regulations specify retention times longer than 1 year.

- Eliminate special emergency spill regulations (250.37).*
    - Eliminate requirements for the transporter to notify appropriate officials in the case of a spill and to file a report on the spill.
    - Eliminate requirement for transporter to clean up spill or to take other action required to insure the spill no longer presents a hazard to human health or the environment.

- Eliminate requirement that if a transporter consolidates shipments of hazardous wastes that do not require a manifest, the entire shipment must be delivered to a permitted facility (250.30[a]).*

<u>3004 Modifications (Subpart D)*</u>

- Eliminate special waste standards for cement kiln dust wastes, utility wastes, phosphate rock mining and processing wastes, uranium mining wastes, and oil drilling muds/brines (250.46).*
    - Exclude these wastes from compliance with Section 3004 regulations.

TABLE 4-3 (Continued)

- Change the application of the threshold limit value for air contaminants from non-point emission sources (250.42-3[b]).*
  - The threshold limit value is to be applied as time-weighted average for a 24-hour day rather than as a time-weighted average for an 8-hour day and 40-hour week.

- Decrease the minimum distance active portions of facilities must be located from the facility's property line from 200 feet to 100 feet (250.43-1[h]).*

- Decrease the minimum distance surface impoundments, active portions of landfills, and treated areas of landfarms must be located from any functioning public or private water supply or livestock water supply from 150 meters (500 feet) to 75 meters (250 feet) (250.45-2[a][3], 250.45-3[a][3], and 250.45-5[c][3]).*

- Decrease the financial responsibility required of owners/operators of treatment, storage, or disposal facilities during site operation from a minimum of $5 million to a minimum of $2 million (250.43-2[b]).*

- Decrease the time during which the owner/operator of a facility is to provide post close-out care from a period which need not exceed 20 years from closure to a period which need not exceed 10 years from closure (250.43-8[k][1]).*
  - The annual cash payment into the trust fund for post close-out monitoring and maintenance is to be adjusted based upon this 10-year period (250.43-2[a][2]).*

- For incineration, reduce the required destruction efficiency of the principal components of the waste from 99.99% to 99.9%, the combustion efficiency from 99.9% to 99%, and halogen removal from exhaust gases from 99% to 90% (250.45-1[b], 250.45-1 [d], and 250.45-1[h]).*

- For all landfills and surface impoundments, decrease the required permeability of the soil liner and of the final cover from less than or equal to 1 x 10-7 cm/sec. to less than or equal to 1 x 10-6 cm/sec. (250.45-2[b][10], 250.45-2[b][12][ii], 250.45-2[b][12][v], 250.45-2[c][1], 250.45-3[c][2], and 250.45-3[c][9]).*

- Limit to groundwaters that are underground drinking water sources the requirement that all facilities, except landfarms, that have the potential to discharge to groundwater must be monitored to detect any discharge (250.43-9).*

TABLE 4-3 (Continued)

  - There does not have to be monitoring of potential discharge to groundwaters which are non-underground drinking water sources.

- For those facilities for which there is to be groundwater and leachate monitoring, eliminate the quarterly monitoring and minimum analysis of samples from both the leachate detection system and the groundwater (250.43-9[b][4] and 250.43-9[b][5]).*
  - Eliminate the quarterly reporting of this monitoring data (250.43-9[d][1]).*
  - Retain annual monitoring and comprehensive analysis (250.43-9[c][4] and 250.43-9[c][5]).*

- Eliminate the restriction on the maximum vapor pressure of wastes that may be treated, disposed, or stored as indicated below (250.44-1[a][1], 250.45-2[b][5][iii], 250.45-3[b][1][v], 250.45-4[2][e], and 250.45-5[1][ii]).*
  - Wastes with a vapor pressure greater than 78 mm of Hg at 25 C may be disposed in landfills, placed in surface impoundments or basins, landfarmed, or put in storage tanks vented directly to the atmosphere.

- Increase the time interval for completing training of personnel from 6 months to 1 year (250.43-5[a]).*

- Eliminate the regulation of commercial products made from hazardous wastes (250.45-7).*
  - Such commercial products are not to be considered hazardous wastes.

- Replace requirements for recordkeeping of manifest copy with a requirement for recordkeeping of shipping paper/bill of lading (250.43-6[a][2].*
  - Decrease recordkeeping time for shipping paper/bill of lading used in lieu of manifest from 3 years to 1 year (250.43-6[a][2]).*

- Eliminate need for signatures on shipping paper/bill of lading, except as required under the DOT Hazardous Materials Regulations (250.43-6[a][1][a]).*

TABLE 4-3 (Concluded)

3005 Modifications (Subpart E)*

- Increase the length of the permit exclusion for generators who temporarily store hazardous wastes prior to off-site disposal from 90 days to 1 year (250.61[dd]).*

- Eliminate the need for publicly owned treatment facilities, qualified hospital-medical care facilities, and ocean dumping barges or vessels to apply for a special permit (250.62-7[b], 250.62-8[b], and 250.62-9[b]).*
  - Such facilities are automatically granted the special permits.

3006 Modifications (Subpart F)*

- Eliminate restrictions on granting of full or partial authorization to states with more stringent standards (250.72[a][ii] and 250.72[b][1]).*

- Eliminate all restrictions on granting of interim authorization, except for the Memorandum of Understanding (250.73).*
  - All states desiring interim authorization are to be granted it, providing that they have a Memorandum of Understanding

3010 Modifications (Subpart G)*

- Retail generators need not notify (250.820[a]).*

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*Section of the baseline regulations in Appendix B that is being changed by this modification.

†No equivalent regulation appears in the baseline regulations in Appendix B.

The exclusion from the Section 3002 regulations for generators who produce less than 100 kilograms per month of hazardous wastes has been replaced by an exclusion for all generators who produce less than 1000 kilograms per month. The 90-day permit exclusion for temporary waste accumulation by generators prior to off-site disposal has been increased to a one-year exclusion. Retail generators have been excluded from notification required under Section 3010.

For off-site shipments of hazardous wastes by generators, the Section 3002 manifest requirements are replaced by a requirement that all such shipments (interstate and intrastate) must be accompanied by a shipping paper/bill of lading which designates delivery to a permitted storage, treatment, or disposal facility and which meets the requirements of the DOT Hazardous Materials Regulations.* For example the spill information required by the manifest is not required for the shipping paper/bill of lading, and the signature requirements of the manifest are replaced by signature requirements under the DOT Hazardous Materials Regulations (i.e., only the generator shipping the wastes needs to sign the shipping paper/bill of lading).

The reporting of shipping papers/bills of lading not received at the designated facility is eliminated. Recordkeeping requirements for shipping papers/bills of lading are reduced from 3 years to 1 year for

*The DOT Hazardous Materials Regulations are to be applied to both interstate and intrastate shipments of hazardous wastes.

generators, transporters, storers, treaters, and disposers. The special emergency spill regulations for transporters have been eliminated.

Regulation of 'special wastes' under Section 3004 has been eliminated. Design and operating standards for facility location, nonpoint source air emission concentrations, incineration, post close-out care, soil liner permeabilities, groundwater monitoring, financial responsibilities, management of volatile wastes, training of personnel, and commercial products have been made less stringent.

Permit requirements for POTW's, qualified hospital-medical care facilities, and ocean dumping barges or vessels have been eliminated. Such facilities would be granted permits by rule and would not have to comply with any Section 3004 requirements.

All restrictions on the granting of interim authorization, except the Memorandum of Understanding, have been eliminated. Any state desiring interim authorization would be granted such status, providing the state submits a Memorandum of Understanding that specifies how the state plans to become eligible to attain full authorization at the end of the interim authorization period. States may also impose considerably more stringent standards than those promulgated under Sections 3001 through 3005 and still be authorized for full or partial authorization, even if there is no public health and/or environmental protection basis for the more stringent standards.

4.5 Phase I Alternative

The Phase I Alternative contains the set of non-technical modifications that are being considered for inclusion in the final Phase I Subtitle C regulations, based both upon recent studies conducted by EPA and upon public comments received by EPA subsequent to the proposal of Subtitle C regulations in December 1978. The Phase I Alternative has been included for the purpose of analyzing the potential change in impacts that could result from modifications to the baseline Subtitle C regulations which incorporate this specific set of non-technical changes.

The regulations comprising Sections 3001 through 3004 of the Phase I Alternative are presented in Appendix N. The regulations comprising Sections 3005 and 3006 are contained in the Proposed Consolidated Permit Regulations published in the Federal Register, Vol. 44, No. 116, Parts II and III, June 14, 1979.

Table 4-4 summarizes the specific changes to each section of the baseline regulations that are included in this alternative. As previously discussed, all components of the baseline regulations discussed in Appendix B are assumed to be included under this Phase I Alternative, except for those specific modifications indicated in Table 4-4. Thus, all the Section 3004 technical standards of the baseline regulations (e.g., landfill standards) are assumed to be included under this alternative.*

*Modifications to the Section 3004 technical standards are to be assessed as an additional alternative in Part II of the EIS.

TABLE 4-4

PHASE I ALTERNATIVE

3001 Modifications (Subpart A)*

- Modify the definition of materials that are to be considered solid waste subject to the requirements of Section 3001 (such solid waste may be identified as hazardous waste under Section 3001) (250.11[d and g]).*
  (1) Clarify the definition of those discarded (and not used or re-used) materials that are to be considered solid waste (261.2[a][2]).†
  (2) Add requirement for listing as solid wastes specific materials that are used or re-used or that are being stored for use or re-use (261.2[a][3] and 261.2[b]).†
    (a) Place waste oil on this list (261.2[a][3][i])† and delete those specific used oils listed in 250.11(d)(2)(ii).*
    (b) Listing of other materials is reserved (261.2[a][3][ii]).†
  (3) Add requirement for listing as solid wastes specific materials that are used or re-used or processed for material or energy recovery, or stored for such purposes (261.2[a][4] and 261.2[b]).†
    (a) Delete those specific used oils listed in 250.11[d][2][ii]).*
    (b) Listing of materials is reserved (261.2[a][4][i]).†
  (4) Clarify two additional wastes specifically excluded from being identified as solid waste (250.10[c]).*
    (a) Point source air emissions that are subject to regulation under the Clean Air Act, as amended (261.4[a][5]).†
    (b) Dredge spoils that are disposed of in navigable waters, including wetlands, and that are subject to regulation under Section 404 of the Clean Water Act, as amended (261.4[a][7]).†

- Exclude the following solid wastes from regulation as hazardous wastes and from notification under Section 3010 (250.10[d]).*
  (1) Material that is used, re-used, or processed for energy recovery or is stored for such purposes and that is not listed in 261.2(a)(4).†
  (2) Material that is not listed in 261.2[a][3]† and that is used or re-used in a manner constituting disposal or that is being stored for such purposes.
  (3) In-situ mining wastes, including in-situ wastes from certain oil shale, uranium, and other extraction processes which extract minerals, fuels, or other materials from geological formations without removing the waste material from the formation (261.4[b][5]).†

TABLE 4-4 (Continued)

(4) Fly ash, bottom ash, or boiler slag that is both (i) generated by a utility or industrial boiler, process steam generator, or coal gasification or liquefaction unit from the sole use of fossil fuels or from the use of certain fuels in combination with fossil fuels, including refuse-derived fuels from municipal solid waste or any alternative fuel which is not a hazardous waste and (ii) used in the construction of roads, as a de-icing agent on roads, or as a soil conditioner (261.4[b][6]).†

(5) Cement kiln dust waste used in the construction of roads or for soil conditioning, including agricultural liming (261.4[b][7]).†

(6) Blast furnace slag used in the construction or maintenance of railroad beds or roads (261.4[b][8]).†

- Eliminate the 100 kilogram generator limit (250.21[6])* and replace it with the following:

(1) Except for those hazardous waste identified in subparagraphs (a) through (d) below, none of the hazardous wastes generated by a commercial establishment or the part(s) of commercial establishments that is exclusively engaged in the retailing of merchandise or an individual facility that generates and dispose of no more than 1000 kilograms (2200 pounds) of hazardous waste in any 30-day period is subject to regulation as hazardous waste (261.4[c]):†

(a) Any quantity of those hazardous wastes listed under 261.33 (a or b).†

(b) Any quantity greater than 10 kilograms (22 pounds) of those hazardous wastes listed under 261.33(c).†

(c) Any quantity greater than 100 kilograms (220 pounds) of those hazardous wastes listed under 261.33(d).†

(d) Any quantity of a hazardous waste listed in 261.31† or 261.32,† for which an exclusion limit is specified, that is generated and disposed of in an amount that exceeds the specified exclusion limit.

Comment: Exclusive of the exceptions in subparagraphs (a) through (d), paragraph (1) does not specifically exclude small quantities of hazardous wastes: it only excludes hazardous wastes from retailers and generators of small quantities (less than 1000 kilograms per 30-day period) of hazardous waste. If a non-retail, individual facility generates a quantity of hazardous waste that exceeds 1,000 kilograms in any 30-day period, all quantities of hazardous wastes, including any and all quantities of individual hazardous waste(s) generated in amounts less than 1,000 kilograms per 30-day period, are subject to regulation as hazardous waste.)

(2) The Administrator will revise the exclusion of paragraph (1) to reduce the 1000 kilograms for a 30-day period to 100 kilograms (220 pounds) for a 30-day period. This revision will be made through rulemaking initiated not before two years nor after five years after original promulgation of Section 3001. The Administrator may make this reduction in steps during the three-year period (261.4[d]).†

- Modify the pH limits for identifying an aqueous waste as a corrosive waste (250.13[a][2]).*
  - Change the pH limits to ≤2 or ≥12.5 instead of ≤3 or ≥12 (261.21[a][1]).†

- Modify the characteristic for identifying toxic waste (250.13[a][4]).*
  (1) A solid waste possessing the characteristic is defined as a Type I toxic waste (261.23[a])†, rather than as a toxic waste (250.13[a][4]).*
  (2) Raise the concentration of contaminants in the extract used to identify a Type I toxic waste (250.13[a][4][i]).*
    - Increase the contaminant concentration in the extract from 10 times the EPA Primary Drinking Water Standards to 100 times that Standard (261.23[Table I]).†

- Eliminate the criterion of Administrator's Judgment for listing hazardous waste (250.14[a])* and replace it with the following criteria (261.11):†
  (1) The Administrator will list a solid waste (or classes or types of solid wastes) as a hazardous waste if, after considering the criteria delineated in 261.11(g thru j)†, he determines that the solid waste, if improperly treated, stored, transported, disposed of, or otherwise managed, may:

TABLE 4-4 (Continued)

(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.

(2) In listing a hazardous waste or class or type of hazardous waste, the Administrator will designate the waste as one or a combination of the following (261.11[g thru j]† delineate the criteria for each category):
(a) Type II Toxic Waste.
(b) Type III Toxic Waste.
(c) Radioactive Waste.
(d) Infectious Waste.

- Modify the list of hazardous wastes from non-specific sources (250.14[a][1]).*
  - See 261.31† and 261.33† for new lists. The listing of wastes under 261.33 is reserved.

- Modify the list of specific sources generating hazardous waste (250.14[a][2][ii]).*
  - See 261.32† for new list.

- Modify the list of infectious wastes (250.14[a][2][i]).*
  (1) For hospital, veterinary hospitals, and medical and research laboratories, eliminate the listing of all wastes generated by specified departments and replace with a more specific listing of wastes (See 261.34† for new list).
  (2) Delete listing of unstabilized sludge from non-publicly owned treatment works.

- Modify the methods used to demonstrate that a listed wastes generated by an individual facility is not a hazardous waste (250.14[b]).*
  - See 261.39† for revised methods.

- Delineate the procedure to be used for petitions both for identifying characteristics of hazardous waste or for listing of hazardous waste (250.12[b][2])*, (261.40).†

TABLE 4-4 (Continued)

3002 Modifications (Subpart B)*

- Modify exclusion from Section 3002 regulations for generators engaged solely in retail trade (250.20[f]).*
  (1) Eliminate exclusion that retailers must comply with all Section 3002 requirements only with regard to the generation of waste automotive oil (250.20[f]).*
  (2) Add a requirement that commercial establishments or the part(s) of commercial establishments exclusively engaged in the retailing of merchandise must comply with Section 3002 requirements only for those wastes specified in 261.4(c).†

- Modify exclusion from Section 3002 regulations for generators engaged principally in farming (250.20[f]).*
  (1) Eliminate exclusion that farmers must comply with all Section 3002 requirements only with regard to the generation of waste automotive oil (250.20[f]).*
  (2) Add a requirement that a farmer who disposes only waste pesticide from his own use is not subject to Subtitle C requirements for the waste pesticide, if it is hazardous, providing the farmer complies with the requirements of 262.51(a).†
  (3) Add a requirement that a farmer who generates hazardous waste other than waste pesticide in a quantity in excess of that specified in 261.4(c)† must comply with all Section 3002 requirements for that waste (262.51[b]).†

- Add a requirement that any person who imports hazardous waste into the jurisdiction of the U.S. must comply with all Section 3002 requirements (262.10[c] and 262.50[a and d]).†,‡

- Revise the generator limit of 100 kilograms per month (250.21[6])* to the generator limit specified in 261.4(c and d).†

- Limit the number of permitted facilities to which the generator may designate transport of the waste (250.22[a][4]).*
  (1) Add a requirement that the generator must designate on the manifest one facility which is permitted to handle the waste described on that manifest (262.20[b]).†
  (2) Add a requirement that the generator may designate on the manifest one alternative facility which is permitted to handle the waste in the event an emergency prevents delivery to the primary designated facility (262.20[c]).†

- Revise information required on manifest (250.22[a])*:
  (1) Eliminate spill response information.

TABLE 4-4 (Continued)

(2) Eliminate use of EPA shipping description and hazard class when the DOT shipping description and hazard class are not applicable (262.21[a][5]).†

(3) Add a requirement for specifying number and type of containers (262.21[a][6]).†,‡

- Eliminate reporting and recordkeeping exclusion for generators that designate hazardous waste for off-site treatment, storage, or disposal at a facility which the generator owns and which is located in the same state in which the hazardous waste generation occurs (250.20[d]).*
  - Such generators need to prepare annual reports (262.41[a])† and exception reports (262.42)† and to retain copies of manifests for three years (262.40[a]).†

- Add two additional recordkeeping requirements (250.24).*

  (1) A copy of each annual report and exception report must be retained for a period of three years (262.40[b]).†

  (2) Records of any test results, waste analyses, or other determinations made in accordance with 262.11† must be retained for not less than three years from the date that the waste was last sent on-site or off-site for treatment, storage, or disposal (262.40[c]).†

- Except for international shipments, increase the reporting frequency for manifests not recieved from the designated permitted facility from quarterly to 45 days from date of acceptance by the initial transporter (250.23[a][2])* , (262.42[b]).†
  - Add a requirement that generators who do not receive a signed copy of the manifest from the designated permitted facility within 35 days of acceptance by the initial transporter shall contact the transporter and/or designated facility to determine status of movement (262.42[a]).†

- For international shipments eliminate quarterly reporting of all shipments (250.23[a][2] and 250.23[f][2])* and add manifesting and reporting requirements specified in 262.50(a,b, and c).†

- Add an additional requirement with regard to generators accumulating hazardous waste on-site for less than 90 days without a permit (250.25)*.
  - The date upon which the period of accumulation begins is to be clearly marked and visible on each container (262.34[a][3].†

TABLE 4-4 (Continued)

- Add a requirement that the Administrator may, as he deems necessary, require generators to furnish additional reports (262.43).†,‡

3003 Modifications (Subpart C)*

- Add one additional way in which a transporter is required to comply with the Section 3002 generator requirements (250.36[c])*:
  - The transporter imports a hazardous waste into the United States (263.10[c]).†

- Eliminate the prohibition against transporters accepting containers that are leaking or that appear to be damaged (250.34[e]).*

- Add a requirement that the transporter must deliver the entire quantity of hazardous waste in accordance with 263.21(a) ; if the movement cannot be delivered in accordance with that requirement, the transporter must contact the generator for further directions and must revise the manifest according to the generators instructions (263.21[b]).†,‡

- Remove the exemption that allows non-bulk water transporters not to obtain a signature (on the manifest or shipping papers) for intramodal transfers of hazardous waste movements (250.35[b])*
  - Non-bulk water transporters must obtain signatures at each intramodal transfer (263.21[d][3]).†

- Eliminate the requirement allowing a transporter up to five working days after delivery of the hazardous waste to obtain the signature of the authorized agent of the designated permitted facility (250.35[d][2]).*
  - The transporter must obtain the signature upon delivery of the waste (the transporter is responsible for the waste until the signature is obtained) (263.21[c][3][i] and 263.21[d][4][i]).†

- Add a requirement that transporters who transport movements out of the United States must comply with the requirements of 263.21(e)†,‡ and 263.22(c).†,‡

TABLE 4-4 (Continued)

- Revise the start date of the three year period for retaining the manifest or shipping paper to the date of initial acceptance by a transporter (263.22)† instead of the date of transfer to another transporter or the date of delivery to the designeated permitted facility (250.33).*

- Replace the term hazardous waste spill (250.37)* with the term hazardous waste discharge (263.30).†
  (1) Replace the requirement that all transporters must immediately notify either the National Response Center or designated government official of any discharge of hazardous waste (250.37[b])* with a requirement that air, rail, highway, and water (non-bulk shipment) transporters must give notice as may be required by 49 CFR 171.15 and that water (bulk shipment) transporters must give notice as may be required by 33 CFR 153.203 (263.30[c][1] and 262.30[d]).†
  (2) Replace the requirement that all transporters must file a written report on each discharge within 15 days (250.37[b][3])* with a requirement that air, rail, highway, and water (non-bulk shipment) transporters must report in writing as required by 49 CFR 171.16 (263.30[c][2]).†

<u>3004 Modifications (Subpart D)*</u>

- Add a requirement that where portions of a facility at which waste management activities took place before the effective date of the Section 3004 regulations could potentially interfere with the monitoring and/or control of an active portion, the owner/operator may be required to comply with one or more of the requirements specified in 264.1[e]† for those portions.‡

- Eliminate special wastes and the special standards for the special wastes (250.40[c] and 250.46).*
  (1) Add the discriminate standards specified in Part 266† for uranium mining and phosphate rock mining, beneficiation, and processing waste.
  (2) All other special wastes must comply with all Section 3004 requirements.

- Eliminate all Human Health and Environmental Standards and all requirements to comply with such standards (250.42, 250.40[e], 250.43[a], 250.43[c], 250.43[d], 250.43[e], 250.44[d], 250.45-6[a], 250.45-4[1], 250.45-3[3], 250.45-3[c][1], 250.45-3[c][8], 250.45-3[d][1], 250.45-5[a][1][ii], 250.45-5[c][4], 250.45-2[a][3], 250.45-2[b][8,9, and 11].*

TABLE 4-4 (Continued)

- Revise the General Facility Standards (250.43)* as follows:
  (1) Add a requirement that an owner/operator of a facility that has arranged to receive hazardous waste from foreign sources must notify the Regional Administrator at least two weeks in advance of the expected arrival date of the shipment (264.12[a]).†,‡
  (2) Add a requirement that an owner/operator of a facility that receives hazardous waste from off-site (except when the owner/operator is also the generator) must inform the generator in writing that he has the appropriate permit(s) for and will accept the waste; such notice must be retained by the owner/operator (264.12[b]).†,‡
  (3) Add a requirement that before transferring ownership or operation of a facility during its operating life, or a disposal facility during the post-closure care period, the owner/operator must notify the new owner/operator in writing of the Section 3004 requirement (264 12[c]).†,‡
  (4) Add a requirement for the development of a waste analysis plan which provides for periodic analysis of the waste managed at the facility (250.43[h])*, (264.13[a][3] and 264.13[b]).†
  (5) Exempt on-site facilities from the requirement that each waste shipment be tested to determine whether the shipment matches the identity of the waste designated on the accompanying manifest (250.43[i])*, (264.13[a][4] and 264.13[c]).†

- Replace the requirements that the active portion of a facility must be surrounded by a fence or barrier (250.43-3[a])* and that the ingress to the facility must be controlled (250.43-3[b])* with the requirements specified in 264.14(b).†

- Revise the Inspection Standards as follows:
  (1) Eliminate the requirement for daily inspections of the items specified in 250.43-7(a).*
  (2) Add a requirement for facility owners/operators to develop and implement a schedule for inspection of monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment that are important to the prevention and detection of, or response to, environmental or human health hazards (264.15[a and b]).†,‡
  (3) Add a requirement that repairs or other remedial action be performed as specified in 264.15(c).†

TABLE 4-4 (Continued)

- Revise the Emergency Procedures and Contigency Plans Standards as follows:
  (1) Add a requirement that facilities must be designed, constructed, maintained, and operated so that the possibility of a discharge, fire, or explosion which could threaten the environment outside the facility is minimized (264.31).†,‡
  (2) Add a requirement that the contigency plan shall include provisions for unplanned non-sudden discharges of hazardous waste (250.43-4[a][1])*, (264.51[a]).†
  (3) Limit implementation of the contigency plan to those discharges which threaten the environment or human health outside the facility (250.43[a][1])*, (264.51[b]).†
  (4) Add a requirement that the contingency plan must include provisions for controlling spills (250.434[a]),* (264.52[a]).†
  (5) Eliminate the requirement that the contingency plan must include an outline of a program for familiarizing employees with emergency procedures and for drills on these procedures (250.43-4[a][8]).*
  (6) Add a requirement that the contigency plan must be maintained at the facility (264.53[a]).†,‡
  (7) Add a requirement for revision of contingency plan under the conditions specified in 264.54.†,‡
  (8) Add a requirement allowing the emergency coordinator to be on-call rather than present at the facility (250.43-44[a][4])*, (264.55).†
  (9) Change the requirement that recovered waste, contaminated soil, or contaminated material shall be analyzed to determine whether it is a hazardous waste (250.43-4[c][9])* to a requirement that these materials must be handled as a hazardous waste unless analyzed and determined not to be (264.56[g]).†
  (10) Increase the time for filing written report on emergencies from immediately after the incident (250.43-6[c][1])* to within 15 days of the incident (264.56[j]).†
  (11) Require that the additional information specified in 264.56[j][1,2,4,5,6, and 7]† be included in the emergency report (250.43-4[c][9]).*
  (12) Add a requirement that the facility owner/operator must notify the Regional Administrator, and appropriate State and local authorities, that the facility is in compliance with the requirements of 264.56(h)† before operations are resumed in the affected areas(s) of the facility (264.56[i]).†

- Revise Manifest System, Recordkeeping, and Reporting Standards as follows:

TABLE 4-4 (Continued)

(1) Add a definition of what constitutes a significant discrepancy between the manifest and the waste shipment (250.43-6[c])*, (264.72[a]).†
(2) Increase from immediately (250.43-6[a][1])* to 15 days (264.72[b])† the time limit for notifying the Regional Administrator when significant discrepancies are discovered between the manifest and the waste shipment; the owner/operator must attempt to reconcile the discrepancy during this 15 day period.
(3) Increase from immediately (250.43-6[a][4])* to 15 days (264.76)† the time limit for notifying the Regional Administrator when a facility accepts waste without an accompanying manifest.
(4) Decrease the time for retaining records and results of inspections from the time of facility closure (250.43-6[b][2][f])* to a period of three years (264.73[b][5]).
(5) Increase the time for retaining training records that document the training completed by facility employees from 3 years (250.43-6[b][2][a][5])* to the time of facility closure for current employees and to three years from the time of departure for former employees (264.16[e]).
(6) Add a requirement that records of waste disposal locations must also be turned over to the local land authority upon closure of the facility (250.43-6[b][3])*, (264.74).†
(7) Add a requirement that the annual report submitted by both on-site (250.23[e])* and off-site (250.43-6[a][3][c])* facilities also include the methods of treating, storing, or disposing each hazardous waste (264.75[e]).†
(8) Add a requirement that the Regional Administators may, as he deems necessary, require owners/operators to furnish additional reports (264.77[d]).†,‡

- Revise Groundwater and Leachate Monitoring Standards as follows:
  (1) Add land treatment facilities to and delete incinerators from those facilities that may be required to install, maintain, and operate a groundwater monitoring system (250.43-9)*, (264.90[a and b]).†
  (2) Revise the criteria for implementing groundwater monitoring from a potential for discharge to groundwater (250.43-9)* to that specified in 264.90[a and b].†
  (3) Delete all leachate monitoring requirements (250.43-9[b and c]).*
  (4) Increase the number of monitoring wells from four (250.43-9[a])* to a minumum of four (264.91[a]).†

TABLE 4-4 (Continued)

(5) Add a requirement for annually evaluating and modifying the necesary number of groundwater monitoring wells (264.93[g]).†,‡
(6) Revise the requirement for location of monitoring wells (250.43-9[a][3 and 4])* to that specified in 264.91(b).†
(7) Revise sampling frequency and analyses (250.43-9[c])* to that specified in 264.92.†
(8) Add requirements for preparing a groundwater damage assessment program and a corrective action program, for evaluating impacts to groundwater quality, for notifying the Regional Administator, and for implementing the damage assessment program and/or the corrective action program (264.93[a,b,c,d,e, and f]).†,‡
(9) Increase the time limit for maintaining groundwater monitoring records from three years for all facilities (250.43-9[d][2])* to throughout the active life of storage and treatment facilities and to throughout the post-closure care period for disposal facilities (264.94[a]).†
(10) Revise the reporting of monitoring data from quarterly (250.43-9[d][i])* to the times specified in 264.94(b).†

- Revise the Closure and Post-Closure Standards as follows:
  (1) Add a requirement that all facilities must be closed in a manner that minimizes further maintenance necessary to protect human health and the environment and that minimizes any discharge of wastes, leachate, contaminated rainfall, or waste decomposition products to ground or surface waters or the atmosphere (284.111).†,‡
  (2) Revise the required contents of the closure plan (250.43-8[d])* to that specified in 264.112(a).†
  (3) Delete the term "close out" (250.43-8[e])* and add a requirement that within 90 days of receiving the final volume of wastes, the owner/operator must treat and/or remove all wastes in storage or in process from the site, or dispose of them on-site, in accordance with the closure plan (264.113[a]).†
  (4) Decrease the time limit for completing closure activities from within three years after close out (250.43-8[f])* to within six months of receiving the final volume of wastes (264.113[b])†; a longer time may be permissible if the conditions specified in 264.113(b)† are met.
  (5) Delete the requirement that the owner/operator must notify the Regional Administrator at least 15 days before any partial closure (250.43-8[d])*.

TABLE 4-4 (Continued)

(6) For facilities other than land disposal facilities, increase the time for notifying the Regional Administrator of the expected date of the completion of closure from 90 days before the end of final closure (250.43-8[d])* to 180 days before the end of final closure (264.115[a]).†

(7) Add a requirement that at the completion of closure, the owner/operator must certify that the facility has been closed in compliance with the closure plan (250.43-8[j])*, (264.115[b]).†

(8) Revise post-closure care as follows (250.43-8[m])*:
   (a) Add requirements for reporting of monitoring results and for maintenance of monitoring systems (264.117[a]).†
   (b) Delete requirement for maintenance of waste containment devices.
   (c) Limit maintenance of site security devices to those conditions specified in 264.117(b).†

(9) Delete the requirement that all facilities be designed such that the land is amenable to some acceptable use so that perpetual isolation and care to maintain isolation are not required (250.43-8[c]).*

(10) Remove the prohibition that after closure, all facilities shall be secured such that hazardous waste remaining cannot be contacted by animal (non-human) life (250.43-8[h])*.

(11) Replace the prohibition on future use of the land (250.43-8[b])* with the requirements specified in 264.117(c).†

(12) Increase the time requirement for post-closure care from a period not to exceed 20 years (250.43-8[l])* to a period of at least 30 years, with some variances as noted in 264.117(d).†

(13) Add requirements for submitting and amending a post-closure plan to the Regional Administrator (264.118[a and b]).†,

(14) Limit the time for filing a survey plat to within 90 days after completion of closure (250.43-8[k])*, (264.119).†

(15) Add a requirement that the owner of the property on which a disposal facility is located must record a notation on the deed to the property or, in accordance with State law, on any other such instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous waste, and of the use restriction on the land (264.120).†,‡

- Eliminate requirements for commercial products (250.45-7).*

TABLE 4-4 (Continued)

- Add a set of interim status standards applicable only to facility owners/operators who have fully complied with the requirements for interim status defined in Section 3005(e) of RCRA (264.3).†,‡
  - During the period of interim status, an owner/operator must comply with the requirements specified in Part 265† in lieu of the regulations in Part 264.†

- Add the following General Facility Interim Status Standards (265 Subpart B):†
  (1) Applicability
  (2) Identification number
  (3) Required notices
  (4) General waste analysis
  (5) Security
  (6) General inspection requirements
  (7) Personnel training.

- Add the following Preparedness and Prevention Interim Status Standards (265 Subpart C):†
  (1) Applicability
  (2) Maintenance and operation of facility
  (3) Required equipment
  (4) Testing and maintenance of equipment
  (5) Access to communication or alarm system
  (6) Required aisle space
  (7) Special handling for ignitable or reactive waste
  (8) Arrangements with local authorities.

- Add the following Contingency Plan and Emergency Procedures Interim Status Standards (265 Subpart D):†
  (1) Applicability
  (2) Purpose and implementation of contingency plan
  (3) Content of contingency plan
  (4) Copies of contingency plan
  (5) Amendment of contingency plan
  (6) Emergency coordinator
  (7) Emergency procedures.

- Add the following Manifest System, Recordkeeping, and Reporting Interim Status Standards (265 Subpart E):†
  (1) Applicability
  (2) Use of manifest system
  (3) Manifest discrepancies
  (4) Operating record
  (5) Disposition of records

TABLE 4-4 (Continued)

(6) Annual report
(7) Unmanifested waste report
(8) Additional reports.

- Add the following Groundwater Monitoring Interim Status Standards (265 Subpart F):†
  (1) Applicability
  (2) Groundwater monitoring system
  (3) Sampling and analysis
  (4) Preparation, evaluation, and response
  (5) Recordkeeping and reporting.

- Add the following Closure and Post-closure Interim Status Standards (264 Subpart G):†
  (1) Applicability
  (2) Closure performance standard
  (3) Closure plan; amendment of plan
  (4) Time allowed for closure
  (5) Disposal or decontamination of equipment
  (6) Certification of closure
  (7) Post-closure care and use of property; period of care
  (8) Post-closure plan; amendment of plan
  (9) Notice to local land authority
  (10) Notice in deed to property.

- Add the following Financial Requirements Interim Status Standards (265 Subpart H):†
  (1) Applicability
  (2) Cost estimate for facility closure
  (3) Financial assurance for facility closure
  (4) Cost estimate for post-closure monitoring and maintenance
  (5) Financial assurance for post-closure monitoring and maintenance
  (6) Applicability of State financial requirements
  (7) Transfer of ownership.

- Add the following Use and Management of Containers Interim Status Standards (265 Subpart I):†
  (1) Applicability
  (2) Condition of containers
  (3) Compatibility of waste with container
  (4) Management of containers
  (5) Inspections
  (6) Special requirements for ignitable or reactive waste
  (7) Special requirements for incompatible waste.

TABLE 4-4 (Continued)

- Add the following Tanks Interim Status Standards (265 Subpart J):†
  (1) Applicability
  (2) Construction requirements
  (3) General Operating requirements
  (4) Waste analysis and trial tests
  (5) Inspections
  (6) Groundwater monitoring
  (7) Closure
  (8) Special requirements for ignitable or reactive waste.

- Add the following Surface Impoundments Interim Status Standards (265 Subpart K):†
  (1) Applicability
  (2) General operating requirements
  (3) Containment system
  (4) Waste analysis and trial test
  (5) Inspections
  (6) Closure and post-closure
  (7) Special requirements for ignitable or reactive wastes
  (8) Special requirements for incompatible wastes.

- Add the following Waste Piles Interim Status Standards (265 Subpart L):†
  (1) Applicability
  (2) Protection from wind
  (3) Waste analysis
  (4) Containment
  (5) Special requirements for ignitable waste
  (6) Special requirements for reactive waste
  (7) Special requirements for incompatible wastes.

- Add the following Land Treatment Interim Status Standards (265 Subpart M):†
  (1) Applicability
  (2) General operating requirements
  (3) Waste analysis
  (4) Food chain crops
  (5) Zone of aeration monitoring
  (6) Recordkeeping
  (7) Closure and post-closure
  (8) Special requirements for ignitable or reactive waste
  (9) Special requirements for liquid waste.

- Add the following Landfill Interim Status Standards (265 Subpart N):†

TABLE 4-4 (Continued)

(1) Applicability
(2) General Operating Requirements
(3) Waste analysis
(4) Surveying and recordkeeping
(5) Closure
(6) Post-closure care
(7) Special requirements for ignitable or reactive waste
(8) Special requirements for incompatible wastes
(9) Special requirements for liquid waste.

- Add the following Incinerators Interim Status Standards (265 Subpart O):†
  (1) Applicability
  (2) General operating requirements
  (3) Waste analysis
  (4) Monitoring and inspections
  (5) Closure
  (6) Open burning; explosive waste.

<u>3005 Modifications (Subpart E)</u>*

- Add a requirement for review of RCRA permit at least once every 5 years to determine if the permit should be modified or revoked and reissued (250.62-2[a])*, (122.9).§
  - If the facility also has a UIC, NPDES, or Section 404 permit, the RCRA permit shall be reviewed each time one of these other permits is modified, reissued, or terminated.

- Add the following as cause for termination of the permit (250.62-3[a])*, (122.10).§
  (1) Information indicating that the permitted facility posed a threat to the environment.
  (2) A change in ownership or control at a permitted facility where required by 122.8[e].§

- Eliminate requirement setting a maximum of 3 years for completion of a schedule of compliance (250.62-4[b][1])*, (122.12).§

- Add a requirement limiting the duration of experimental facility permits to not more than 1 year with an allowable extension of not more than 1 additional year (250.62-6[c]*, (122.25[b][3]).§

- Add a requirement for revocation of the health care facility special permit (250.62-7)*, (122.25[a][4]).§

TABLE 4-4 (Concluded)

- Eliminate need for publically owned treatment works (POTW's) and ocean disposal barges or vessels to apply for a special permit (250.62-8[b] and 250.62-9[b])*, (122.26[b and c]).§

3006 Modifications (Subpart F)*

- Eliminate partial authorization of state programs (250.72[b]),* (123.33[b]).§
- Allow states that have legislative authority to control on-site or off-site disposal facilities no later than 90 days after the date of promulgation of Section 3001 to be considered for interim authorization (250.73)*, (123.32[a][1]).§
  - Previously a state needed legislative authority by July 20, 1978.
- Change the time period for interim authorization to the 24 months beginning on the date six months after the date of promulgation of Section 3001 (250.73[a]),* (123.32[a]).§
  - Previously interim authorization was effective only from October 21, 1978 through October 21, 1980.

3010 Modifications (Subpart G)*

- Eliminate the use of limited interim authorization (250.810, 250.811, and 250.812).*

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*Section of baseline regulation in Appendix B that is being changed by this modification.

†Section of Phase I Alternative in Appendix N in which this modification appears.

‡No equivalent regulation appears in the baseline regulation in Appendix B.

§Section of 40 CFR 122, 123, and 124, Proposed Consolidated Permit Regulations (Federal Register, Vol. 44, No. 116, Parts II and III, Thursday, June 14, 1979) in which this modification appears.

Under this alternative, revisions have been made in the mechanisms for identifying whether a waste is hazardous under Section 3001. The lists of hazardous wastes and processes generating hazardous wastes have been modified. The criterion of Administrator's Judgment for listing hazardous waste has been replaced by specific criteria for listing hazardous waste under four new categories. The methods used to demonstrate that a listed waste is not hazardous have been modified. The pH limits for identifying an aqueous waste as a corrosive waste have been contracted. The lower limit on the concentrations of contaminants used to identify a waste as a toxic waste* has been raised. Several additional wastes and materials have been specifically excluded from being identified as hazardous waste. Criteria have been added for listing, as solid wastes subject to the regulations, materials that are used or re-used. In addition, the specific procedures used for petitioning for listing of hazardous waste and/or for identifying characteristics of hazardous waste have been delineated. The exclusion from the regulations for generators who produce less than 100 kilograms per month of hazardous waste has been modified.

The exclusion from the Section 3002 regulations for those generators engaged solely in retail trade or principally in farming for all hazardous waste produced, except waste automotive lubricating

*Such a waste is defined as a Type I Toxic waste rather than a toxic waste under this alternative.

oil, has been modified. Generators engaged solely in retail trade must comply with the regulations only for a specific set of listed wastes. Generators engaged principally in farming must comply with the regulations for all hazardous wastes, except pesticide wastes if certain conditions are met.

The number of permitted facilities to which a generator may designate transport of the waste has been limited to two. Spill response information and EPA shipping descriptions and hazards classes have been eliminated from the manifest. Manifesting and reporting requirements for international shipments of hazardous waste have been delineated. The frequency for generators to report on manifests not received by the designated facility has been increased. The reporting and recordkeeping exclusion for off-site generator-owned facilities located in the same state in which hazardous waste generation occurs has been eliminated. Additional recordkeeping requirements have been added. A requirement for marking the date waste accumulation begins has been added for generators who accumulate wastes on-site, without a permit, for less than 90 days prior to off-site disposal.

The entire body of the Department of Transporation (DOT) hazardous materials regulations were incorporated by reference under Section 3003 of the baseline regulations. Due to revision of the DOT regulations, this incorporation by reference is duplicative and has been eliminated under this alternative. Similarly, the baseline regulations on placarding, labelling, and marking are not considered necessary and have been eliminated. These modifications are not listed in Table 4-4 since they would not lead to change in impacts.

A requirement has been added under Section 3003 that a transporter who imports hazardous waste into the U.S. can be considered a generator subject to Section 3002 requirements. The prohibition that a transporter not transport containers that are leaking or that appear to be damaged has been eliminated. The exclusion allowing non-bulk water transporters not to obtain signatures on manifests (or shipping papers) for intramodal transfers of hazardous wastes has been eliminated. A requirement has been added that transporters must contact the generator for further directions if the hazardous waste movement cannot be delivered to either of the facilities designated on the manifest. The requirement allowing transporters up to five working days after delivery to obtain the signature of the authorized agent of the permitted facility has been eliminated; the signature must be obtained at the time of delivery.

Requirements for movements of hazardous waste out of the United States have been added. The requirements for all transporters to notify immediately the National Response Center or designated government official of any discharge of hazardous waste has been replaced by a requirement that the transporter must give notice as may be required by 49 CFR 171.15 or 33 CFR 153.203. The requirement that all transporters must file a written report on each discharge within 15 days has been replaced by a requirement that the transporter must report in writing as required by 49 CFR 171.16.

Under Section 3004, only the non-technical standards have been modified; the technical standards (e.g., landfill standards) are not changed from the baseline regulations. A requirement has been added for regulation of portions of a facility at which waste management activities took place before the effective date of the Section 3004 regulations if such portions could potentially interfere with the monitoring and/or control of active portions of the facility. All human health and environmental standards and all commercial product standards have been eliminated. Special wastes and the special standards for special wastes have been eliminated. Discriminate standards have been added for uranium mining and phosphate mining, beneficiation, and processing waste.

Extensive modifications have been made to all General Facility Standards except site selection and financial requirements. For example, leachate monitoring has been eliminated and the period for post-closure care has been increased from a period not to exceed 20 years to a period of at least 30 years.

A set of interim status standards have been added; during the period of interim status specified in RCRA, an applicable owner/operator must comply with the interim status requirements instead of the full set of Section 3004 requirements. Interim status standards apply to:

- General Facility Requirements;
- Preparedness and Prevention;
- Contigency Plan and Emergency Procedures;
- Manifest System, Recordkeeping, and Reporting;
- Groundwater Monitoring;
- Closure and Post-Closure;
- Financial Requirements;
- Use and Management of Containers;
- Tanks
- Surface Impoundments;
- Waste Piles;
- Land Treatment;
- Landfills;
- Incinerators.

The application for a RCRA permit under Section 3005 has been consolidated with the applications for NPDES permits under the Clean Water Act, UIC permits under the Safe Drinking Water Act, and Section 404 permits (Dredge Or Fill) under the Clean Water Act. A requirement has been added for the review of the RCRA permits at least once every five years. Requirements for termination of permits or revocation of the health care facility special permit have been added. Requirements have been added allowing publically owned treatment works (POTW's) and ocean disposal barges or vessels to obtain permits by rule following Section 3010 notification. The duration of the experimental facility permit has been limited to one year with an allowable extension of not more than one year. The limit of three years for the completion of a schedule of compliance has been eliminated.

Partial authorization of state programs under Section 3006 has been eliminated. The date for the beginning of interim authorization and the date by which a state needs legislative authority to be able to qualify for interim authorization have been changed to six and three months, respectively, after the date of promulgation of Section 3001 regulations.

Limited interim authorization of states under Section 3010 has been eliminated.

5.0 EXISTING HAZARDOUS WASTE GENERATION AND MANAGEMENT PRACTICES

This chapter provides a characterization of the types of wastes that could be considered as potentially hazardous under the Subtitle C regulations and identifies potential sources of hazardous waste generation. Examples of the types of potentially hazardous waste generated by selected sources are also presented. Prevalent transport, storage, treatment, and disposal methods are also described, and the relevant aspects of typical hazardous waste management praetices are summarized. Estimates of the quantities of hazardous waste being generated are provided in Chapter 6.

5.1 Characterization of Hazardous Waste Generation

This section presents a general description of the characteristics of wastes that are considered hazardous. This is followed by selected examples identifying existing sources of hazardous waste and the types of potentially hazardous waste currently being generated by such sources. It is the intent of this section to characterize hazardous waste only to the extent necessary to provide a general understanding of the various properties, types, and sources of such waste rather than to present an exhaustive delineation of potentially hazardous wastes and their sources of generation.

5.1.1 Hazardous Waste Characteristics. The Subtitle C regulations and the alternatives to the regulations (see Chapters 3 and 4) contain characteristics and lists for identifying wastes that are to be considered hazardous and, thus, to be brought under control of the regulations. The specific characteristics that have been considered for use in identifying hazardous waste are as follows:

- Flammability;
- Corrosiveness;
- Infectiousness;
- Reactivity;
- Radioactivity;
- Toxicity.

Appendix B (Subpart A) and Chapters 3 and 4 describe the specific properties a waste must exhibit to be considered hazardous or nonhazardous under any one or more of these characteristics and list waste materials which are considered hazardous.

Wastes to which these characteristics apply and which could thus be identified as hazardous under Subtitle C include garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.* Wastes specifically exempted from regulation by RCRA itself, and thus exempted from Subtitle C, include solid or dissolved material in domestic sewage; solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under Section

*However, the Subtitle C regulations contain provisions specifically exempting household refuse and household septic tank pumpings from regulation.

402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880); and source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923). Any waste, except those wastes specifically exempted from regulation, which meets any one or more of the specified characteristics or which is listed, would be considered as hazardous under the Subtitle C regulations.

In attempting to characterize those wastes that could be considered hazardous under Subtitle C, it must be realized that most waste streams consist of a mixture of waste materials and that it is this mixture, not just individual components, which establishes the hazardous nature of the waste. Very rarely do wastes consist of just one material. The hazardous nature of every waste stream depends upon several factors, including the types of materials present, the concentration of each constituent, the interactions of the materials present, and the physical form of the waste materials.

The types of materials (both hazardous and nonhazardous) present in any waste stream, and the relative concentrations of these materials, vary from waste stream to waste stream and are very highly dependent upon such factors as the types of feedstock utilized by the process or activity generating the waste, the specifics of that process or activity, and the presence of any pollution controls and waste treatment practices. No two waste streams are identical; similar processes or activities can generate waste streams that are very different in nature. In fact, most waste generators produce more than one type of waste stream, e.g., waste streams from any generator may be in the form of liquids, solids, sludges, slurries, containerized gases, or any combination of these and any one or all of these waste streams may be classified as hazardous under the Subtitle C regulations. (Section 5.1.2 presents examples of potentially hazardous waste streams and waste stream constituents for selected generators.)

With regard to the constituents present, the totality of the waste streams generated in the U.S. is likely to contain, to some degree, practically every type of substance or product produced in or imported into the U.S. as well as nearly every type of material used as a feedstock in a manufacturing process along with many of the intermediate materials generated by these processes. Many of these constituents are by themselves potentially hazardous and their presence, in sufficient concentration, can make the waste stream hazardous.

A number of studies have attempted to define the characteristics that make materials toxic and/or hazardous* and to identify and rank such materials. Most of these studies have dealt with pure substances and commercial products, rather than with wastes. Thousands

*Materials which are toxic are hazardous. However, toxicity is just one of several characteristics for judging a waste to be hazardous. Wastes do not necessarily have to be toxic to be hazardous.

of compounds have been listed as potentially toxic or hazardous. For example, the United States Toxic Substances Control Act, Interagency Testing Committee has initially identified about 3,600 compounds as representing the potentially most hazardous compounds within the larger universe of around 60,000 chemicals used in U.S. commerce. These 3,600 compounds represent a consolidation of 19 separate priority chemical lists compiled in recent years (U.S. Environmental Protection Agency, 1978). Table 5-1 indicates the sources of these other 19 lists, the number of chemicals included, and the main selection criteria. For a more detailed discussion of the selection criteria and the substances included on each list, see the individual sources. Every one of the thousands of materials contained in these lists may appear in some waste stream, and the presence of any one could, in sufficient quantity, result in the waste stream being hazardous.

While the types and the concentrations of materials present are the prime determinants of the hazardous nature of the waste stream, interactions among the various constituents can drastically alter the hazardous nature of the waste stream. Interactions which can occur include synergisms, antagonisms, complex formation, and chemical reactions.

Synergism involves two or more materials acting together to create a combined effect which is greater than the sum of their individual effects or to lower the threshold level at which effects

TABLE 5-1

SOURCES OF CHEMICALS FOR INCLUSION ON THE INITIAL LIST OF THE TOXIC SUBSTANCE CONTROL ACT INTERAGENCY TESTING COMMITTEE*

Source lists used	Number of chemicals included	Main selection criteria
1. Toxic Pollutants in Point Source Water Effluent Discharge, Environmental Defense Fund/EPA PL-92-500	129	T
2. Scoring of Organic Air Compounds, June 1976, MITRE, MTR-6248	337	T & P
3. Final Report of NSF Workshop Panel to Select Organic Compounds Hazardous to the Environment, April 1975, Stanford Research Institute/National Science Foundation	80	P
4. Potential Industrial Carcinogens and Mutagens, National Center for Toxicological Research	88	T & P
5. Occupational Carcinogens for Potential Regulatory Action, Department of Labor--Occupational Safety and Health Administration (OSHA)	116	T
6. Chemicals Tested or Scheduled for Testing at the Fish-Pesticide Research Laboratory, Department of Interior--Department of Fish and Wildlife	174	T
7. Substances with Chronic Effects other than Mutagenicity, Carcinogenicity or Teratogenicity: A Subfile of the NIOSH Registry (Source List 13)	--	T
8. Criteria Documents Prepared or Planned by NIOSH, February 24, 1977	127	T & P
9. Suspected Carcinogens; A Subfile of the NIOSH Registry	1,900	T

TABLE 5-1 (Continued)

Source lists used	Number of chemicals included	Main selection criteria
10. Suspected Mutagens; A Subfile of NIOSH Registry	100	T
11. Suspected Teratogens; A Subfile of the NIOSH Registry	200	T
12. Department of Health Education and Welfare, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances, 1976	21,453	E, T, O
13. The Ecological Impact of Synthetic Organic Compounds on Estuarine Ecosystems, September 1976, EPA-1600/3-76-075	9	E & T
14. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1976, American Conference of Government Industrial Hygienists	570	T & O
15. National Occupational Hazard Survey (1972-1974)/National Institute for Occupational Safety and Health	7,000	T & O
16. Chemicals Being Tested for Carcinogenicity by the Bioassay Program DCCP, National Cancer Institute, 1977	372	O, T, & P
17. EPA, Office of Toxic Substances List of Priority Toxic Chemicals, 1977	162	T
18. A Study of Industrial Data on Candidate Chemicals for Testing, EPA Contract #68-01-4109, November 1976, Stanford Research Institute	650	P
19. General List of Problem Substances, Environmental Contaminants Committee, Ottawa, Ontario, Canada, 1977	160	T & P

TABLE 5-1 (Concluded)

Other lists used for reference, but not used as source lists	Number of chemicals included	Main selection criteria
1. Research Project to Gather and Analyze Data and Information on Chemicals that Impact Man and the Environment, National Institute of Health, National Cancer Institute/Stanford Research Institute	3,200	T & P
2. Other Potential Modifiers of the Stratosphere, 1975, National Institute of Environmental Health Sciences/Stanford Research Institute	41	E & P
3. EPA/Office of Research and Development, Chemical Production, 1975	140	P

KEY: T = Toxicity
P = Production/Use
O = Occupational Exposure
E = Environmental Persistence

*U.S. Environmental Protection Agency, 1978.

begin to occur. For example, chlorinated aromatics become more toxic in the presence of various solvents (Battelle Pacific Northwest Laboratories, 1973). Antagonism is the opposite of synergism and involves two or more materials acting together to create a combined effect which is less than the sum of their individual effects or to raise the threshold level at which effects begin to occur.

Complex formation in the waste stream involves the forming of a chemical bond between a metal ion and a complexing agent, e.g., organic compounds. This complex formation affects the solubilities and reactions of the materials involved. For example, the formation of water soluble metal-organic complexes with heavy metals may increase the concentrations of these constituents in leachate to levels far in excess of their normal solubilities, while the formation of water insoluble complexes may decrease the concentrations of these constituents in leachate. Chemical reactions in the waste stream involve two or more materials combining to produce a potentially hazardous material which is not originally present in the waste or combining to neutralize or eliminate potentially hazardous materials which are present.

The net effect of all such interactions can be to make waste streams hazardous even if they do not contain any individually hazardous materials and to render other waste streams nonhazardous even if they contain individually hazardous materials.

In addition to such interactions, the physical form of both the waste stream and its constituents can also influence the hazardous nature of the waste stream. For example, beryllium dust is toxic at relatively low levels when inhaled; however, beryllium in water poses little ingestive threat at equivalent concentrations (U.S. Environmental Protection Agency, 1976a).

With regard to identifying hazardous wastes, a number of previous studies (Booz-Allen, Applied Research, Inc., 1973; Battelle Pacific Northwest Laboratories, 1973; Ottinger et al., 1973; Arthur D. Little, Inc., 1973) have attempted to delineate the specific characteristics that make waste hazardous, to list waste stream constituents whose forms and quantities could make waste streams hazardous, and to identify sources of these potentially hazardous waste stream constituents. A series of more recent studies (Arthur D. Little, 1976b; Battelle Columbus Laboratories, 1976; Calspan Corporation, 1977; Jacobs Engineering Company, 1976; SCS Engineers, Inc., 1976; Swain et al., 1977; TRW, Inc., 1976; Versar, Inc., 1975, 1975a, 1976; Wapora, Inc., 1975, 1977, 1977a) have attempted to identify potentially hazardous waste streams generated within selected industries, using a few preselected hazardous constituents as the basis for the determination.*

All of the above studies have indicated numerous problems in identifying and characterizing hazardous waste streams and hazardous waste constituents due to considerable data limitations, both with

*This group constitutes a series of EPA contractor studies on industrial hazardous waste practices in selected manufacturing industries. For ease in referencing these studies, the entire set will henceforth be called the Industry Studies (1975-1978).

regard to determining what materials are actually hazardous and the levels at which they are hazardous and with regard to determining what materials are present in different waste streams and the concentrations and interactions of the various constituents. Furthermore, the different studies have used different definitions of hazardous waste and hazardous material. Therefore, the types and sources of wastes identified as hazardous have varied among the studies and, in some cases, may be discrepant with the regulatory definition under Subtitle C. Detailed descriptions of the waste streams considered in the Industry Studies are presented in Appendix C. Table 5-2 lists some of the general types of hazardous waste constituents most frequently identified in the various studies.

5.1.2 <u>Sources of Hazardous Waste.</u> Waste is generated as a byproduct of nearly every activity of man. Sources of hazardous waste generation can be broadly grouped into four categories:

- Manufacturing processes;
- End use activities;
- Finished products becoming unusable, unneeded, or unwanted;
- Spills of hazardous, nonwaste materials during transport.

5.1.2.1 Manufacturing Processes. Manufacturing processes generate a wide variety of potentially hazardous waste streams and waste stream constituents. The types of hazardous waste generated by different manufacturing processes are characterized based upon the findings of the Industry Studies (1975-1978). These studies identified potentially hazardous waste streams within each of the following thirteen manufacturing industries:

TABLE 5-2

EXAMPLES OF GENERAL TYPES OF POTENTIALLY HAZARDOUS WASTE CONSTITUENTS

Acids
Caustics
Cyanides
Dyes
Explosives
Fluorides
Heavy metals and their compounds
Organics
- Oils
- Phenols
- Polynuclear aromatics
- Other organic compounds and organic residues

Paints
Pesticides
Radioactive materials
Solvents

- Textiles;
- Inorganic chemicals;
- Pharmaceuticals;
- Paint and allied products and contract solvent reclaiming;
- Organic chemicals, pesticides, and explosives;
- Petroleum refining;
- Petroleum re-refining;
- Leather tanning and finishing;
- Metal smelting and refining;
- Electroplating and metal finishing;
- Special machinery manufacturing;
- Electronic components manufacturing;
- Storage and primary batteries.

Table 5-3 contains examples of the potentially hazardous waste streams and waste stream constituents generated by each of these manufacturing industries. Potentially hazardous waste from manufacturing processes very seldom consists of pure materials; the wastes usually consist of a mixture of materials from one part of the process which are then combined with other mixtures of wastes from other parts of the process. A detailed description of each potentially hazardous waste stream from each industry and an enumeration of specific, potentially hazardous constituents within the waste stream appears in Appendix C.

It should be noted that no one individual facility within any of these industries generates all of the potentially hazardous waste streams and waste stream constituents shown in Table 5-3. It is also not meant to be implied that all waste streams and waste stream constituents identified as potentially hazardous in Table 5-3 would necessarily be considered hazardous under the Subtitle C regulations.

TABLE 5-3

EXAMPLES OF POTENTIALLY HAZARDOUS WASTE STREAMS FROM SELECTED MANUFACTURING INDUSTRIES

Manufacturing industry	Potentially hazardous waste stream	Potentially hazardous constituents
Textiles* (SIC 22)	Wastewater treatment sludge	Heavy metals, dyestuffs, chlorinated organics, other residual organics
	Discarded dye and chemical containers	Residual dyestuffs and residual chemicals
	Solvents and still bottoms	Solvents and organic residues
Inorganic chemicals† (SIC 281)	Wastewater treatment sludges	Heavy metals, fluorides, cyanides, pigments
	Solids	Heavy metals, cyanides, radioactive materials
Pharma-ceuticals‡ (SIC 2831, 2833, 2834)	Waste solvents	Organic solvents
	Still bottoms, tars, and muds	Organic residues
	Solids	Heavy metals, contaminated high inert content wastes, active ingredients
Paint and allied products § (SIC 285)	Raw material containers	Heavy metals, organic and inorganic pigments, solvents, additives
	Water treatment sludges	Heavy metals
	Solids	Heavy metals
	Waste products	Heavy metals, solvents, pigments, additives, fungicides
	Wash solvents and still bottoms	Organic and inorganic solvents, pigments, organic residues

TABLE 5-3 (Continued)

Manufacturing industry	Potentially hazardous waste stream	Potentially hazardous constituents
Leather tanning and finishing§§ (SIC 3111)	Fleshings	Heavy metals
	Trimmings and shavings	Heavy metals
	Buffing dust	Heavy metals
	Finishing residues	Heavy metals, organic solvents
	Wastewater treatment sludges	Heavy metals
Metal smelting and refining *** (SIC 33)	Sludges	Heavy metals, fluorides, cyanides, oils, phenols, grease
	Slurries	Heavy metals
	Dusts	Heavy metals
	Slag	Heavy metals
	Waste ammonia liquor	Phenols, cyanides
	Waste pickle liquor	Heavy metals, acids
Electroplating and metal finishing††† (SIC 3471)	Wastewater treatment sludges	Heavy metals, cyanides, acid and alkaline cleaners, solvents, oils, grease
	Process preparation wastes	Heavy metals, lubricants, buffing compounds
	Miscellaneous process solids	Process chemicals, heavy metals, acid and alkaline cleaners, plating salts, organic additives, solvents, cyanides, paints
	Degreaser sludges	Heavy metals, oils, grease, buffing compounds, organic solvents, paint pigments, abrasives

TABLE 5-3 (Continued)

Manufacturing industry	Potentially hazardous waste stream	Potentially hazardous constituents
Special machinery manufacturing## (SIC 355 and 347)	Heat treating wastes	Heavy metals, cyanides, oils, additives, organic solvents, acid and alkaline cleaners, organic residues
	Electroplating wastes	Heavy metals, cyanides organic solvents, acid and alkaline cleaners, oils, grease, scale
	Machining wastes	Oils, organic solvents, heavy metals
	Coating wastes	Paints, solvents, acid and alkaline cleaners
Electronic components§§§ (SIC 367)	Wastewater treatment sludges	Heavy metals, fluorides
	Solvents and still bottoms	Organic solvents, organic residues, heavy metals, oils,
	Waste oils	Oils, heavy metals, additives
	Paint wastes	Heavy metals, oils, solvents, fungicides, resins
	Metal scrap	Heavy metals
Storage and primary batteries**** (SIC 3691 and 3692)	Wastewater treatment sludges	Heavy metals, electrolytic solutions
	Rejected and scrap batteries	Heavy metals

TABLE 5-3 (Continued)

Manufacturing industry	Potentially hazardous waste stream	Potentially hazardous constituents
Organic chemicals pesticides and explosives ** (SIC 286, 2879 2892)	Liquid heavy ends still bottoms sludges waste products solids semi-solids	See Appendix D.3.5 for specifics
Petroleum refining †† (SIC 2911)	Tank bottoms	Oil, phenols, polynuclear aromatics, other organics heavy metals
	Process sludges	Oil, phenols, ammonia salts, polynuclear aromatics, other organics, heavy metals, acids
	Filter clays	Oil, phenols, polynuclear aromatics, ammonia salts, other organics, heavy metals
	Wastewater treatment sludges	Phenols, ammonia salts, heavy metals, runoff constituents
	Fines	Phenols, ammonia salts, heavy metals
Petroleum re-refining‡‡ (SIC 2992)	Sludges	Acids, caustics, heavy metals, ammonia, cresol, oils, polymers, other polar compounds, asphaltenes
	Spent clay	Oil, heavy metals, polymers, other polar compounds
	Process water	Heavy metals, oils, polymers, other polar compounds, phenols, sulfur compounds

TABLE 5-3 (Concluded)

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*Versar, Inc., 1976

†Versar, Inc., 1975

‡Arthur D. Little Inc., 1976

§Wapora, Inc., 1975

**TRW, Inc., 1976

††Jacobs Engineering Company, 1976

‡‡Swain et.al., 1977

§§SCS Engineers Inc., 1976

***Calspan Corporation, 1977

†††Battelle Columbus Laboratories, 1976

‡‡‡Wapora, Inc., 1977

§§§Wapora, Inc., 1977a

****Versar, Inc., 1975a

5.1.2.2 End Use Activities. Activities which involve the end use of finished products generate four basic categories of potentially hazardous wastes:

- Product containers with residual product;
- Spills of hazardous products;
- Used products containing hazardous materials;
- Residuals from product consumption.

End use generators of potentially hazardous waste include, but are not limited to, households*, governmental agencies, utilities, agricultural activities, service industries, construction activities, wholesale and retail trade, and transportation activities. For the most part, the potentially hazardous waste streams from these end use activities tend to be more homogeneous than those from manufacturing activities.

Different end use activities use or consume practically every product manufactured, produced, or imported into the U.S. As previously discussed, many of these products are by themselves potentially hazardous. Such products usually are packaged or containerized for delivery to the point of end use. Following this end use, the product container or packaging is normally discarded as a waste. These waste containers or packaging materials usually contain residual amounts of the potentially hazardous product and, thus, may represent a potentially hazardous waste. These residues may include pesticides, paints, cleaning fluids, and oils. Packaging materials

*Households are specifically exempted from regulation under Subtitle C.

containing pesticide residuals, for example, may be found in wastes from households, agriculture, garden stores, golf courses, and organizations engaged in right-of-way maintenance such as governmental agencies, utilities, and railroads.

End use activities may also result in spills of potentially hazardous products. Following cleanup, the spilled product is usually discarded as a waste. Both this waste product and the materials which are used to clean up the spill represent potentially hazardous waste.

A third category of potentially hazardous waste from end use activities consists of used, broken, or nonfunctioning products that are hazardous themselves or that contain potentially hazardous material. These products may include waste automotive oils and solvents; used dry cleaning fluids; spent batteries and fluorescent tubes containing mercury; nonfunctioning capacitors and transformers containing polychlorinated biphenyls (PCB's); nonfunctioning smoke detectors containing radioactive materials; and waste construction materials containing asbestos.

End use activities which consume part or all of a product may produce residual materials which are potentially hazardous. For example, coal-fired power plants generate coal ash which may be a potentially hazardous waste, depending upon its constituents.

5.1.2.3 Unusable, Unneeded, or Unwanted Products. Unusable, unneeded, or unwanted finished products that are potentially hazardous represent a further source of potentially hazardous waste.

Finished products may become unusable, unneeded, or unwanted for a variety of reasons, including governmental regulations prohibiting the use of specific products; product recalls due to contamination, decomposition, deficiencies, or other problems; and products becoming obsolete or overage. For example, a number of pesticides, such as DDT, chlordane, and mirex have had their registrations canceled for some or all of their uses, and the existing supplies have become potentially hazardous wastes. Recalled products that have become potentially hazardous waste include contaminated or decomposed lots of pharmaceuticals. Obsolete military munitions, such as initiating agents, propellants, pyrotechnics, explosives, and riot control agents, represent a third type of finished product that has become a potentially hazardous waste.

5.1.2.4 Transportation-Related Spills of Hazardous Materials That Are Not Wastes. Spills of hazardous materials that are not wastes occasionally occur during transport and are a further source of hazardous waste. When many hazardous materials particularly liquids, volatile materials, and fine materials, are spilled, this material is likely to become a waste and would be subject to regulation under Subtitle C if it exhibits the properties in Appendix B, Subpart A. Spills can also occur during the manufacture or end use of any product or material; however, such spills are included in existing waste streams from such activities and do not represent an additional source of potentially hazardous wastes.

Major sources of transportation-related spills of hazardous materials include rail, truck, barge, and pipeline transport and transfer operations. Table 5-4 shows examples of potentially hazardous materials that have been spilled in recent years.

5.2 Characterization of Hazardous Waste Transport

The basic role of the hazardous waste transport industry is to move hazardous waste from the point of generation to off-site facilities for purposes of storage, treatment, and/or disposal. Hazardous waste transport includes intrastate, interstate, and international movements by highway, rail, air, pipelines, and waterway.

Three hazardous waste transport industry segments have been identified in a study by Arthur D. Little, Inc. (1978a). These segments are as follows: generator/transporter, hazardous waste management facility/transporter, and for-hire transporter.

- Generator/transporters are hazardous waste generators who function as private carriers by self-hauling hazardous wastes off-site to hazardous waste management facilities (transport by this segment is invariably by truck).

- Hazardous waste management facility/transporters are operators of hazardous waste management facilities who also function as contract or private carriers in providing transportation from generators to storage, treatment, or disposal facilities (transport by this segment is invariably by truck).

- For-hire transporters are common and contract carriers who transport hazardous wastes (and other property as well) but who do not generate, treat, store, or dispose of such wastes (transport by this segment is primarily by truck, but includes rail, waterway, and air).

TABLE 5-4

EXAMPLES OF SPILLS OF POTENTIALLY HAZARDOUS MATERIALS*

Acids	Ink
arsenic	Kepone
chlorosulfuric	Latex
hydrochloric	Lead oxide
muriatic	Linseed oil
nitric	Methyl alcohol
phosphoric	Methyl bromide
sulfuric	Naptha
Acrylonitrile	Nitrofurizone
Ammonia solution	Oils
Ammonium nitrate	crude
Anhydrous ammonia	cutting
Batteries and electrolytic fluid	fuel
Benzene	hydraulic
Butyl cellusolve	lube
Caustic soda	turbine
Chlorine	Paint
Coolants	Paint thinner
Copper sulfate	PCB
Creosote	Pentachorophenol
Cyanide	Perchloroethylene
Cyclohexylamine	Pesticides
Denatured ethyl alcohol	Phenol
Dyes	Phosdrin
Ethylene diamine	Phosphorus
Ethylene glycol	Potassium hydroxide
Ferric chloride	Resins
Ferrous sulfate	Seed corn (containing captan)
Formaldehyde	Sodium hydroxide
Gasoline	Solvents
Hexane	Toluene
	Trimethylamine

* U.S. Department of Transportation, Materials Transportation Bureau, 1976; personal communication, J.E. Aho, Minnesota Pollution Control Agency, 1977; State of Ohio, 1974; personal communication, J. Dobbins, Ohio Environmental Protection Agency, 1977; Illinois EPA Emergency Action Center, 1977.

According to the Arthur D. Little, Inc. study, neither the number of firms within each industry segment nor in the industry as a whole is known, nor is the rate of firms entering or leaving the industry. Furthermore, the quantity of hazardous wastes transported annually by the industry is unknown, as is the distribution of waste transport by mode or by industry segment.

To illustrate the magnitude of hazardous waste being transported off-site, based upon the waste quantities in Chapter 6 and the average off-site disposal factor (see Table 5-10), there is on the order of 8 to 10 million metric tons of potentially hazardous manufacturing waste currently being transported off-site on an annual basis. Table 5-5 presents a qualitative estimate of the relative amount of hazardous waste moved by mode and by industry segment. The vast majority of such waste is transported by highway with a small amount being transported by rail and even smaller amounts being moved by waterway. Appendix E contains a detailed description of the three industry segments, based on the Arthur D. Little, Inc. (1978a) study. The following reiterates pertinent portions of that description.

5.2.1 Generator/Transporter. According to Arthur D. Little, Inc., reliable data are extremely limited with regard to generator/transporters; most of the information available on generator/transporters is contained in the Industry Studies (1975-1978) prepared for EPA. About 3.5 percent of the plants inventoried in the Industry

TABLE 5-5

RELATIVE AMOUNT OF HAZARDOUS WASTES TRANSPORTED OFF-SITE BY MODE AND INDUSTRY SEGMENT*

Mode	Generator/ transporter	Hazardous waste management facility/ transporter	For-hire transporter
Air	None	None	Negligible
Rail	None	None	Small
Highway	Very small	Large	Large
Waterway	None	None	Very small
Pipeline	Negligible	Negligible	None

*Modified from Arthur D. Little, Inc., 1978a.

Studies transported their own wastes off-site, and less than three percent of the total quantity of waste hauled off-site was transported by the generator.

The tendency to self-haul is industry dependent. For example, waste oil re-refiners self-haul over 50 percent of their wastes going off-site while the metal smelting and refining industry does little or no self-hauling. The limited data available suggest that self-hauling firms tend to be the smaller firms in an industry and tend to be located in rural areas where contractor services are not available. Wastes transported by self-hauling firms are usually transported a distance of under 10 miles, and often are moved no more than 1 to 2 miles.

Wastes that are hauled by generators are typically transported as generated, without treatment, and are usually taken either to a site owned and operated by the company and dedicated specifically to its wastes, or to a general-purpose municipal or private landfill that also handles municipal wastes.

Generators, at least the major generators, do keep records of how much waste is shipped, who carried it, and where it went. Such records are usually kept for a period of at least seven years. Self-haulers transporting to a company-owned site typically prepare a summary report monthly on the quantity of material hauled (Arthur D. Little, Inc., 1978a).

5.2.2 Hazardous Waste Management Facility/Transporters. In 1977, there were approximately 110 hazardous waste management facilities in the U.S. (Straus, 1977). An estimated 50 to 67 percent of these facilities also transport hazardous wastes (Arthur D. Little, Inc., 1978a; Straus, 1977).

Transportation activities of the hazardous waste management/transporters tend to be interstate; 64 percent of the facilities contacted in the Arthur D. Little, Inc. study have interstate transportation capabilities. Further, 56 percent have locations in more than one state or receive waste materials from out of state. Those hazardous waste management facility/transporters who operate intrastate tend to serve a relatively small geographical area or section of the state. Those who operate interstate generally operate within one region rather than within several regions. The portion of hazardous waste handled by each type of operation is not known, nor is the portion of the interstate operator's business that is done outside his home state.

Nearly all the facilities contacted keep records which contain limited information about the quantity, source, waste type, and delivery point for each transport/disposal job. These records are in various forms and include: billing records (invoices), shipping documents or bills of lading, purchase orders or job tickets, and self initiated or state required manifests. Usually these documents are filed together and are retained for several years, based in part upon requirements by the Interstate Commerce Commission (3-year retention), Internal Revenue (7-year retention), state tax department, and other state agencies (Arthur D. Little, Inc., 1978a).

5.2.3 For-Hire Transporters. For-hire transporters include common and contract carriers that transport hazardous waste by highway, rail, air, pipeline, and waterway.

5.2.3.1 Common and Contract Highway Carriers. According to Arthur D. Little, Inc., very few data are available with regard to common and contract highway carriers involved in the transport of hazardous waste, and as a result, it was not possible even to develop a representative sample for study purposes. Thus, the information reported by the study should only be considered as preliminary.

About one-half of the for-hire transporters contacted do not transport any hazardous waste across state borders. Others indicated that anywhere from 80 to 100 percent of their hazardous waste transport is interstate. Within those states which required permits for transporting hazardous waste, the transporters usually indicated statewide service. Smaller transporters tended to see states requiring permits as the practical limit of their service radius. Excluding the national common carriers who provided no estimates, transporters indicated trip distances ranging from 25 to 150 miles, with most companies responding at 50 miles. One common carrier indicated that 500 to 600 mile trips were normal. However, the above figure may not be representative of the entire industry. Quantities of hazardous waste being transported interstate or intrastate could not be identified, nor, in most cases, could the total quantity of hazardous waste being transported by individual companies.

Very sketchy information is available on the nature of the wastes transported. Most of the firms contacted handled primarily liquid wastes. General transporters who handled the following types of waste were identified: liquids/solids/sludges, waste oils, solvents for recycle, general hazardous trash, paint wastes, hydrocarbons, chlorine, acids, cyanide wastes, caustic wastes, hydrogen fluoride, cleaning solutions, and radioactive wastes. Though some general transporters specialize in a particular waste, such as waste oil or spent acid, most handle many kinds of hazardous waste.

All of the firms contacted keep records. The most common forms for recordkeeping are the bill of lading and the weigh ticket. The transporters indicated that records were retained for at least five or seven years as a result of state, Internal Revenue Service, and/or Interstate Commerce Commission regulations in addition to general management practice.

5.2.3.2 Rail Transport. As common carriers under the ICC, the railroads must accept all cargo tended to them that is properly packaged and labeled. One of the most important aspects of the practices and regulations in the transport of hazardous waste by railroad is that the railroad does not directly handle the hazardous material as such, but only transports rail cars ready for delivery. The shipper must provide to the railroad the sealed or closed containers of the hazardous material or waste and certify in the bill of lading that the shipment conforms to regulations.

A small amount of hazardous waste is transported by rail as compared to highway transport. Most rail shipments are by tank car. Only a limited number of disposal sites accept hazardous waste by rail, and only a small portion of the total hazardous waste transported by rail is believed to go to such disposal sites; most of it is believed to go to reclamation and recovery facilities. For example, nearly all spent sulfuric acid and petroleum refinery treating wastes transported by rail go to recyclers who have rail sidings on their own property.

The relevant documents for the transport of hazardous waste consist of the bill of lading and the waybill. The bill of lading is prepared by the shipper, the waybill by the railroad. For hazardous materials, a copy of the certified bill of lading must be kept on file by the original carrier for at least three years, in accordance with ICC regulations (Arthur D. Little, Inc., 1978a).

5.2.3.3 Air Transport. The amount of hazardous waste transported by air is very small, possibly on the order of several tons per year. Small amounts of waste acids, flammable metal shavings, radioactive materials, and laboratory samples of hazardous wastes have been identified as being shipped by air.

The existing DOT and FAA regulations require that copies of shipping papers, prepared by the shipper, must be carried onboard.

The originating carrier must then maintain a copy of the shipping paper for 90 days. In addition to shipping papers, the air carrier is to prepare a manifest for the total cargo of the shipment.

5.2.3.4 Pipeline Transport. Off-site pipeline transport of hazardous waste is extremely limited. On a national level, there are no major pipelines for transporting wastes; the commercial pipeline industry is almost entirely devoted to the transport of fuel products. Waste transport by pipeline is generally limited to a few concentrated industrial areas in the U.S. A number of isolated cases of hazardous waste transport by private, not for-hire, pipeline were identified by the Arthur D. Little, Inc. study.

5.2.3.5 Waterway Transport. The quantity of hazardous waste transported by barge on inland waters appears to be small relative to highway transport. No vessels other than barges are known to carry hazardous waste. Shipments of hazardous waste move primarily on the Gulf Intracoastal Waterway-Mississippi River System in tank barges with a capacity range of 1,200 to 1,500 tons. A typical one-way trip may be on the order of 1,000 or more miles. Most often, the waste transported includes spent acids, spent caustics, and waste glycol. The wastes are generally in liquid bulk form with a water content up to 90 percent and normally are transported to resource recovery facilities.

The bill of lading, weigh ticket, and shipping manifest papers are the commonly used forms for recordkeeping. The companies contacted by Arthur D. Little, Inc. stated that records are retained in current files for 5 to 7 years because of legal requirements as well as administrative procedures. In addition to the above forms, shipping papers and a dangerous cargo manifest must accompany shipments of hazardous packaged cargo and solids in bulk.

5.3 Characterization of Hazardous Waste Storage, Treatment, and Disposal

Hazardous waste storage, treatment, and disposal currently occurs both on and off the site of generation. When transported offsite as described in Section 5.2, the hazardous waste goes to such locations as dumps, hazardous waste management facilities, resource recovery facilities, and municipal and private landfills and incinerators. This section presents a summary of typical hazardous waste management practices; Appendix D provides a more detailed discussion.

5.3.1 Storage. Hazardous waste is often stored before treatment or disposal, both on-site by the generator and off-site by treatment and disposal facilities. In the case of off-site treatment or disposal, the waste is usually also stored by the generator until economically transportable loads are accumulated. Hazardous waste is typically stored in ponds, lagoons, basins, drums, tanks, piles on the ground, tank trucks, and dumpsters (see Appendices D and J). Table 5-6 shows examples of storage practices in selected industries.

TABLE 5-6

EXAMPLES OF STORAGE PRACTICES IN SELECTED INDUSTRIES*

Industry	Type of waste	Storage mode	Storage time
Pesticides	Rinsed and crushed 5-gallon metal insecticide containers	Bin	3 months
Pharmaceuticals	Radiocative material	Packed in drums with vermiculite	3-4 months
Paints and coatings	Emulsion sludge from tank washings - 18% solids, 82% water	Holding tank	1-2 days
Electroplating and metal finishing	Plating sludges Spent liquid PCB's	Holding tank 55-gallon drums	4 hours 5-10 days
Waste oil re-refining	Tarry sludge	Holding tank	3-7 days
Waste oil re-refining	Oil soaked in earth (filter medium)	Contractor supplied containers	5 days

*Arthur D. Little, Inc., 1978a.

Engineered storage is sometimes used when there is no safe method of treating or disposing a particular hazardous waste. Under such circumstances the waste is containerized and buried or otherwise stored until technologies are developed for treating or disposing it. Wastes that have been subject to engineered storage in recent years are discussed in Appendix D.

5.3.2 Treatment. The treatment of hazardous waste is generally directed toward separating the hazardous components from the non-hazardous components of the hazardous waste stream, concentrating the hazardous waste, rendering the waste less hazardous, reducing the volume of waste requiring ultimate disposal, and/or recovering materials or energy from the waste. There are four basic types of methods typically used for the treatment of hazardous waste: physical treatment, chemical treatment, biological treatment, and thermal treatment.

Physical treatment consists of non-chemical means to remove soluble and suspended constituents from aqueous waste streams and to concentrate various constituents of the waste stream. Chemical treatment involves alteration of the molecular structure of waste constituents so as to render the wastes less hazardous or to separate specific constituents of the waste stream. Biological treatment involves the use of microorganisms to remove or degrade organic materials present in wastewater streams by adsorption and direct metabolism. Thermal treatment employs heat to destroy hazardous waste, to render the waste less hazardous, and to recover materials and energy from the waste. Appendix D describes typical processes used for each of the four treatment methods and the types of wastes amenable to treatment by each method.

Treatment of hazardous waste is at times limited to the application of just one of the methods discussed above. However, in many instances, especially in the case of wastewater treatment or resource recovery, several of the methods are used in the course of treating the hazardous waste.

The treatment of hazardous waste using the above methods does not typically constitute the ultimate disposal of the waste. Treatment generally produces a residual (e.g., sludge, ash, still bottom, concentrated waste) which may be hazardous and which is typically disposed using the methods discussed in Section 5.3.3. For example, many of the various physical, chemical, and biological treatment methods are used as part of primary, secondary, or tertiary wastewater treatment and produce a sludge which is potentially hazardous (see Table 5-3) and which requires disposal.

Data are not available to estimate the portion of hazardous waste that is annually treated prior to disposal, nor to estimate the portion treated using each of the four basic types of treatment methods.

5.3.3 Disposal. Disposal of hazardous waste involves the discharge, deposit, injection, dumping, spilling, leaking, or placing of any of the waste into or on any land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwaters. Methods typically used for ultimate disposal of hazardous waste include: open dumping, landfilling, landfarming, lagooning (surface impoundment), incineration, deep-well injection, discharge to municipal sewer systems, surface discharge to rivers and streams, ocean dumping, road application, and detonation. In addition, engineered storage is used in some instances. Appendix D describes each of these disposal methods and the types of wastes amenable to disposal by each method.

Data are not available to estimate the portion of all hazardous waste disposed annually by each method. However, Table 5-7 provides an estimate of the portion of hazardous waste from 14 manufacturing industries disposed annually by each method during the period from 1973 to 1975. The table also provides an estimate of the portion of waste disposed by each method that were disposed in environmentally adequate and inadequate manners. Less than 10 percent of these hazardous manufacturing wastes are estimated to have been treated/ disposed in an environmentally adequate manner.

5.3.4 <u>Typical Management Practices for Hazardous Industrial Waste.</u> Typical hazardous waste management practices are characterized for thirteen manufacturing industries in Appendix D. The manufacturing industries discussed are as follows: electronic components manufacturing; electroplating and metal finishing;

TABLE 5-7

ESTIMATED PORTION OF HAZARDOUS WASTES FROM FOURTEEN MANUFACTURING INDUSTRIES DISPOSED BY METHOD, 1973-1975

Disposal method	Percent disposed by method‡	Percent environmentally adequate	Percent environmentally inadequate
Surface impoundment	48§	< 0.1	> 99.9
Dump Landfill	33	7	93
Incineration	15§	37	63
Deep-well injection	2	-	100
Landspreading	0.3	-	100
Road application	< 0.1	-	100
Sewer	< 0.1	-	100
Other†	2	N/A¶	N/A¶
Weighted average	-	10	90

*Office of Solid Waste, unpublished data.
†Primarily resource recovery
‡Due to rounding, total exceeds 100%.
§An unknown portion of the wastes handled by this method were ultimately disposed by other methods, primarily landfilling and dumping.
¶Not available.

inorganic chemicals; leather tanning and finishing; metal smelting and refining; organic chemicals, pesticides, and explosives; paint and allied products and contract solvent reclaiming; petroleum refining; petroleum re-refining; pharmaceuticals; special machinery manufacturing; storage and primary batteries; and textiles.

Tables 5-8 and 5-9 indicate the estimated portion of potentially hazardous waste treated/disposed by various methods in four manufacturing industries for which data are available. Table 5-8 shows estimated on-site treatment/disposal. Table 5-9 shows estimated off-site treatment/disposal. Some of the methods listed, e.g., incineration and recovery, may generate hazardous residuals requiring further disposal. Data are not available as to the disposal of such residuals. It should be noted that the data in Tables 5-8 and 5-9 are based upon limited surveys of the industries and, according to the various authors, may not be entirely typical of the industry as a whole.

For the thirteen manufacturing industries, treatment of potentially hazardous wastes has, for the most part, been limited to dewatering and some neutralization of hazardous sludges from wastewater treatment, segregation of some waste streams or waste stream components, and incineration of specific wastes or waste streams. Where reclamation and recovery is practiced, it has typically been limited to on-site recovery of solvents, metals, oil, products, plating solutions, and energy and to off-site recovery of solvents, metals, and oil.

TABLE 5-8

ESTIMATED PERCENTAGE OF TOTAL HAZARDOUS WASTES TREATED/DISPOSED ON-SITE BY VARIOUS METHODS FOR SELECTED INDUSTRIES - 1973*

Industry	Treatment/disposal method (percentage of total generated)						
	Biological treatment/lagoon	Deep-well	Incineration	Landfarm	Landfill	Recovery	Application
Organic chemicals†,§	<1	2	70	‡‡	15	8	-
Pharmaceuticals‡,¶	2	-	37	-	-	-	-
Petroleum refining‡,**	18	1	-	8	17	-	-
Petroleum re-refining†,††	-	-	-	-	12	‡‡	‡‡

* 1975 data used for petroleum re-refining industry.
† Based upon dry weight of hazardous waste stream.
‡ Based upon wet weight of hazardous waste stream.
§ TRW, Inc., 1976.
¶ Arthur D. Little, Inc., 1976b.
**Jacobs Engineering Company, 1976.
††Swain et al., 1977.
‡‡Small amount, data not available.

TABLE 5-9

ESTIMATED PERCENTAGE OF TOTAL HAZARDOUS WASTES TREATED/DISPOSED OFF-SITE BY VARIOUS METHODS FOR SELECTED INDUSTRIES - 1973*

	Treatment/disposal method (percentage of total generated)				
	Incineration	Lagoon	Landfill	Recovery	Road application
Organic chemical†,§	2	-	4	-	-
Pharmaceuticals‡,¶	51	-	9	1	-
Petroleum refining‡,**	-	21	34	-	-
Petroleum re-refining†,††	-	-	70	12[‡‡]	6[‡‡]

* 1975 data used for petroleum re-refining industry.
† Based upon dry weight of hazardous waste stream.
‡ Based upon weight of hazardous waste stream
§ TRW, Inc., 1976.
¶ Arthur D. Little, Inc., 1976b.
**Jacobs Engineering Company, 1976
††Swain et al., 1977.
‡‡Includes small amount treated/disposed on-site.

Table 5-10 presents, for the indicated year of assessment, the estimated portion of hazardous waste treated/disposed on-site and off-site and the portion going to reclamation for each of the thirteen manufacturing industries. A weighted average of about 82 percent of the hazardous waste is treated/disposed on-site and about 15 percent is transported off-site for treatment/disposal. It should be noted that these figures for on-site and off-site treatment/disposal must be considered slight overestimates since they include a very small amount of hazardous waste that is recovered on-site or off-site, but for which separate data are not available. It is estimated that such waste comprises less than two percent of the total hazardous waste. The weighted average of hazardous waste for which resource recovery is practiced is thus estimated to be three to five percent.

Three levels of treatment/disposal were identified for the thirteen manufacturing industries by the Industry Studies (1975-1978). These levels are as follows:

- Level I - the level of treatment/disposal used commonly by the industry for a particular waste;
- Level II - the best technology employed commercially by the industry for a particular waste;
- Level III - the technology necessary for protection of health and the environment.

It was possible (though unusual) for Level I to be the same as Level II for a given waste. Levels II and III were frequently reported as being the same (Battelle Columbus Laboratories, 1978).

TABLE 5-10

ESTIMATED PERCENTAGE OF HAZARDOUS WASTES TREATED/DISPOSED OR RECOVERED ON-SITE AND OFF-SITE*

Industry	Treated/ disposed on-site	Treated/ disposed off-site	Recycled/ reclaimed
Electronic components manufacturing§	13	66	21
Electroplating and metal finishing§	19	81¶	-
Inorganic chemical†	85-90	10-15	**
Leather tanning and finishing‡	10	90	**
Metal smelting and refining‡	98	2	††
Organic chemicals†	87	5	8
Paint and allied products‡	5	90	5
Petroleum refinery†	44	56	‡‡
Petroleum re-refinery§	12	76	12
Pharmaceuticals†	39	60	1
Special machinery manufacturing§	10	90	‡‡
Storage and primary batteries†	35	65	‡‡
Textiles‡	49	51	**
Weighted average	82	15	3§§

* Industry studies, 1975-1978.
† 1973 data.
‡ 1974 data.
§ 1975 data.
¶ Includes 45% sent to sanitary sewer systems
**Data not available, small amount reclaimed included in off-site data.
††Data not available, small amount reclaimed included in on-site data.
‡‡Data not available, small smount reclaimed included in off-site and on-site data.
§§Small additional amount included in off-site and on-site data.

Table 5-11 provides, for four manufacturing industries for which data are available, estimates of the portion of hazardous wastes generated by each industry that was subject to Level I, II, or III treatment/disposal during the year of assessment. Data are not available to provide similar estimates for the other nine manufacturing industries. For the industries listed in Table 5-11, between 70 and 85 percent of the hazardous waste was treated/disposed using Level I technologies (i.e., one that is not the best technology commercially available nor adequate for protection of health and environment) and between zero and 5 percent was treated/disposed using Level III technologies.

5.3.5 Hazardous Waste Management Service Industry. The hazardous waste management service industry is engaged in the off-site storage, treatment, disposal, and reprocessing/recovery of hazardous wastes. The industry operates independently of hazardous waste generators; however, as a service to generators, over half the firms in the industry transport hazardous waste to their facilities from generators (Arthur D. Little, Inc., 1978a).

In 1975 there were approximately 95 firms active in the industry, operating about 110 hazardous waste management facilities. The industry's facilities are concentrated in industrial areas, with nearly 60 percent of both the facilities and the overall process capacity* located in EPA Regions II, V, and IX. Figure 5-1 shows

*Process capacity consists of the throughput capability for handling hazardous wastes and includes storage, treatment, disposal, and recovery capacity.

TABLE 5-11

ESTIMATED PERCENTAGE OF HAZARDOUS WASTES TREATED/DISPOSED BY LEVEL I, II, OR III TECHNOLOGY FOR SELECTED MANUFACTURING INDUSTRIES

Industry	Level I	Level II	Level III
Leather tanning and finishing*,¶	85	10	5
Paint and allied products†,¶	70	25	5
Petroleum re-refining‡,**	78	22	-
Special machinery manufacturing§,**	70	30	-

*SCS Engineers, Inc., 1976.

†Wapora Inc., 1975.

‡Swain et al., 1977.

§Wapora, Inc., 1977.

¶1974 data.

**1975 data.

the geographic distributions of the facilities. Total employment within the industry was approximately 2,000 persons in 1975 (Foster D. Snell, Inc., 1976).

At the end of 1974, the process capacity for the industry as a whole was nearly 7.3 million metric tons per year, with about 53 percent of the overall process capacity being utilized on an annual basis* (Foster D. Snell, Inc., 1976). Since some hazardous waste requires several process stages (e.g., treatment and disposal), the total quantity of waste that can be handled is somewhat less than the overall process capacity. The Foster D. Snell, Inc. study estimated that about 5.3 million metric tons of the overall process capacity might be considered environmentally adequate.† The study further estimated that the overall process capacity would expand to 8.2 million metric tons at the end of 1977, with about 6.2 million metric tons being considered environmentally adequate.+ Table 5-12 shows, for selected processes, the daily capacity available in 1974 by EPA Region.

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*According to the Foster D. Snell, Inc. study, the low capacity utilization is the result of poor regulations and/or poor enforcement of regulations applicable to hazardous waste treatment/disposal.

†The Foster D. Snell, Inc. study considered incineration, secure landfills, chemical treatment, biological treatment, and resource recovery as environmentally adequate processes. Some unknown portion of these processes, however, might not be considered environmentally adequate under the Subtitle C regulations.

TABLE 5-12

CAPACITY OF SELECTED HAZARDOUS WASTE MANAGEMENT SERVICE INDUSTRY PROCESSES - 1974*

EPA region	Number of facilities	Process capacity (thousands of gallons per 24 hour day)				
		Chemical treatment	Incineration	Secure landfill	Deep well injection	Resource recovery
I	6	46	4	4	-	9
II	18	71	153	239	-	57
III	9	265	35	15	-	15
IV	7	20	44	46	-	-
V	27	1,530	361	230	100	315
VI	10	70	60	135	795	230
VII	8	250	5	66	-	50
VIII	1	†	†	†	†	††
IX	19	57	14	639	-	400
X	5	28	-	325	-	405
Total	110‡	2,337‡	676‡	1,714‡	895‡	1,481‡

*Foster D. Snell, Inc., 1976.
†Data are not available.
‡Does not include EPA Region VIII.

The hazardous waste management service industry generally groups the wastes it handles into five categories: metals/metal finishing; paints/solvents/coatings; organics; petroleum; and inorganics. Table 5-13 lists examples of the types of hazardous wastes handled within each category and typical treatment/disposal methods employed.

5.3.6 State Data on On-Site and Off-Site Disposal. Very few states have at this time accumulated sufficient data to estimate the portion of hazardous waste generated within the state that is being disposed on-site and off-site of the generation facility. Table 5-14 presents, for eight states and one EPA Region, recent estimates of the portion of each state's hazardous industrial waste that is disposed on-site and off-site, the portion of the waste whose disposal whereabouts is unknown, and the portion of the waste being reclaimed. Table 5-14 also indicates the estimated portion of each state's hazardous industrial waste upon which the disposal and recovery estimates are based. The fate of the remainder of the hazardous industrial waste in these states is not known.

Except for Texas and Illinois, the data in Table 5-14 were collected as part of studies to assess existing hazardous waste management practices in the state and to determine needed changes in the state's regulatory approach to hazardous waste management. The data for Texas and Illinois were reported to these states as required under their hazardous waste regulations. Comparable data for disposal and recovery practices either prior to or after enactment

TABLE 5-13

TYPES OF HAZARDOUS WASTES HANDLED AND TYPICAL TREATMENT/DISPOSAL METHODS FOR THE HAZARDOUS WASTE MANAGEMENT INDUSTRY

Market category	Typical treatment/disposal methods	Types of hazardous wastes handled
Metals/metal finishing	Neutralization Chemical treatment Sanitary landfill Secure landfill Deep well injection Ocean disposal	Acid solutions Metals containing sludges
Paints/solvents/ coatings	Incineration Chemical treatment Sanitary landfill Secure landfill	Organics Solvents
Organics	Incineration Biological treatment Chemical treatment Sanitary landfill Secure landfill	Pesticides Biologicals Rubber Plastics
Petroleum	Incineration Deep well injection	Oily wastes
Inorganics	Chemical treatment Ocean dumping Secure landfill	Aqueous solutions of salts, metals,etc.

*Foster D. Snell, Inc., 1976

TABLE 5-14

ESTIMATED PERCENTAGE OF HAZARDOUS INDUSTRIAL WASTES
DISPOSED BY LOCATION OR RECLAIMED FOR SELECTED STATES

State	Percent of wastes included in estimate*	Disposal location					Reclaimed
		On-site	Off-site	Unknown	Other†		
					Discharges	Deep-well injection	
Florida‡,§	NA§§§	85	8	7	§	-	-
Illinois¶	100	50	18	21	-	10	-
Kansas**	23	39	49	-	5	-	7
Maryland††,‡‡	NA	12	33	51	‡‡	-	4
Massachusetts§§	100	-	14	65	10	-	11
Minnesota¶¶	9-16	65	25	-	3	-	7
Region X***	NA	63	22	-	-	-	15
Rhode Island†††	NA	1	81	-	14	-	4
Texas‡‡‡	100	36	9	20	-	31	4

TABLE 5-14 (Concluded)

* This is the estimated portion of the state's total, hazardous, industrial wastes upon which the disposal and recovery percentages are based

† Other includes disposal by methods which are not regulated under Subtitle C. These include discharges to municipal sewer systems, surface discharges under National Pollution Discharge Elimination System (NPDES), and deep-well injection.

‡ Carter et al., 1977.

§ These data have been modified to eliminate a large volume of wastewater containing a small amount of hazardous waste that is discharge to municipal sewers.

¶ Personal communication, S. Miller, 1978.

** State of Kansas, 1977.

†† State of Maryland, 1977.

‡‡ These data have been modified to eliminate a large volume of wastewater containing a small amount of hazardous waste that is discharge municipal sewers and to streams.

§§ Fennelly et.al., 1976. If waste automotive oil is included, the percentages are as follows: on-site - 0%, off-site - 8%, unknown - 68%, discharged - 6%, reclaimed - 18%.

¶¶ Battelle Pacific Northwest, 1977.

***Stradley et.al., 1975. Region X includes Alaska, Idaho, Oregon, and Washington.

†††Rhode Island Department of Health, 1977.

‡‡‡State of Texas, 1976.

§§§NA means not available.

of the state's current hazardous waste legislation (or equivalent legislation) are not available. Differences in the portion of waste disposed on-site and off-site in the various states are due primarily to factors such as differences in types of industries and wastes generated by these industries, availability of allowable on-site and off-site disposal locations, and specific state regulations and enforcement policies.

5.4 Resource Conservation and Recovery

RCRA defines resource conservation as the reduction of the amounts of solid waste that are generated, the reduction of overall resource consumption, and the utilization of recovered resources. Resource recovery is defined as the recovery of material or energy from solid waste.

This section describes typical methods used for resource conservation and recovery and the typical operations specializing in the recovery of hazardous waste. Estimates of the extent to which hazardous waste is presently being recovered or recycled are presented, along with examples of the potential for increasing the recovery and recycling of hazardous waste. Factors which have tended to constrain the recovery and recycling of hazardous waste are summarized.

5.4.1 Resource Conservation and Recovery Methods and Operations. There are three basic procedures for recovering materials and energy from potentially hazardous wastes: separation, material conversion, and energy conversion (Sittig, 1975).

Separation involves the removal of specific waste constituents using the physical and chemical treatment methods discussed in Appendix D. Material conversion involves the transformation of waste constituents from a form which is not acceptable for recovery or reuse to one that is acceptable, using the chemical treatment methods discussed in Appendix D; the waste may not be in an acceptable form due to such factors as its toxicity or its inability to yield to separation. Energy conversion involves the direct utilization of the waste as an energy source either through combustion using the incineration methods discussed in Appendix D or by using the waste to drive a chemical process.

Operations that specialize in the recovery of hazardous waste can be categorized as follows: solvent reclaimers, mercury reprocessors, metal reprocessors, petroleum rerefineries, industrial waste information clearinghouses, and industrial waste exchanges (Straus, 1977). Of these resource recovery operations, the industrial waste clearinghouses and exchanges would likely have the most direct bearing on increasing the recovery of hazardous waste. These operations are described in Appendix G.

Table 5-15 presents the nationwide distribution of these types of recovery operations. A total of 131 solvent reclaimers, eight mercury reprocessors, seven metal reprocessors, 28 petroleum re-refiners, eight industrial waste information clearinghouses, and one industrial waste exchange have been identified. The states with

TABLE 5-15

DISTRIBUTION OF HAZARDOUS WASTE RECOVERY OPERATIONS IN THE UNITED STATES*

State	Solvent reclaimers	Mercury reprocessors	Reprocessors (metal) non-mercury	Petroleum re-refiners	Industrial waste information clearinghouses	Remarks
Alabama	1					
Alaska						NA
Arizona	4					
Arkansas						NA
California	11	2		4	1 Waste Exchange	
Colorado	1					
Connecticut	1					
Delaware	1					
Florida	2			3		
Georgia	3			1	1	
Hawaii						NA
Idaho						
Illinois	14	1	1	1	1	
Indiana	5		1	1		
Iowa	7				1	
Kansas	4			1		
Kentucky	2					
Louisiana						
Maine						
Maryland	2					
Massachusetts	2	1			1	one firm ocean dumps
Michigan	9			1		
Minnesota				2		
Mississippi				1		
Missouri	4				1	
Montana						NA
Nebraska	1					
Nevada						
New Hampshire						NA
New Jersey	10	1	1	1	one firm ocean dumps	
New Mexico						NA
New York	6	1	4	1	1	
North Carolina	1					
North Dakota						NA

TABLE 5-15 (Concluded)

State	Solvent reclaimers	Mercury reprocessors	Reprocessors (metal) non-mercury	Petroleum re-refiners	Industrial waste information clearinghouses	Remarks
Ohio	10			1		
Oklahoma				1		
Oregon	3			1		
Pennsylvania	4	1		2		
Puerto Rico						NA
Rhode Island	2					
South Carolina	2					
South Dakota						NA
Tennessee	3			1	1	
Texas	8	1		3	1	
Utah				1		
Vermont						NA
Virginia			Agent for ocean-going incineration ship			
Washington	3					
West Virginia						NA
Wisconsin	5			1		
Wyoming						NA
	131	8	7	28	8	

*Straus, 1977.

the greatest activity in this area are California, with 17 reclaimers and one industrial waste clearinghouse, Illinois with 17 reclaimers and one industrial waste exchange, New Jersey with 13 reclaimers, New York with 13 reclaimers and one industrial waste clearinghouse, and Texas with 12 reclaimers and one industrial waste clearinghouse (Straus, 1977).

5.4.2 Resource Recovery and Recycling Estimates. This section discusses the quantity of hazardous waste currently being recovered and recycled and the potential for increasing the recovery and recycling of hazardous waste.

5.4.2.1 Quantities Recovered and Recycled. Extremely limited data are available as to the extent to which resource recovery from hazardous waste currently occurs in the U.S. The available data tend to be very industry and waste stream specific. As discussed below, the available data indicate that only a very small portion of the total hazardous waste stream is subject to any resource recovery, probably less than 3 to 5 percent of all such wastes. This recovery rate is similar to, but slightly less than, that for post-consumer municipal wastes. In recent years between 8 and 10 percent of the overall post-consumer municipal wastes have been recovered for recycling, with waste paper accounting for over 85 percent, by weight, of the material recovery (Office of Solid Waste, 1977b). Section 5.4.3 discusses factors that have tended to limit the recycling and recovery of all waste materials.

Table 5-16 presents examples of hazardous waste recovery and recycling practices for the manufacturing industries analyzed in the Industry Studies (1975-1978). Such practices are generally limited to the recovery of solvents, oil, metals, and energy and to some recycling of off-specification and rejected products back into the production process (see Appendix D for a more detailed discussion of recovery and recycling practices). For these industries, it is estimated that on the order of 3 to 5 percent of the total hazardous waste stream is annually subject to resource recovery (see Table 5-10).

Table 5-14 shows, for eight states and one EPA Region, the percentage of the industrial hazardous waste that is estimated to have been reclaimed in recent years. These available data indicate that four percent or less of the hazardous waste is being reclaimed in five of these states. Only in Massachusetts and EPA Region X is more than 10 percent of the hazardous waste being reclaimed.

The only specific hazardous waste components for which nationwide recovery data are available are waste oil and waste solvents. Table 5-17 indicates sources of waste oil generation and uses of this waste oil during 1972. Over 51 percent of the waste oil is estimated to have been recycled, with about 44 percent used as a fuel and about 8 percent re-refined to lube oil.

Data are not available as to the total quantity of wastes solvent generated annually; however, it is estimated that in 1974

TABLE 5-16

EXAMPLES OF HAZARDOUS WASTE RECOVERY AND RECYCLING PRACTICES IN SELECTED INDUSTRIES*

Industry	Hazardous waste stream	Reclamation practice+
Textiles (SIC 22)	Dye and chemical containers	Recycled
	Solvent and still bottoms	Solvent recovery
Inorganic chemicals (SIC 281)	Mercury contaminated wastes	Mercury recovery
	Chlorinated hydrocarbons	Used inorganic chemicals manufacture
	Chrome pigments production	Metal recovery
Pharmaceuticals (SIC 2831, 2833, and 2834)	Waste solvents	Solvent recovery; energy recovery; production of low grade fuel
	Heavy metals	Zinc and chromium recovery
Paint and allied products (SIC 285)	Discarded products and spills	Recycled in lower grade products
	Waste wash solvents	Solvent recovery

TABLE 5-16 (continued)

Industry	Hazardous waste stream	Reclamation practice†
Organic chemicals, pesticides, and explosives (SIC 286, 2879, and 2892)	Heavy ends from mitrobenzene production	Energy recovery
	Semisolid wastes from toluene diisocynate production	Energy recovery
	Sludge from lead alkyls purification	Lead recovery
	Red water	Recycled to kraft pulp mills
Petroleum refining (SIC 2911)	Crude tank bottoms	Oil recovery
	API separator sludge	Oil recovery
	Dissolved air flotation float	Oil recovery
	Slop oil emulsion solids	Oil recovery
	Spent lime	Recycled to spent acid neutralization
	FCC catalyst fines	Aluminum recovery
	Spent catalyst	Metal recovery

TABLE 5-16 (continued)

Industry	Hazardous waste stream	Reclamation practice†
Leather tanning and finishing (SIC 3111)	Trimming and shavings	Used in fertilizer, animal feed supplements, glue, leather articles
	Finishing residues	Solvent recovery
Metal smelting and refining (SIC 33)	Primary copper dusts	Metal recovery
	Primary copper slurries	Metal recovery
	Primary lead sludge	Metal recovery
	Primary zinc sludge	Metal recovery
	Primary aluminum potliners and pot skimmings	Cryolite recovery
	Iron and steel mill sludges	Iron and tin recovery
	Iron and steel mill scales	Iron recovery
	Iron and steel pickle liquor	Acid regeneration
Electroplating and metal finishing (SIC 3471)	Degreaser sludges	Solvent recovery

TABLE 5-16 (Concluded)

Industry	Hazardous waste stream	Reclamation practice†
Special machinery manufacturing (SIC 355 and 357)	Machinery wastes	Solvent recovery; metal recovery; recovery and/or reuse of oils
	Electroplating wastes	Metal recovery
	Heat treating wastes	Solvent recovery, metal recovery
Electronics components manufacturing (SIC 367)	Solvents	Solvent recovery
	Oils	Recovery and/or reuse metal recovery
	Metal scraps	Metal recovery
Storage and primary batteries (SIC 3691 and 3692)	Wastewater treatment sludge	Metal recovery
	Rejected and scrap cells	Metal recovery

* Industry studies (1975-78)
† On-site and/or off-site reclamation practices

TABLE 5-17

WASTE OIL SOURCES AND USES, 1972*

Source and uses	Quantity (million gallons)
Consumption of lube oils	
Automotive	1,100
Industrial and aviation	700
Other (includes government)	400
Total consumption	2,200
Generation of waste lube oils	
Automotive	600
Industrial and aviation	400
Other (includes government)	100
Total waste oil generation	1,100
Current uses of waste oil	
Fuel	480
Re-refined	90
Road oil and asphalt	200
Fate unknown	340†
Total	1,110

* U.S. Environmental Protection Agency, 1974
† Includes 30 million gallons of re-refining wastes

contract solvent reprocessing operations reclaimed about 270,000 metric tons of waste organic solvents and that an unknown amount of solvents was also recovered on-site by generators (Wapora, Inc., 1975). Two major categories of solvents are reprocessed. One category is halogenated solvents, such as methylene chloride, trichloroethylene, perchloroethylene, and 1,1,1-trichloroethane, which result primarily from degreasing and metal cleaning operations. The other category is non-halogenated solvents which includes aliphatic hydrocarbons, aromatic and naphthenic hydrocarbons, alcohols, ketones, and esters. These waste solvents are generated by the chemical process industry, metal cleanings and coatings operations, industrial painting operations, printing operations, solvent manufacture and distribution, and paint manufacture (Wapora, Inc., 1975).

5.4.2.2 Potential for Recovery and Recycling of Hazardous Wastes. This section discusses the potential for increased resource recovery and recycling of hazardous waste. Any evaluation of the potential recoverability of hazardous waste is complicated by the diverse nature of both the waste itself and the processes for recovering or for recycling the waste material. Because of this extreme diversity, each waste stream must be considered separately within each industry, and often on a plant-by-plant basis, in order to obtain an accurate picture of the recovery or recycling potential for that type of waste. In addition, the processes required for recovery or recycling must also be considered to determine their economic viability. The following examples are presented to illustrate the potential for increased recovery and recycling. Appendix F presents several other examples of specific waste streams that have a potential to be recoverable.

Arthur D. Little, Inc. (1976) examined the potential for transferring selected wastes from generators to other facilities that could use the waste as a feedstock.* Individual hazardous waste streams identified as having a relatively high potential for recovery or recycling are those which contain: solvents, alkalies, concentrated acids, catalysts, oils, combustibles, and high concentrations of recoverable metals. Based upon these potentially recoverable constituents, Table 5-18 presents estimates of the types and quantities of selected hazardous wastes that might have a potential for being recovered or recycled. It should be noted that the quantities in Table 5-18 are meant only as an order-of-magnitude estimate; the listed wastes were selected by Arthur D. Little, Inc. based solely upon the properties previously described, without regard to the economic or technical feasibility of their recovery; the quantities represent the estimated total amount of such wastes generated, not necessarily the amount that could realistically be expected to be recovered or recycled. The listed wastes represent about 25 percent of the hazardous waste stream from the industries included in the Industry Studies and about 3 percent of the total solid waste stream

*The hazardous wastes examined were those identified in the Industry Studies (1975-1978).

TABLE 5-18

ESTIMATED MAGNITUDE OF HAZARDOUS WASTES FROM SELECTED INDUSTRIES THAT MAY BE POTENTIALLY RECOVERABLE OR RECYCLABLE*

Industry	Waste	Potential value for recovery or recycling	Quantity as generated (metric tons/year)
Pharmaceuticals (SIC 283)	Halogenated solvents, tars, still bottoms, carbon filter aid	Degreasing solvents; cleaning or paint solvents; fuel	160,000
Paint and allied products (SIC 2851)	Spoiled paint or lacquer batches and wash solvents	Solvent recovery, upgrading	14,000
Organic chemicals pesticides, explosives (SIC 286, 2879, & 2892)	Chlorinated hydrocarbon liquid heavy ends	Degreasing solvents	247,000
	Other still bottoms	Fuel	1,600,000
Petroleum refining (SIC 2911)	Coke fines	Fuel	13,000
	FCC catalyst fines	Catalyst recovery	117,000
Leather tanning and finishing (SIC 3111)	Sludges and trimmings	Leather composites	12,000

TABLE 5-18 (Concluded)

Industry	Waste	Potential value for recovery or recycling	Quantity as generated (metric tons/year)
Primary metals (SIC 331)	Still pickle liquor	6% sulfuric acid with metals	3,500,000
Electroplating (SIC 3471)	Degreaser sludges	Solvent recovery	105,000
Special machinery manufacturing (SIC 355 & 357)	Solvents, metals, oils, acids, and alkalis	Recovery and reclamation	73,000
Primary batteries (SIC 3692)	Reject cells	Metal recovery (17-70% Zn, Hg, Pb, Cd)	1,200
	Wastewater treatment sludge	Metal recovery (40% Cr)	25
Total			5,800,000

* Modified from Arthur D. Little, Inc., 1976.

from these industries (Arthur D. Little, Inc., 1976). It should also be noted that an unknown portion of these wastes is currently being recovered (see Appendix D).

Table 5-19 shows, for selected industrial processes in SIC Code 28 and selected organic chemical wastes from these processes, potential uses to which the wastes might be recycled. Again any such use would be very dependent upon technical, economic, and environmental considerations (Arthur D. Little, Inc., 1976).

Reynolds, Smith and Hills (1977) examined the potential for energy recovery from selected wastes from eight industries. The industries were chosen based upon the following criteria: heating value of their waste, annual volume of hazardous waste generated, relative toxicity of hazardous components, and ability to use recovered energy. Table 5-20 summarizes the industries selected and the potentially hazardous waste streams studied. Table 5-21 shows the total quantity of process related wastes (hazardous and non-hazardous) from each industry, the total quantity of hazardous process waste included in the study, the estimated average heating value of the waste streams studied, the maximum energy estimated to be annually recoverable from the waste streams studied, and the estimated annual fuel savings based upon this maximum energy recovery. It should be noted that in determining the maximum recoverable energy, it was assumed that the entire waste stream would be incinerated. Of the waste streams studied, those of the paints and

TABLE 5-19

GENERATION AND POTENTIAL USE OF ORGANIC CHEMICAL WASTES*

Wastes Generated			Potential Uses
SIC code	Product manufactured/process	Waste constituents	
2869	Ethylene Glycol	Glycols and water	Solvent reclamation
2865	Phenol	Phenol, cresol, orf-spec in water	Wood preservative for boat or fence post manufacture
2865	Phenol/Cumene	Acetophenone, phenol, cumyl phenol evaporation residue	Wood preservative
2865	Iso and Tere-phthalic acids	Phthalic acid, toluic acid, benzoic acid, trimellitic acid, aldehydes, acetic acid, Bi, Mn, Co-still bottoms	Film forming in paint manufacture
2821	Acrylic acid	Aqueous acrylic acid and hydroquinone	Acrylic emulsion paints
2865	Phthalic anhydride/xylene	Pitralic anhydride/maleic anhydride tar	Polymeric binder for shingles wood chips, grinding wheels, retractory bricks, etc.
2865	Maleic anhydride	Maleic anhydride tars	Polymeric binder
2879	Carbaryl	Naphthol residues	Dye intermediate
2869	Aromatic amines	Long chain amines (solid)	Ore Benefication
2843	Surface active agents	C-8-C-18 fatty alkyl acids, nitriles, amines	Ore Benefication
2821	SANpolymers	Styrene and acrylonitrile	Film forming Molding Compounds
2869	Ethylene dichloride (EDC)	EDC, tri- and tetra-chloroethanes; sludge	Dry cleaning Degreasing of metal parts
2869	Hexachlorocyclobutadiene	Chlorinated toluenes, pentanes, benzenes	Degreasing solvents
2869	Perchloroethylene (Perc)	Perc., CCl_4 chlorinated hydrocarbons-liquid still bottoms	Dry cleaning solvents Degreasing solvents
2833	Pharmaceuticals	Various solvent wastes-chlorobenzene, toluene, methanol, methylene dichloride, tetrachloroethane	Solvent recovery Degreasing Cleaning Paints
2869	Sulfonic Acids	Emulsified oils and sulfones	Leather lubricant and treatment
2822	Urethane	Mixed polyols and phosphate esters	Molding compound Filler for wood, wallboard
2869	Tetraethylorthosilicate	Tetraethyl orthosilicate, iodine, alcohol, Genusolu D	Stone or concrete preservation Mortar Paints
2833	Penicillin	Butyl acetate and butyl alcohol	Solvent reclamation (done routinely)
2833	Alkaloids	Chlorinated solvents	Degreasing Reclamation
2865	Nitrobenzene	Benzene, nitrobenzene stripping	Paint Formulation Degreasing
2869	Ethyl chloride	Ethyl chloride, chloroethanes,	Paint remover solvents
2869	Epichlorohydrin	trichloroethylene, etc. - liquid still bottoms	Degreasing
2821	Methyl methacrylate	Hydroquinone; polymer heavy ends	Paper board binder
2869	Dicumyl peroxide	Organic perioxides	Paint industry-film formers

*Arthur D. Little, Inc., 1976.

TABLE 5-20

INDUSTRIES AND HAZARDOUS WASTE TYPES STUDIED FOR ENERGY RECOVERY POTENTIAL*

Industry	Types of hazardous wastes considered
Organic chemicals SIC 286	Distillation column bottom sludges, evaporator residues, filter residues
Plastics SIC 282	Distillation column bottoms
Pharmaceuticals SIC 283	Waste solvents (halogenated and non-halogenated, organic chemical residues, contaminated inerts
Petroleum refining SIC 291	Tank bottoms, API separator sludges, DAP sludges, slop oil emissions
Tires and inner tubes SIC 301	Floor sweepings, air pollution equipment dust
Fabricated rubber products SIC 306	Air pollution equipment dust, floor sweepings
Paints and allied coatings SIC 285	Solvent recovery still bottoms, waste solvents
Solvent reclaiming	Distillation column bottoms

*Reynolds, Smith and Hills, 1977.

TABLE 5-21

ESTIMATED ANNUAL WASTE QUANTITIES AND TOTAL RECOVERABLE ENERGY*

Industry (SIC code)	Total process related wastes (10^3 metric tons) (1977)†	Total hazardous wastes considered (10^3 metric tons)	Average heating value**		Maximum total recoverable energy (1977)		Annual fuel savings (10^3 equivalent barrels of oil)
	Wet	Wet	KCal/Kg	Btu/lb	KCalx10^{12}	Btux10^{12}	
Organic Chemicals (286)	10900‡	3430	3900	7040	8.05	31.9	6700
Plastics (282)	2335	¶	¶	¶	¶	¶	¶
Petroleum Refining (291)	1504	758	6010	10820	2.73	10.8	2275
Tires & Inner Tubes (301)	236	223	7220	13000	0.97	3.8	808
Fabricated Rubber Products (306) (Dry Process Only)	210	210	7410	13340	0.93	3.7	778
Paints & Allied Coatings (285)	450	14	8300	14940	0.11	0.44	88
Solvent Reclaiming (No SIC Code)	72	72	6940	12500	0.30	1.20	253
Pharmaceuticals (283)	1910§	66	6180	11120	0.25	1.0	204

* Reynolds, Smith and Hills, 1977
† Includes hazardous and non-hazardous wastes
‡ This includes those streams which are diluted for hydraulic transport for deep well injection or lagooning. Practically all wastes streams (ca.98%) are dry as discharged from the process.
§ This contains large quantities of mycellium which are non-hazardous.
¶ Not determinable
** For purpose of comparison, bituminous coal has a higher heating value of approximately 6,200 KCal/kg (12,000 Btu/lb)

allied coatings industry (SIC 285) had the highest estimated heating value--8,300 KCal/kg (14,940 Btu/lb)--and those of the organic chemicals industry (SIC 286) had the lowest estimated heating value--3,900 KCal/kg (7,040 Btu/lb). These heating values can be compared with an approximate higher heating value of 6,700 KCal/kg (12,000 Btu/lb) for bituminous coal.

The Reynolds, Smith and Hills study found that the organic chemicals, plastic, petroleum refining, pharmaceuticals, paint, and solvent reclaiming industries have considerable potential for incineration with heat recovery. The study found that the tire and fabricated rubber industries do not have a high potential due to the fact that the hazardous waste from these industries consists primarily of floor sweepings with a large ash content.

5.4.3 <u>Constraints to Resource Conservation and Recovery.</u> There are several basic factors that have tended to limit the application of resource conservation and recovery measures to waste in general and to hazardous waste in particular. These factors include: national policies favoring the use of virgin materials, economics, technological considerations, and institutional constraints.

The Federal government has historically played a major role in stimulating natural resource development. Special tax laws relating to mining and forestry and Federal subsidies for raw materials exploration, research, and development all have favored virgin raw materials and encouraged a materials-intensive economy. In addition, a number of laws and agency policies have tended to discriminate against recovered or recycled materials and waste reduction measures (Office of Solid Waste, 1977b). Similarly, most state laws have either tended to favor the use of virgin materials or not to have encouraged the recovery and recycling of waste materials.

Economic factors affecting resource recovery and recycling include both the cost of recovery and the cost of the transportation required to bring the waste where needed, as well as the relationship of recovery costs to disposal costs and to costs of virgin materials. As indicated above, tax laws and subsidy policies have tended to favor the use of virgin materials. Furthermore, due to the nature of most waste, recovery costs have tended to be high compared both to disposal costs under existing practices and to virgin material costs, thus also favoring the use of virgin materials (see Appendix F). Historically, environmental costs from inadequate hazardous waste disposal practices have tended to be borne by society in general or by third parties rather than by the waste generators whose disposal practices have caused damages; as a result, such costs have not generally been included in the economic decision process. Furthermore, the very limited data on the location and quantities of wastes available for recycling and on the specific characteristics of the diverse waste materials have tended to limit markets for waste recycling (Office of Solid Waste, 1977b; Arthur D. Little, Inc., 1976; Sittig, 1975).

Development of technologies for the recovery and for the reuse or recycling of waste materials have tended to lag behind the development of technologies for utilizing virgin materials due to the factors discussed above. Technologies for recovering and reusing many waste materials are still in a conceptual stage or have not been commerically demonstrated (Versar, Inc., 1977; Arthur D. Little, Inc., 1976; Sittig, 1975).

Institution factors include the general lack of industrial, institutional, and public acceptance or encouragement of resource recovery practices. For example, some generators hesitate to release waste to others for recycling purposes for fear either of possible injury to their reputation for quality or of legal liability for incidents associated with the transfer (Arthur D. Little, Inc., 1976). Federal agency policies and standards have also tended to discriminate against the use of recycled materials (Office of Solid Waste, 1977b). There have also been few formalized programs by industry to encourage resource recovery, especially with regard to potentially hazardous waste. The National Ash Association, for example, has a formalized program and has estimated that ash recycling has risen to 20 percent from 12.3 percent in a recent 10-year period (National Ash Association, 1977).

6.0 QUANTITIES OF HAZARDOUS WASTES GENERATED AND CONTROLLED

This chapter presents estimates of the quantities of hazardous waste currently generated by both manufacturing and non-manufacturing sectors, estimates of hazardous waste generation in 1980 and 1984, discussions of the magnitude of hazardous spills, and a discussion of the amount of wastes currently under various aspects of state control.

6.1 Current Hazardous Waste Generation

Estimation of the amount of hazardous wastes which is currently generated in the United States is complicated by a lack of comprehensive data. Data which are available are usually based on surveys performed by many different groups with difference objectives who consequently used varying definitions for hazardous wastes.

6.1.1 Manufacturing Industries. For the purpose of estimating hazardous waste generation by the manufacturing industries at the national level, data from the nine most consistent sources were used to calculate generation factors for industry groups categorized by the 2-digit SIC (Standard Industrial Classification) codes 20, 22-39. The sources used represented data from eight states and one EPA region:

- Illinois (Personal communication, S. Miller, Ohio Environmental Protection Agency, 1977)
- Kansas (State of Kansas, 1977)
- Maryland (State of Maryland, 1977 and 1977a)
- Massachusetts (Fennelly, et al., 1976)
- Minnesota (Battelle, Pacific Northwest, 1977)
- Mississippi (State of Mississippi, 1975)

- Texas (Personal communication, J. Carmichael, Texas Division of Solid Waste Management, 1977)
- Washington (State of Washington, 1974)
- EPA Region X (Stradley, et al., 1975)

The generation factors were derived based on the assumption that the ratio of the amount of hazardous wastes generated by an industry to the number of employees in that industry is approximately constant among all establishments in each industry (as grouped at the 2-digit SIC code level). The methodology used is presented in Appendix H, along with a description of each data source and a discussion of the assumptions and limitations. As discussed in Appendix H, inaccuracies may have resulted from inconsistencies in data sources, possible biases in the coverage of industries, errors introduced in the state surveys, over-generalization of industry groups, and from variations in actual hazardous waste generation per employee within industry groups. Nevertheless, it is felt that the computed generation factors represent the best presently available method of estimating the total quantities of hazardous wastes generated by manufacturing industries in the U.S. The generation factors were used with U.S. census data (U.S. Department of Commerce, 1977) to estimate the amounts of hazardous wastes generated by each industry in each EPA Region. Table 6-1 summarizes the estimates by SIC code.

Based on these estimates, the manufacturing industries generated approximately 47.5 million metric tons of hazardous wastes during 1975. Approximately 60 percent of this, or about 28.7 million metric tons, was generated by industries in SIC code 28 (Chemicals and

TABLE 6-1

SUMMARY OF HAZARDOUS WASTE GENERATED BY EPA REGION -- 1975*
(1000 metric tons per year)

Standard Industrial Classification	ENVIRONMENTAL PROTECTION AGENCY REGION										Total	Percent of Total	Ranking
	I	II	III	IV	V	VI	VII	VIII	IX	X			
20 Food and kindred products	10	25	30	45	70	30	25	9.0	35	15	290	0.5	10
22 Textile mill products	10	10	15	100	3.5	2.5	0.5	<0.5	2.0	0.5	140	0.5	15
23 Apparel and other textile products	7.0	30	20	40	10	10	4.0	1.0	10	1.0	130	0.5	16
24 Lumber and wood products	4.0	3.0	7.0	20	10	8.0	2.5	2.0	8.5	20	80	<0.5	18
25 Furniture and fixtures	9.5	20	25	75	50	15	7.5	1.5	25	2.5	240	0.5	12
26 Paper and allied products	290	350	290	530	760	200	120	10	180	130	2,870	6	4
27 Printing and publishing	9.0	20	15	15	30	8.0	8.5	3.0	10	2.5	130	0.5	17
28 Chemicals and allied products	1,060	5,290	3,600	5,920	5,770	3,270	1,230	170	1,880	460	28,700	60	1
29 Petroleum and coal products	25	95	85	50	160	330	45	30	110	20	950	2	7
30 Rubber and misc. plastics products	20	25	20	35	75	15	10	2.0	20	2.0	220	0.5	13
31 Leather and leather products	130	95	70	90	120	35	85	8.5	10	1.5	640	1.5	9
32 Stone, clay and glass products	65	160	210	230	350	120	60	35	130	30	1,390	3	6
33 Primary metal industries	140	290	870	350	1,520	190	110	75	200	95	3,830	8	3
34 Fabricated metal products	140	170	180	180	700	150	85	20	160	25	1,800	4	5
35 Machinery, except electrical	370	450	400	420	1,830	350	290	80	400	60	4,650	10	2
36 Electric and electronic equipment	20	30	20	25	55	10	9.0	1.5	25	1.0	200	0.5	14
37 Transportation equipment	65	55	60	80	350	60	60	10	150	45	940	2	8
38 Instruments and related products	10	15	5.5	4.0	15	2.0	2.0	1.5	8.0	1.5	65	<0.5	19
39 Misc. manufacturing industries	40	55	20	35	60	15	10	6.0	20	5.0	270	0.5	11
TOTAL†	2,440	7,190	5,940	8,240	11,900	4,810	2,170	470	3,380	920	47,500		
Percent of Total	5	15	13	17	25	10	5	1	7	2			

*These numbers are estimated based upon the generation factors as derived in Appendix H.

†Totals may not balance due to rounding of numbers.

Allied Products). The next largest generators were industries in SIC codes 35 (Machinery, except Electrical), 33 (Primary Metal Industries), and 26 (Paper and Allied Products), with about ten, eight, and six percent of the total U.S. generation, respectively.

Also indicated in Table 6-1, about 25 percent of the wastes are generated in the six north-central states of EPA Region V, while the eight southeastern states of EPA Region IV account for about 17 percent. Application of the generation factors to individual state employment indicates that seven states account for approximately half of the total U.S. generation. These states are in alphabetical order:* California, Illinois, New Jersey, New York, Ohio, Pennsylvania, and Texas. Following the national pattern, most (46 to 83 percent) of the hazardous wastes generated in these five states are produced in SIC code 28, with industries in SIC codes 35 and 33 ranking either second or third. These three industry groups account for between 73 and 90 percent of the hazardous wastes generated in each of the five states.

6.1.2 Other Potentially Hazardous Wastes. In addition to the manufacturing industries, there are numerous other sources generating potentially hazardous waste. This section discusses various non-manufacturing waste categories that have been identified by previous studies as containing potentially hazardous waste and

*Since the generation factor approach relies to a large extent on averaging over large areas, its accuracy decreases when applied to smaller areas such as states. Therefore, individual estimates of waste generation are not presented on a state-by-state basis.

presents the best available estimates on the quantity of potentially hazardous waste generated within these waste categories.

It should be recognized that there is a wide variation in the degree of hazard associated with the waste categories discussed in this section and that this variation exists both among and within the different waste categories. Data are incomplete with regard to both the amount of waste generated within specific categories and the protion of waste within each specific category that is associated with any particular degree of hazard. It is not meant to be implied that all the waste generated within each category discussed would be identified as a hazardous waste under Subtitle C, nor even that all categories would contain any waste identified as hazardous under Subtitle C.

Categories of potentially hazardous waste from non-manufacturing sources include non-industrial waste oils, hospital wastes, agricultural wastes, household wastes, military wastes, fly ash, oil well brines and muds, cement kiln dusts, dredge spoils, and phosphate slimes. Additionally, administrative and other governmental agencies often engage in activities such as research and demonstration projects and pest control, which produce significant amounts of hazardous wastes.

Table 6-2 and the followng discussion present estimates of the quantities of waste generated within each of the above categories and, to the extent practical, estimates of the portion of the waste

TABLE 6-2

ESTIMATED ANNUAL GENERATION OF NON-MANUFACTURING WASTES IDENTIFIED AS INCLUDING POTENTIALLY HAZARDOUS WASTE

Waste Stream/Source	Volume* (million metric tons)	Reference
Waste oils	2.5	Based on U.S. EPA, 1974 and U.S. D.O.C., 1977c
Service stations	1.3	Battelle Columbus Labs, 1978
Hospitals	.06†	Battelle Columbus Labs, 1978;
	1-2†	Based on Singer et al., 1973; and Kiefer, 1974
Pesticide containers	.02†	Trask, 1977
Households	10.5†	Based on person communication, Morris, OSW, 1977 and U.S. D.O.C., 1977b.
U.S. Armed Forces	Not Avaiable	
Coal ash - total	54	Faber, 1976
Fly ash	38	
Bottom ash	12	
Boiler slag	4	
Oil brines	1.9	OSWMP, 1977
Drilling muds	2.3	Environmental Research Co., 1978
Cement kiln dust	13	Personal communication, Portalnd Cement Assoc., 1978 and U.S. EPA, 1973
Dredge spoils		
Corps of Engineers	330-420	Council of Environmental Quality, 1975
Other	210	American Society of Civil Engineers, 1977
Phosphate slimes		
Tailings and beneficiation	82	Personal communication,Palm, G. F. Palm Assoc., 1978
Phosphoric acid production	20-27	Environmental Quality Systems, 1976; and U.S. EPA, 1974a
Administrative/government	Not Available	

*Except as noted, it is not yet known how much, if any, of the total quantity of each waste generated may in fact be hazardous waste. See text.
†Includes only that portion of total waste estimated to be hazardous.

within each category that is potentially hazardous. It should be recognized, however, that the portion of waste actually meeting the definition of hazardous waste under Subtitle C may be significantly different.

The primary sources of non-industrial waste oils are from the transportation industry. The U.S. Environmental Protection Agency (1974) estimates indicate that about 56 percent of the automotive and aviation oils sold in 1972 were not consumed and hence became waste oils. Applying this factor to the total U.S. 1975 automotive and aviation oil sales (1.2 million gallons - U.S. Department of Commerce, 1977c) yields an estimated waste oil generation of 2.5 million metric tons per year. This is approximately twice the Battelle Columbus Laboratories (1978) estimate of 1.3 million metric tons from service stations alone.

Battelle Columbus Laboratories (1978) estimates the annual 1977 hazardous waste generation from hospitals as 58,000 metric tons. If the rapidly increasing volumes of disposable items are included, this number could reach 1 to 2 million metric tons (based on data from Singer et al., 1973; Kiefer, 1974).

The primary hazardous wastes associated with agricultural activities are used pesticide containers which still contain residual amounts of pesticides. Based on information compiled by Trask (1977), approximately 98 million pesticide containers (mostly bags) were used in 1971 by 2.5 million farmers. The total container weight (empty) was estimated at 20,000 metric tons. Additionally, it was estimated that 39 percent of the farmers using pesticides hired custom application services, and only 5 percent rinsed their containers. Other estimates (Energy Resources Co., 1978) are that 25 to 40 million small containers (made of glass, plastic, or metal) and 250,000 to 500,000 large containers (30 to 50 gallon steel drums) are used annually.

Based on an estimated hazardous waste generation of 7.5 pounds per/household per year (Personal communication, M. Morris, Office of Solid Waste, 1977) and 1975 Census data (U.S. Department of Commerce, 1977b), hazardous waste generation by individual households could reach 10.5 million metric tons per year. This figure may include some of the waste automotive oils discussed above, plus various cleaning fluids, caustics, pesticides, and miscellaneous chemicals.

The amounts of hazardous wastes generated by the U.S. Armed Forces is unknown. However, the armed forces own and operate many of their own supply and maintenance facilities, including munitions plants, chemical production facilities, metal plating shops, and foundries. The military services maintain large stockpiles of munitions which must be periodically replaced due to deterioration. Additionally, the military services store large quantities of unused and retrograde chemicals, primarily pesticides, which no longer have valid registration for use or have deteriorated. It can therefore be expected that the amounts of hazardous wastes generated or stored by the military are large and may approach the amounts produced by all the manufacturing industries combined. Most of the services are beginning to survey their hazardous waste generation as of the fall of 1978.

Estimates of the 1975 U.S. coal ash production are on the order of 38 million metric tons of fly ash, 12 million metric tons of bottom ash, and 4.2 million metric tons of boiler slag (Faber, 1976). Of these amounts, about 8.9 million metric tons (16.3 percent) was utilized in secondary products, primarily in the cement and concrete, and in the manufacture of lightweight aggregates (Faber, 1976). The inclusion of many of the potentially toxic trace elements and other constituents (e.g., complex organic compounds) originally contained in the coal may result in the designation of at least some ash as hazardous.

The U.S. Army Corps of Engineers either conducted or contracted for the dredging of between 310 and 390 million cubic yards (330 to 420 million metric tons) of bottom materials per year during the period 1970 through 1975 (Council on Environmental Quality, 1975). Of this, at least 24.8 million cubic yards (29 million metric tons) was considered contaminated (U.S. Army Corps of Engineers, 1977). An additional estimated 200 million cubic yards (210 million metric tons) are dredged annually by port authorities, municipalities, and other government agencies (i.e., U.S. Navy and Coast Guard) (American Society of Civil Engineers, 1977).

Industry sources estimate that 120 million metric tons of overburden and 82 million metric tons of tailings, clay, and mud ball slimes (excluding overburden) are generated each year from phosphate mining and beneficiation operations in Florida (the source of 78 percent of the phosphate rock mined in the U.S.) (Personal communication, G. Palm, Gordon F. Palm and Associates, 1978). In addition, estimates of the annual gypsum slime waste generation from phosphoric acid production range from 20 million metric tons per year (Environmental Quality Systems, Inc., 1976) to about 27 million metric tons per year (U.S. Environmental Protection Agency, 1974a). These wastes are generally radioactive, and contain fluorine and trace contaminants. The gypsum slimes from acid production also exhibit very low pH.

The amounts of hazardous wastes generated by non-military government agencies are not known. Typical potentially hazardous wastes generated by such agencies include unused pesticides, empty pesticide containers, waste oils and solvents, paint sludges, petroleum wastes, laboratory wastes, expired and unusable medicines, pathological and infectious wastes, and other miscellaneous chemical wastes. Bourns et al. (1978) reported that non-military Federal agencies in Region IX generate at least 5,000 metric tons/year (including 3,600 metric tons of drilling muds), stating that the "quantities estimated probably are considerably less than those actually generated".

The wastes discussed in this section do not represent all of the potentially hazardous non-manufacturing wastes generated in this country. Other sources include mining operations; construction companies; dry cleaning plants; testing, research, and development laboratories; cleaning, disinfecting, and exterminating services; retailers and wholesalers of drugs, chemicals, paints, solvents, and other products; marinas; and others. Although data on generation from these sources are sparse, it can be concluded that the total amounts of potentially hazardous wastes from non-manufacturing industries are very large (on the order of several hundred million tons) and could greatly exceed the 50 million metric tons attributed to the manufacturing industries.

6.2 Hazardous Waste Generators

U.S. Census data indicate that there were 313,000 establishments engaged in the manufacturing industries in 1972 (U.S. Department of Commerce, 1976). SIC codes 27 (Printing and Publishing) and 35 (Machinery, except Electrical) contained the largest number of establishments with about 40,000 each. SIC codes 24 (Lumber and Wood Products) and 34 (Fabricated Metal Products) accounted for 34,000 and 30,000 of the establishments, respectively. SIC code 28 (Chemicals and Allied Products), the largest generators, ranked tenth in the number of establishments with 11,000.

Figure 6-1 shows the cumulative size distribution of hazardous waste genrators in the manufacturing industries. The horizontal axis represents the annual waste generation of a single establishment, and the vertical axis represents the percentage of establishments which generate more than that value. Figure 6-2 shows the cumulative

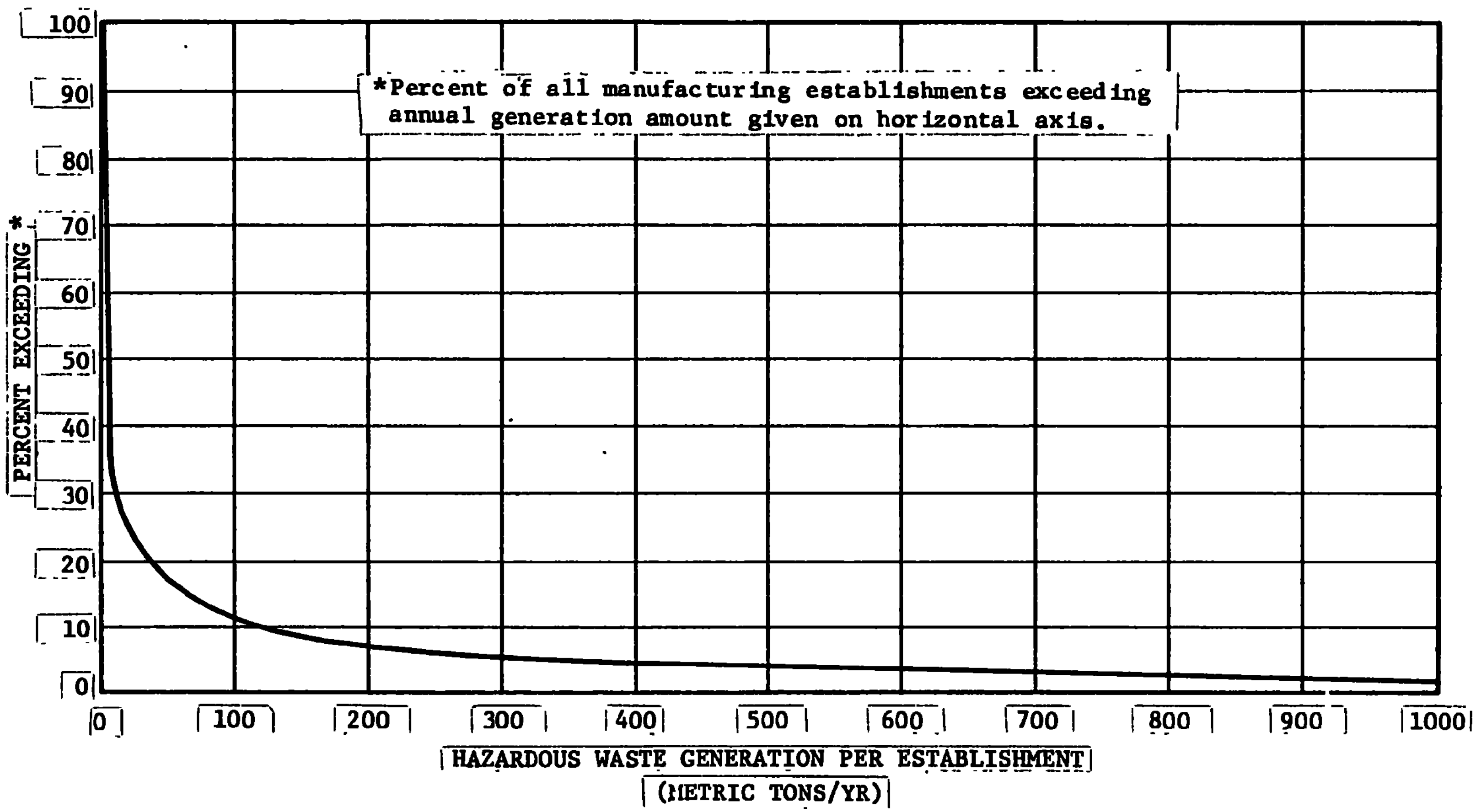

FIGURE 6-1
CUMULATIVE SIZE DISTRIBUTION OF HAZARDOUS WASTE GENERATORS 1975

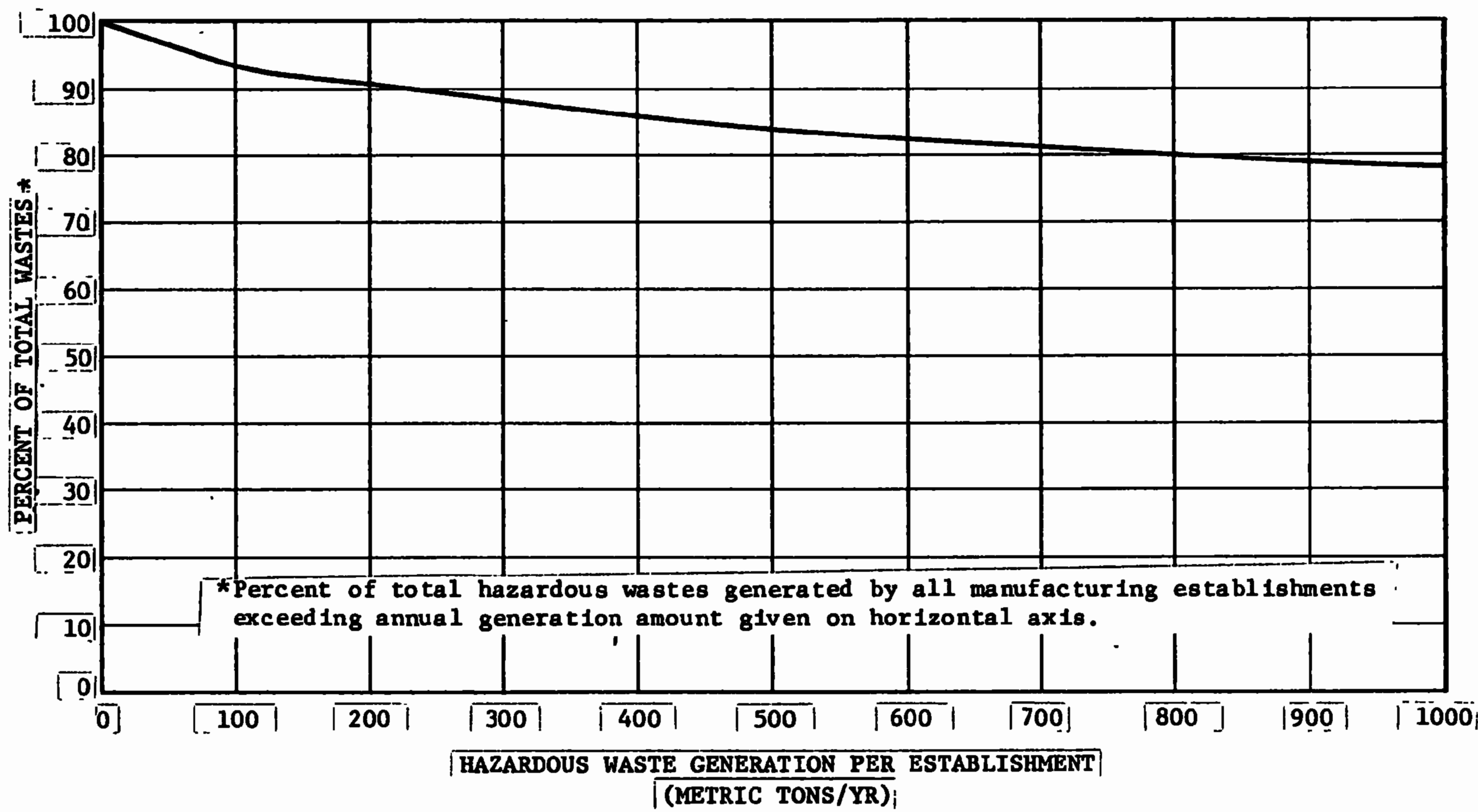

FIGURE 6-2
CUMULATIVE HAZARDOUS WASTE DISTRIBUTION 1975

percentage of the total amount of hazardous wastes generated as function of firm size (i.e., the fraction of total wastes generated by all establishments exceeding a particular annual generation value). These figures are plots of the output of the cycling option of the phasing program as described in Appendix I. They were based on the generation factors developed in Appendix H and on the U.S. manufacturing establishment size distribution data published by the U.S. Department of Commerce (1976 and 1977). Examination of the two figures reveals that although less than three percent of the manufacturing establishments generate more than 1,000 metric tons of hazardous wastes per year, those establishments account for 78 percent of the total hazardous manufacturing wastes generated in the U.S. Similarly, the 25 percent of the establishments which generate more than 25 metric tons per year are responsible for about 98 percent of the total hazardous wastes. It should be noted that these estimates are subject to several important assumptions, the implications of which are discussed in Appendices H and I. Additionally, they do not account for the relative hazardousness of different waste streams.

6.3 Estimation of Future Hazardous Waste Generation

1980 has been selected as the base year, and 1984 as the target year for estimating the full impacts of implementation of the Subtitle C regulations. Estimates of the rate of increase of hazardous waste generation were developed using data presented in the Industry

Studies (1975-1978) discussed in Chapter 5.* The total increase in hazardous waste generation projected by these studies between 1974 and 1983 is 42 percent, or about 3.6 percent per year. Much of this increase is attributed primarily to increased sludge volumes resulting from the more effective air and water pollution equipment being brought on line in response to recent environmental legislation. Many other factors also affect future hazardous waste generation, but there are no reliable means of estimating their effects. These factors include changes in manufacturing processes, increased use of coal and synthetic fuels, and growth in manufacturing industries in general. Although different industries will be affected to different degrees, the average rate of 3.6 percent per year has been applied to all SIC groups in the absence of more complete data. The resulting estimated annual hazardous waste generation from manufacturing industries is about 57 million metric tons in 1980 and 65 million metric tons in 1984.

6.4 Hazardous Spills

Spills of hazardous materials need to be handled as hazardous wastes regardless of whether the spilled material was originally a

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*The Industry Studies (1975-1978) are a set of studies of hazardous waste generation in 13 major industrial segments. They were performed by individual contractors using their own definitions for hazardous wastes. As a result of the differences in definitions and the incomplete coverage of potential waste sources, these studies were not used in the development of the hazardous waste generation factors. However, it was assumed that the rate of increase of hazardous waste generation projected by the studies was applicable to all hazardous manufacturing wastes as estimated using the generation factor approach.

waste or a valued product. In addition to the volume of material spilled, a much larger volume of soil, water, and/or sorbent or other cleanup material often also becomes contaminated. In most cases, such contaminated materials must also be considered and handled as hazardous wastes.

As discussed in Chapter 2, the responsiblity for documentation of, and dealing with, hazardous spills is presently divided between the U.S. Coast Guard (USCG), Department of Transportation (DOT), and the Environmental Protection Agency (EPA). All releases of hazardous materials (as defined in 49 CFR 172) during the course of transportation must be reported to DOT's Hazardous Material Regulation Board. All discharges of hazardous quantities of oil or hazardous substances (as defined in 40 CFR 116 and 118) to navigable wastes must be reported to the National or Regional Response Centers or to regional offices of either EPA or USCG. Spills of materials not meeting the definitions cited above, and spills which are not related to transportation and which do not threaten the broadly interpreted "navigable waters" are not presently subject to reporting requirements.

Table 6-3 presents statistics on the spill incidents reported to EPA during the one year period from February 1977 to February 1978. Since the regulations listing hazardous wastes subject to reporting requirements (40 CFR 116) were not promulgated until March 1978, the non-oil wastes listed in the table were reported voluntarily. Of the 75 cases presented, 39 are either exclusively oil spills or are oil

TABLE 6-3

EPA HAZARDOUS SUBSTANCES SPILL FILE SUMMARY
(FEBRUARY 1977 - FEBRUARY 1978)*

Date of Reported Occurrence	Material Spilled	Quantity Spilled	Upland or Waterway Spill	Type of Spill	Geographic Location
3 Feb 1977	NR 6 oil	10,000 gallons	Waterway	Barge went aground	Perth Amboy, NJ
3 Feb 1977	NR 6 oil	500 gallons	Waterway	Heating plant	Washington, D.C.
3 Feb 1977	Oil	2,000 gallons	Waterway	Barge spill	Buzzards Bay, MA
3 Feb 1977	Oil	134,000 gallons	Waterway	Tanker spill	Marcus Hook, PA
21 Mar 1977	Oil	546,000 gallons	Waterway	Tanker spill	Atlantic Ocean
21 Mar 1977	Heavy crude oil	32,000 gallons	Waterway	Tanker spill	Guayanilla Bay, PR
21 Mar 1977	Gas	131,100 gallons† 38,000,000 cu ft†	Waterway Air	Gas well blowout	Louisiana/Texas
21 Mar 1977	Oil	210,000 gallons	Waterway	Holding tank & separator system	Oregon, Ohio
29 Mar 1977	Oil and PCBs	600,000 gallons	Upland	Lagoon overflow	Oswego, NY
30 Mar 1977	Hexachlorocyclo-pentadiene	25,000 tons sludge	Upland	Sewage treatment discharge	Louisville, KY
31 Mar 1977	Ammonium nitrate	3.5 tons‡ (1,750 gal)	Waterway	Railroad spill	Rockingham, NC
31 Mar 1977	Oil (NR 6)	21,000 gallons	Waterway	Pipeline break	Ventura River, CO
31 Mar 1977	Crude oil	20,580 gallons	Waterway	Pipeline break	Hardin County, TX
1 Apr 1977	Ammonium nitrate	Unknown	Air	Railroad spill	Rockingham, NC
1 Apr 1977	Formaldehyde	20,000 gallons	Waterway	Railroad spill	Sanford, NC
11 Apr 1977	PCB and oil	2,500 drums	Waterway	-	Diltmer, MD
11 Apr 1977	Crude oil	42,000 gallons	Waterway	Pipeline break	White Oak, TX
11 Apr 1977	NR 2 oil	2,000 gallons	Waterway	Barge spill	Philadelphia, PA
11 Apr 1977	Oil	2,000 gallons	Waterway	Ship spill	San Francisco, CA
11 Apr 1977	Oil	Unknown	Waterway	Unknown	Cape San Martin, CO
22 Apr 1977	Oil	Unknown	Waterway	Unknown	Del. Bay, NJ
29 Apr 1977	Oil	Unknown	Waterway	Unknown	Key West, FL
10 May 1977	Sodium sulfide	3.5 tons	Waterway	Company spill	New Martinsville, VA
13 May 1977	Crude oil	8,400-10,500 gallons	Upland	Company spill	Ventura County, CA
13 May 1977	Crude oil	16,800 gallons	Waterway	Pipeline break	Grant County, OK
19 May 1977	Anhydrous ammonia	15,000 gallons	Waterway and air	Railroad spill	Mississippi
19 May 1977	Ethyl benzene	Unknown	Waterway and air	Unknown	Baltimore, MD
19 May 1977	NR 6 oil	1,000 gallons	Waterway	Barge spill	Mississippi River
3 Jun 1977	2 ethyl, 4 methyl, 1,3, dioxolane, toluene, xylene, methylene chloride, heptane, iso-butyl acetate, acetone, mineral spirits	Unknown	Waterway	Chemical company discharge	Lenoir, NC
3 Jun 1977	Crude oil	16,800 gallons	Waterway	Pipeline break	Crockett, TX
6 Jun 1977	Oil and chemicals	9-10,000 gallons oil 24-30,000 gallons chemicals	Waterway	Storage tank spill	Kernersville, NC
10 Jun 1977	Oil and pollutants	175,000 gallons	Waterway	Lagoon spill	Weirton, WV
24 Jun 1977	Naptha	Unknown	Waterway	Company spill	Akron, OH
28 Jun 1977	Oil	5,000 gallons	Waterway	Barge spill	Yorktown, VA
28 Jun 1977	NR 6 oil	168,000-210,000 gallons	Waterway	Barge spill	Calcasiew, LA
5 Jul 1977	PCB	165 gallons	Upland	Company spill	Brookwood, AL
5 Jul 1977	Crude oil	12,600 gallons	Waterway	Pipeline spill	Stuart, OK

TABLE 6-3 (Concluded)

Date of Reported Occurrance	Material Spilled	Quantity Spilled	Upland or Waterway Spill	Type of Spill	Geographic Location
6 Jul 1977	Acidic ferric chloride	300 gallons	Waterway	Company spill	Port Washington, WI
6 Jul 1977	Crude oil	42,000	Waterway	Pipeline spill	Upshur County, TX
6 Jul 1977	Oil	38,000 gallons	Upland and waterway	Company spill	Rainey Park, NY
7 Jul 1977	Acrylic/styrene polymer emulsion	280,000 gallons	Waterway	Company spill	Dartmouth, MA
13 Jul 1977	Hydrobromic acid	10,000 pounds	Upland and waterway	Tank truck spill	Rockwood, TN
20 Jul 1977	Malathion	550 gallons	Upland	Plane crash	Sheridan, WY
25 Jul 1977	Oil	20,000 gallons	Waterway	Natural flood	Johnston, PA
28 Jul 1977	Tritium	9,000 gallons	Waterway	Nuclear power plant spill	Pittsburg, PA
28 Jul 1977	Crude oil	60,000 gallons	Waterway	Pipeline break	Anaheim, CA
16 Aug 1977	Xylene	Unknown	Waterway	Barge spill	Mile 161, LA
16 Aug 1977	Latex magnesium sulfate; paradichlorobenzene, monoisopropanolamine; methyl acetate propadiene, monochlorobenzene, caustic liquid; denatured alcohol	Unknown	Waterway	Railroad spill	Novi, Mi
22 Aug 1977	Oil	Unknown	Waterway	Unknown	Ocean City, MD
23 Sep 1977	Methychlor lindane; endrin	Unknown	Waterway	Unknown	N. Miami Beach, FL
28 Sep 1977	Ammonium nitrate	Unknown	Upland and waterway	Railroad spill	Kennesaw, GA
11 Oct 1977	PCB and oil	Unknown	Waterway	Company spill	Philadelphia, PA
2 Nov 1977	Crude oil	21,000-126,000 gallons	Waterway	Company spill	Kansas City, MD
4 Nov 1977	Gasoline	8,000 gallons	Waterway	Tank truck spill	Alexandria, VA
10 Nov 1977	Anhydrous ammonia	Unknown	Upland, waterway and air	Railroad spill	Pensacola, FL
18 Nov 1977	Acrylamide	5,000-6,000 gallons	Waterway and air	Tank truck spill	Evergreen, AL
1 Dec 1977	Hydrogen peroxide ammonia	Unknown	Waterway and air	Railroad spill	West Virginia
7 Dec 1977	Acrylonitrite	8,000-20,000 gallons	Waterway	Railroad spill	Frankfort, KY
9 Dec 1977	Benzene trichloride, ethyl acetate, nitrobenzene; PCB	Unknown	Upland	Company spill	Logan Township, NJ
13 Dec 1977	Xylene	84,000 gallons	Waterway	Pipeline spill	Danville, IL
5 Jan 1978	Sulfurtrioxide	Unknown	Air	Company spill	Baltimore, MD
10 Jan 1978	Gasoline; #2 fuel oil	495,000 gallons	Waterway	Barge spill	Long Island, NY
11 Jan 1978	Gasoline	10,000 gallons	Waterway and air	Company spill	Hertford, NC
11 Jan 1978	Crude oil	12,600 gallons	Upland	Company spill	Dansville, MI
16 Jan 1978	Tetrahydroturan	300 gallons/hr	Upland	Railroad spill	Uhrichsville, OH
16 Jan 1978	Crude oil	12,000,000 gallons	Waterway	Tanker spill	Sao Paulo, Brasil
19 Jan 1978	Methyl ethyl ketone, acetone, caustic soda	20,000 gallons	Waterway	Railroad spill	Milstead, AL
19 Jan 1978	Acetaldehyde	14,000 gallons	Waterway	Railroad spill	Pond Eddy, PA
26 Jan 1978	Assorted chemicals	150,000,000 gallons	Waterway	Lagoon spill	Pascagoula, MS
26 Jan 1978	NR 2 oil	15,000 gallons	Upland and waterway	Company spill	Dresden, NY
26 Jan 1978	Edichlorohydrin	20,000 gallons	Upland	Railroad spill	Point Pleasant, WV
26 Jan 1978	Oil	50,000 gallons	Waterway	Barge spill	Galveston, TX
30 Jan 1978	Acrylonitrile, LPG	Unknown	Air	Railroad spill	Leon, KY
31 Jan 1978	NR 6 Oil	Unknown	Waterway	Barge spill	Portsmouth, NH
31 Jan 1978	Liquid oxygen	Unknown	Air and waterway	Company explosion and spill	Moundsville, WV

*U.S. Environmental Protection Agency, Oil and Special Materials Control Division, 1978c.
†Assuming all 9.5 cu ft of gas and 104 barrels of condensate produced per day escape to the air and the water, respectively for 4 days
‡Assuming 1 ton = 500 gallons.

mixed with other hazardous substances. Although oil-related spills represent 52 percent of the total for the year, this figure may be unrepresentative due to the lack of a definition and, therefore, of specific reporting requirements for hazardous substances during that period. Data on volumes are presented to give some idea of the quantities of materials spilled in individual incidents. Calculation of the total volume of material spilled during the period would be unrealistic due to the number of estimated ranges that were given and due to the number of incidents reported where the spill volume was not even estimated. For comparison purposes, however, the volumes of reported spills range from 500 gallons to as much as 150 million gallons, though only two spills exceed 1 million gallons and most were less than 100 thousand gallons. Most of the reported incidents involved spills to a body of water; however, it must be kept in mind that the reporting of upland spills (not directly involving or threatening U.S. waters) is not mandatory.

Table 6-4 shows all discharges recorded by the USCG Pollution Incident Reporting System (PIRS), primarily oil and hazardous discharges reported to the National Resource Center, or other USGS and EPA offices, but also includes releases subject to the Hazardous Materials Transportation Act, and other spills reported voluntarily or collected from other sources. The PIRS file contains only those discharges into, or which threaten, the waters of the United States. Assuming a range of densities from six to ten pounds per gallon, the

TABLE 6-4

TYPES OF DISCHARGES REPORTED FOR 1976 UNDER SECTION 311, PL 92-500*

	Number of incidents	% of total	Volume in gallons	% of total
Crude oil	2,667	21.1	4,990,691	14.7
Fuel oil	909	7.2	9,780,886	28.9
Gasoline	658	5.2	764,168	2.3
Other distillate fuel oil	251	2.0	462,140	1.4
Solvent	34	0.3	95,317	0.3
Diesel oil	2,063	16.3	1,100,133	3.2
Asphalt or residual fuel oil	132	1.0	4,982,195	14.7
Animal or vegetable oil	93	0.7	94,513	0.3
Waste oil	1,217	9.6	131,377	0.4
Other oil	2,636	20.8	724,294	2.1
Liquid chemical	296	2.3	2,110,048	6.2
Other pollutant (sewage, dredge spoil, chemical wastes, etc.)	130	1.0	6,468,940	19.1
Natural substance	94	0.7	6,468	0.0
Other material	146	1.2	2,120,386	6.3
Unknown material	1,329	10.5	20,274	0.1
Total	12,655	100.0	33,851,830	100.0

*U.S. Department of Transportation, Coast Guard, 1977.

total weight of the spilled materials shown in the table amounts to 90 to 150 thousand metric tons. Table 6-4 includes the 7.5 million gallon spill of fuel oil by the Argo Merchant, which accounts for 22 percent of the total volume of discharges during the year. Excluding that single spill the largest category in terms of volume is "other pollutant", including sewage, dredge spoil, and chemical wastes, with 6.5 million gallons (about 25 percent of the total volume excluding the Argo Merchant spill). Much of the volume of spills such as that reported in this table cannot be recovered and therefore could not be placed in RCRA-approved disposal facilities. However, as discussed above, in the cases in which removal of spills is possible, the clean-up operations must usually remove a large volume of contaminated soil and water in addition to the original volume of spilled material. This volume would greatly increase the amount of material requiring disposal in RCRA-approved facilities.

Table 6-5 gives the distribution of spills by source category. The largest category of spill sources was non-transportation related facilities other than refineries, bulk storage, and production facilities. These sources were responsible for 29 percent of the total spill volume and 90 percent of the total non-oil spill volume.

Table 6-6 is included to illustrate the type of commodities which were named most often in hazardous materials incident reports as documented by the U.S. Department of Transportation for the period from January 1, 1971 to December 31, 1975. This list does not imply

TABLE 6-5

SOURCES OF DISCHARGES REPORTED FOR 1976 UNDER SECTION 311, PL 92-500*

	Number of incidents	% of total	Volume in gallons	% of total
Vessels				
Dry cargo ships	41	0.3	11,679	0.0
Dry cargo barges	324	2.6	24,840	0.1
Tank ships	623	4.9	8,930,029	26.4
Tank barges	976	7.7	1,953,442	5.8
Combatant vessels	179	1.4	26,987	0.1
Other vessels	1,153	9.1	245,013	0.7
Total	3,296	26.0	11,191,990	33.1
Land vehicles				
Rail vehicles	82	0.6	269,440	0.8
Highway vehicles	335	2.6	323,391	1.0
Other/unknown vehicles	47	0.4	20,968	0.1
Total	464	3.6	613,799	1.9
Non-transportation-related facilities				
Onshore refinery	101	0.8	211,614	0.8
Onshore bulk/storage	365	2.9	5,873,932	17.4
Onshore production	242	1.9	349,053	1.0
Offshore production facilities	1,358	10.7	274,732	0.8
Other facilities	1,055	8.3	9,759,869	28.8
Total	3,131	24.6	16,469,200	48.0
Pipelines	653	5.2	4,530,094	13.4
Marine facilities				
Onshore/offshore bulk Cargo transfer	321	2.5	333,712	1.0
Onshore/offshore fueling	88	0.7	21,708	0.1
Onshore/offshore nonbulk Cargo transfer	23	0.2	15,643	0.0
Other transportation Related marine facility	128	1.0	5,787	0.0
Total	560	4.4	376,850	1.1
Land facilities	182	1.4	442,730	1.3
Misc./unknown	4,379	34.6	227,167	0.7
Total	12,655	100.0	33,851,830	100.0

*U.S. Department of Transportation, Coast Guard, 1977.

TABLE 6-6

COMMODITIES NAMED MOST OFTEN IN HAZARDOUS MATERIALS INCIDENT REPORTS *

Section 172.5 Commodity	Number of Reports (1971-1975)	Approximate % of All 32,000 Reports Received
Paint and paint related compounds	6,590	20½
Gasoline	4,243	13½
Batteries and electrolyte fluid	3,593	11
Compounds, cleaning, liquid (Cor.)	2,194	7
Sulfuric acid	1,081	3½
Cement, liquid, n.o.s.	903	3
Flammable liquids, n.o.s.	844	2½
Hydrochloric acid	825	2½
Corrosive liquids, n.o.s.	714	2¼
Insecticides, liquid (Poison B)	422	1¼
L.P.G.	395	1¼
Poisonous liquids, n.o.s. (Poison B)	364	1
Ink	355	1
Alcohol, n.o.s.	337	1
Acids, liquids, n.o.s.	316	1
Caustic soda liquid	304	1
Nitric acid	265	0 3/4
Resid solution	240	0 3/4
Anhydrous ammonia	222	0 3/4
Compounds, tree or weed kill (Poison B)	215	0 3/4
Compounds, cleaning, liquid (FL)	211	0 3/4
Total	24,633	77
Total of All Reports Received	32,000	100

*U.S. Department of Transportation, Materials Transportation Bureau, 1976 a ranking of risk or hazard to the public. For example, most of the paint spills (comprising 20.5 percent of the total number of reports recorded) were less than 5 gallon amounts, and most of the battery acid spills (comprising 11 percent) were less than one quart amounts. Many of the gasoline spills, however, (comprising 13.5 percent of the total number of reports recorded) were of 100 gallons or more. This table is intended to show only which commodities were reported most often.

6.5 Hazardous Wastes Under State Control

As discussed in Chapter 2, existing state programs to control hazardous waste range in scope from essentially non-existent to highly comprehensive. Due to the variability in the degree of control and the uncertainties in estimating individual state generation, the amount of hazardous waste presently under state control cannot be estimated with confidence.

Table 6-7 shows, summarized from Chapter 2, the number of states with selected legal mechanisms for allowing control of hazardous wastes. As discussed in Chapter 2, the existence of enabling authority provides the state with the formalized power to control a specific activity, while standards and regulations provide specific requirements that are to be met. In most states that do not have standards or regulations, the enabling authority is exercised on a case-by-case basis.

Table 6-8 shows the status of state control in the seven states which are estimated to generate about 50 percent of the potentially

TABLE 6-7

SUMMARY - STATE CONTROL OVER HAZARDOUS WASTES

	Permit		Manifest		Recordkeeping		Reporting		Inspection	
	P*	S†	P*	S†	P*	S†	P*	S†	P*	S†
Generators‡	14	7	25	10	23	8	23	9	22	6
Transporters	23	10	25	11	23	12	19	8	18	5
Storer§	25	9	21	7	18	6	17	5	23	5
Treater§	25	9	23	10	22	8	20	6	24	7
Disposers§	38	17	25	12	34	15	29	13	39	15

*Number of states with provisional authority.
†Number of states with regulatory standards.
‡Control of generators who store, treat, or dispose hazardous waste on-site.
§Applies to off-site storage, treatment, or disposal.

TABLE 6-8

HAZARDOUS WASTE CONTROL IN LARGE GENERATOR STATES*

	State Legislation Applicable to:				
State	Generators†	Transporters	Storers	Treaters	Disposers
California	(S):M,Rp,Rc,I (P):P	(S):P,M,Rc,I	(S):P,M,Rp, Rc,I	(S):P,M,Rp, Rc,I	(S):P,M,Rp,Rc,I
Illinois	(S):M,RP (P):P,I	(S):P,M,I	(S):M,Rc,Rp (P):P,I	(S):M,Rc,Rp (P):P,I	(S):P,M,Rp,Rc,I
New Jersey	(P):M,Rc,Rp	(P):M,Rc	---	---	(P):P,M,Rc,Rp,I
New York	---	---	---	(P):P	(S):P (P):Rc,Rp,I
Ohio	(S):P (P):M	(S):P (P):M	(S):P (P):M	(S):P (P):M	(S):P (P):M,I
Pennsylvania	---	---	---	---	(P):P,Rc,I
Texas	(S):M,Rc,Rp,I	(S):M,Rc (P):Rp	(S):P,M,Rp, Rc,I	(S):M (P):Rc,I	(S):P,M,Rc,Rp,I
Total	P M Rc Rp I	P M Rc Rp I	P M Rc Rp I	P M Rc Rp I	P M Rc Rp I
(S)	1 3 2 3 2	3 3 2 0 2	3 3 3 3 2	2 3 2 2 1	5 3 3 3 3
(P)	2 2 1 1 1	0 2 1 1 0	1 1 0 0 1	2 1 1 0 2	2 2 3 2 4
All	3 5 3 4 3	3 5 3 1 2	4 4 3 3 3	4 4 3 2 3	7 5 6 5 7

*These states generate about one half of the potentially hazardous manufacturing wastes in the United States (see text).

†Applies to those generators who store, treat, or dispose hazardous wastes on-site.

Key: (S) - existing standards; (P) - enabling authority only; P - permit; M- manifest; Rc - recordkeeping; Rp - reporting; I - inspection.

hazardous manufacturing wastes in the U.S. The trend is towards manifest systems in these states, though only three of these seven states are presently operating such a system under specific regulation. Additionally, two of these states have essentially no control over activities other than disposal, and another has only enabling authority with no specific standards.

It should be emphasized that, as discussed in Chapter 2, both the comprehensiveness of existing state standards and regulations, and the degree to which they are enforced, vary widely from state to state. Furthermore, only 16 states presently have officially defined hazardous wastes by either criteria or listings. In summary, even when considering the subjective nature of the data presented in Tables 6-7 and 6-8, it may be concluded that at present, state control of hazardous wastes is fragmented, and that, although some states exert very good control, the potential for damage from uncontrolled disposal of hazardous wastes is substantial, as shown by the reported incidents summarized in Appendix J.

7.0 IMPACTS OF THE BASELINE ACTION

This chapter addresses the potential impacts, both beneficial and adverse, that could result from implementation of the baseline Subtitle C regulations. Two major types of impacts are analyzed: primary impacts and secondary impacts. Primary impacts include those effects that would be directly attributable to the implementation of the baseline regulations. Secondary impacts include those effects that would be indirectly attributable to the implementation of the baseline regulations. In some cases, secondary impacts might not be observed until years or even decades after implementation of the regulations.

Where practical, potential impacts are analyzed for two separate years: 1980, the year of expected implementation of the regulations, and 1984, the year by which the full effects of the regulations are expected to become established. For the reasons discussed in Section 7.1.2, it is anticipated that at least five years would be required for such effects and resultant impacts to become fully established.

The impact analysis is, for the most part, both generic in scope and conducted on a national level due to the extreme waste-specific, process-specific, and site-specific nature of most impacts, and due to the extensive data limitations previously indicated. Because most available data relate to manufacturing industries, the emphasis of the impact analysis is necessarily directed toward manufacturing industries. To the extent the limited available data allow, impacts are assessed quantitatively.

Over 300 reported incidents of damage from the improper management of hazardous wastes were reviewed to assist in identifying the potential for adverse impacts resulting from current hazardous waste management practices. Appendix J briefly describes each of these reported incidents. Table 7-1 summarizes the type and extent of the adverse impacts that have been reported. From the way in which most of the incidents have come to light, it is very likely that the vast majority of such incidents go unreported, especially human health incidents which may require many years of exposure and for which direct causative relationships are difficult to trace or establish. The reported incidents indicate that there is often a considerable time interval between the occurrence of those events which lead to damage and the time when the damage becomes evident. Since virtually all of the reported incidents were discovered only after damage had already occurred, there is, nationally, a very significant potential for many similar damage incidents to be detected in the future from wastes that have already been improperly stored, treated, or disposed.

It should be noted that a potentially large category of hazardous wastes, termed 'special wastes,' are only briefly addressed in the impact analysis. 'Special wastes' include cement kiln dusts, utility wastes, oil drilling muds/brines, phosphate rock mining and

TABLE 7-1

NUMBER AND TYPES OF REPORTED INCIDENTS FROM THE IMPROPER MANAGEMENT OF HAZARDOUS WASTES*

Management Method	Air quality impacts	Water quality impacts†	Soil contamination	Identifiable public health impacts	Drinking water contamination	Identifiable biological impacts
Generation	1	4	-	1	-	2
Transport	6	1	-	4	1	-
Storage	5	23	2	9	9	7
Dumping	5	73	4	12	25	37
Landfill	1	69	3	16	27	20
Lagoon	4	55	2	2	19	19
Incineration	2	1	-		1	1
Resource recovery	2	4	-	2	2	2
Other treatment	5	3	1	3	-	2
TOTAL	31	233	12	49	84	90

*Summary is based on approximately 300 reported incidents listed in Appendix J.
†Includes drinking water contamination incidents.

processing wastes, uranium mining wastes, and other mining wastes. Any 'special wastes' identified as hazardous under the Subtitle C regulations would be subject to a limited portion of the Subtitle C storge, treatment, and disposal regulations (see Sections 7.1.2.3 and 7.1.2.4). As a result, it is not likely that there would be any significant change in the current storage, treatment, or disposal practices for such wastes. EPA is planning to promulgate Subtitle C requirements specific to the management of 'special wastes'. An additional environmental impact statement or supplementary statement would be prepared for these 'special wastes', if warranted, at such time.

7.1 Potential Primary Impacts

The potential primary impacts from implementation of the proposed regulations are analyzed within the following areas:

- Hazardous wastes to be regulated;
- Changes to existing generation, transport, storage, treatment, and disposal practices and procedures;
- Administrative changes;
- Air impacts;
- Water impacts;
- Public health impacts.

In discussing the primary impacts of the proposed regulations, especially air, water, and public health implications, a limited number of incidents are used to illustrate the potential benefits of the regulations. It should be noted that Appendix J contains many additional examples of adverse incidents that have occurred under present hazardous waste management practices.

7.1.1 Hazardous Wastes to be Regulated. The Section 3001 regulations (see Appendix B, Subpart A) define the wastes that are to be considered hazardous and, thus, subject to the Subtitle C regulations. Two mechanisms are provided for determining those wastes that are hazardous: identifying characteristics and lists of specific hazardous wastes and waste streams. The identifying characteristics are ignitability, corrosivity, reactivity, and toxicity. Wastes which exhibit any of these characteristics, or which are listed, would be considered hazardous and would have to be managed pursuant to the Subtitle C regulations.

Chapter 6 contains estimates of potentially hazardous waste generation within manufacturing and non-manufacturing industries. The estimates for the manufacturing industries have been determined using the generation factors described in Appendix H; the estimates for the non-manufacturing industries have been developed as described in Chapter 6. The quantity of wastes that would be identified as hazardous under the Section 3001 regulations would, however, be less than the quantities indicated as hazardous in Chapter 6 due to the proposed definition of the Section 3001 toxicity characteristic. The toxicity characteristic is to be based solely upon the EPA Primary Drinking Water Standards and, as a result, many wastes that are potentially hazardous due to other indicators of toxicity, especially organic wastes, would presently be excluded from regulations.* However, many other such wastes are specifically included on the lists of hazardous wastes and, thus, would be subject to the Subtitle C regulations.

It is expected that the primary effect of the present toxicity characteristic on manufacturing wastes would be to eliminate from regulation a large portion of the potentially hazardous wastes previously estimated to be generated by industries within SIC Code 28 (Chemicals and Allied Products). EPA staff estimates are that about 35 percent of the potentially hazardous wastes previously estimated to be generated within SIC Code 28 could be identified as hazardous under the Subtitle C regulations. It is therefore estimated, based upon Chapter 6, that approximately 35 million metric tons of manufacturing wastes could be identified as hazardous under the Section 3001 regulations in 1980, and that approximately 40 million metric tons could be identified as hazardous in 1984. The distribution of these regulated wastes among the manufacturing SIC Codes and EPA Regions would be essentially that shown in Table 6-1, except that the wastes in SIC Code 28 would be reduced by 65 percent.

*EPA is considering expanding the toxicity characteristic to bring a greater number of these potentially hazardous wastes under the regulations in the future and would prepare an additional environmental impact statement or supplementary statement for the expanded toxicity characteristic, if warranted, at such time. Specific revisions are not known at this time. The "enhanced public health and environmental protection alternative" assessed in Chapter 8 does, however, include an expanded toxicity characteristic.

Only those persons or Federal agencies who produce and dispose of more than 100 kilograms (about 220 pounds) per month of wastes identified as hazardous under the Section 3001 regulations would be considered generators subject to the Subtitle C regulations. As shown in Table 7-2, this generator limit of 100 kilograms per month could exclude about 29,000 metric tons per year of hazardous manufacturing wastes from regulation. The excluded waste would be less than 0.1 percent of the total hazardous manufacturing wastes. However, about 26 percent of manufacturing establishments generating hazardous wastes could be excluded.

For purposes of comparison, almost 350 million metric tons of total manufacturing wastes (hazardous and non-hazardous) are estimated by EPA to be generated annually. Thus, over 10 percent of the total manufacturing wastes would be regulated as hazardous wastes. Over 60 percent of the manufacturing wastes identified as potentially hazardous in Chapter 6 would be regulated.

In addition to manufacturing wastes, the identifying characteristics and the lists would identify other wastes as hazardous. Several large volume, non-manufacturing waste streams are specifically listed as being hazardous. The listed waste streams include uranium mining wastes, phosphate mining and processing wastes, and pesticide containers that have not been triple rinsed. As discussed in Chapter 6, phosphate mining and processing wastes amount to about 220 million tons annually (however, as discussed in Section 7.1.2, these wastes

TABLE 7-2

ESTIMATED QUANTITY OF HAZARDOUS MANUFACTURING WASTES AND NUMBER OF ESTABLISHMENTS EXCLUDED FROM REGULATION AT A GENERATOR LIMIT OF 100 KG/MO

EPA Region	Number of manufacturing establishments excluded	Percent of total manufacturing establishments excluded	Hazardous manufacturing wastes excluded (metric tons)	Percent of total hazardous manufacturing wastes excluded
I	5,270	23	1,900	< 0.1
II	13,200	25	4,100	< 0.1
III	7,180	25	2,700	< 0.1
IV	14,900	33	5,500	< 0.1
V	14,200	21	5,000	< 0.1
VI	7,090	29	2,700	< 0.1
VII	3,760	26	1,500	< 0.1
VIII	2,110	33	900	< 0.2
IX	9,750	26	3,500	< 0.2
X	3,820	34	1,500	< 0.2
National total	81,420	26	29,300	< 0.1

would be subject to a limited portion of the Subtitle C storage, treatment, and disposal regulations).

Waste pesticide containers from persons engaged principally in farming or solely in retail trade would not be subject to the Subtitle C regulations. This exclusion, coupled with the unknown portion of waste pesticide containers already included in the estimates of manufacturing wastes, precludes any determination of the quantity of waste pesticide containers that would be subject to the regulations. The remainder would, however, be subject to the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act of 1972, as amended.

The identifying characteristics could result in the regulation of such other large volume wastes as waste automotive oil, coal ash, oil drilling muds and brines, cement kiln dusts, and dredge spoils. Estimates of the annual production of these wastes are presented in Chapter 6. The portion of such wastes that could be identified as hazardous by the characteristics is not known.

7.1.2 Changes to Existing Generation, Transport, Storage, Treatment, and Disposal Practices and Procedures. Typical practices and procedures used by generators, transporters, storers, treaters, and disposers of hazardous wastes are discussed in Chapter 5. The Subtitle C regulations would lead to a number of major changes in these existing practices and procedures. The changes would primarily be caused by the enactment of more stringent environmental requirements than those that currently exist, resultant increases in treatment and disposal costs, and specific procedural and operational requirements imposed by the regulations. The intent of this section is to indicate the scope of applicability of the Subtitle C regulations and the major changes likely to occur in existing practices and procedures as a result of the promulgation of the regulations.

It is anticipated that at least five years would be required for the changes in existing practices and procedures to become fully established. Several years would be required for hazardous waste generators to become fully aware of the specific economic implications of the regulations, to assess the alternatives available to them (e.g., process modification, increased recycling of hazardous wastes, shifts in on-site and off-site treatment/disposal practices), and to implement any changes. Due to resource constraints, several years would also be required for EPA or authorized states to act upon all permit applications and to issue permits to acceptable storage, treatment, and disposal facilities. Facilities requiring modifications as a condition of their permits would then have up to three years to complete such modifications. Furthermore, the necessary integration and coordination of RCRA requirements with those of other acts (e.g., Federal Water Pollution Control Act and Safe Drinking

Water Act) requires that there be some delay in permit issuance. For example, in those instances where a treater or disposer has a National Pollution Discharge Elimination System (NPDES) permit, issuance of the RCRA permit would be delayed until the time that the NPDES permit is to be renewed. In addition, since very few states would currently be qualified to attain full authorization, regulatory requirements in those states granted interim authorization would be changed over several years as the states become qualified for full authorization.

7.1.2.1 Generation. The regulations applicable to generators (Section 3002 of Subtitle C) apply only to those persons or Federal agencies, except households, who produce and dispose of more than 100 kilograms (about 220 pounds) per month of wastes identified as hazardous under the Section 3001 regulations. Any person or Federal agency producing and disposing of 100 kilograms or less per month would not be required to comply with the generator regulations. Also any generator engaged solely in retail trade or principally in farming would have to comply with the regulations only with regard to waste automotive oil. However, any person may assume the generator's total liability for compliance with the Subtitle C requirements with regard to waste automotive oil. Generators excluded from compliance with the Subtitle C regulations would, however, still be obligated to dispose of their hazardous wastes in an acceptable manner, e.g., in a landfill that meets RCRA Subtitle D criteria.

The Subtitle C regulations would result in procedural changes, as described below, in the methods used by these regulated generators for tracking and reporting hazardous waste shipments and for preparing such shipments for transport. The regulations could also lead to process changes that would allow increased resource conservation and/or recovery of hazardous wastes.

Manifest. Under the Subtitle C regulations, every generator would be required to provide a manifest for each off-site hazardous waste shipment--intrastate, interstate, and international--sent to a facility not owned by the generator and to file reports and keep records on such shipments. Generators designating hazardous waste to an off-site facility owned by the generator and located in the same state as the generator would have to provide a manifest, but would not have to comply with the reporting or recordkeeping requirements (although the facility itself would be subject to reporting and recordkeeping requirements under Section 3004); shipments to generator-owned facilities in other states would have to comply with the reporting and recordkeeping requirements. On-site shipments would not have to be manifested, but would have to be sent to permitted on-site facilities and would have to be reported to appropriate Federal or state authorities.* Appendix B, Subpart B describes the required content of the manifest and reports. The major purposes of the manifest would be to ensure that off-site shipments of hazardous wastes are sent only to permitted storage, treatment, or disposal facilities and to ensure that all such wastes

*Off-site as used throughout this statement means any facility or location not on a generator's property. On-site means any facility or location on a generator's property.

are actually delivered to the facility to which they are sent (Appendix J describes numerous incidents from the indiscriminate dumping of wastes in transit).

Currently, there are very limited mechanisms for tracking of hazardous wastes. Based upon Tables 2-2 and 2-3, as of 1978 only 10 states have (or have proposed) standards for manifesting of hazardous wastes by generators and only two other states have standards for manifesting by transporters; an additional 14 states have (or have proposed) enabling authority to enforce manifest requirements, but do not have standards. Nine states have (or have proposed) reporting standards applicable to generators; 15 others have (or have proposed) enabling authority for enforcing reporting by generators. In addition, for the small portion of hazardous wastes that meet the Department of Transportation (DOT) criteria of a hazardous material under the Hazardous Materials Transportation Act (49 CFR 100-189), any interstate or international shipment of such wastes by common or contract carriers must be accompanied by shipping papers prepared and signed by the consignor (generator). In addition, over 30 states have adopted, with or without modification, the DOT Hazardous Material Regulations and apply them to intrastate shipments by common and contract carriers.

Due to these limited tracking mechanisms, generators, state authorities, and Federal authorities, have little or no information as to what currently happens to a large portion of the hazardous wastes that are shipped off the generator's site; state and Federal authorities also have little or no information about what happens to a considerable amount of the wastes that remain on the generator's site for treatment or disposal. Furthermore, in states which do not have manifesting or reporting requirements, the ultimate fate of the wastes is not known for a very large portion of the wastes; for example, in Kansas the disposal location is not known for almost 80 percent of the industrial wastes generated in the state and in Massachusetts the disposal location is not known for about 65 percent of the industrial wastes (see Table 5-14). Even in those states with manifest and reporting standards, the disposal location is not always known; for example, in Texas, the fate of about 20 percent of the hazardous wastes is not known.

To remedy this, the Subtitle C regulations would make the generator responsible for determining where his hazardous wastes are to be delivered when sent off-site and for identifying those shipments that may not have been delivered to the designated destination. The manifest (or the equivalent delivery document) would have to be signed by authorized representatives of the generator, the transporter, and the designated delivery facility; after the waste is delivered to the designated treatment, storage, or disposal facility, the signed original of the manifest (or equivalent delivery document) would have to be returned to the generator to verify that the waste has been delivered. Generators would have to file quarterly reports on all manifested shipments for which a signed manifest copy (or equivalent delivery document) is not returned. In addition, generators designating wastes for off-site shipment would be required to file annual reports based on the information in the manifests and to keep a copy of each manifest for a period of three years. Generators who designate hazardous wastes for on-site treatment, storage, or disposal would also have to file annual reports identifying the types and quantities of wastes managed on-site.

Containerization and Labeling. Under the Subtitle C regulations, the generator would also be required to containerize all wastes for transport in accordance with the DOT regulations on packaging under 49 CFR 173, 178, and 179. If no specific packaging is required, the generator would have to place the hazardous wastes in a package in accordance with the DOT regulations on standard requirements for all packages (49 CFR 173.24(a), (b), and (c)(2)-(9)). In addition, the generator would have to label and placard each shipment in accordance with DOT regulations on hazardous materials (49 CFR 172) and mark each package in accordance with DOT regulations on marking (49 CFR 172.300) or with the EPA hazardous waste name (see Appendix B, Subpart A, 250.14), as applicable. Each package must also contain the manifest document number and the generator's identification number.

The DOT regulations cited above currently apply only to interstate or foreign shipments by common or contract carriers or to intrastate shipments by common or contract carriers in those states which have adopted the DOT regulations. The Subtitle C regulations would extend these DOT regulations to all hazardous waste shipments.

Process Changes to Promote Resource Conservation and Recovery. In addition to these procedural changes, the Subtitle C regulations would have the potential to cause generators to modify processes that generate hazardous wastes in order to increase resource conservation and recovery. Since one major result of the regulations would be to increase generator's costs and those costs associated with hazardous waste transportation, storage, treatment, and disposal, generators would potentially have an incentive to modify processes so as to reduce and/or change the types and amounts of hazardous wastes generated by such processes and to enable the increased recycling of hazardous wastes as process feedstocks. According to a recent study on hazardous waste management, (Foster D. Snell, Inc., 1976), there is currently a trend in hazardous waste producing industries to recover, reuse, or recycle waste products that were once either treated or dumped; the primary reasons being economics and public relations.

As discussed in Section 5.4, the potential for process modifications to promote resource conservation and/or recovery would be extremely waste stream and process specific and would depend upon such factors as the economics of disposal, treatment, and transport; the cost of raw materials and energy; the availability of markets for and sources of recyclable hazardous wastes; and the availability both of the necessary technology for specific resource conservation or recovery applications and of environmentally adequate disposal methods. Due to the many complex interrelationships among these factors, the determination of specific process modifications and resultant changes to waste streams that could occur as a result of promulgation of the Subtitle C regulations is beyond the scope of the EIS.

7.1.2.2 Transport. The regulations applicable to transporters (Section 3003 of Subtitle C) apply to any person or Federal agency transporting, within the United States, hazardous wastes that require a manifest under the generator regulations and also apply to any transporter importing a shipment of hazardous wastes from abroad. The transporter regulations do not apply to persons or Federal agencies transporting hazardous wastes solely on the site of generation or solely on the site of a permitted hazardous waste management facility. While the transporter regulations do not apply to hazardous waste shipments not requiring manifests, if any person or Federal agency consolidates for shipment and transports any quantity of unmanifested hazardous wastes from more than one source, the entire shipment would have to be delivered to a permitted facility and would have to comply (for both interstate and intrastate shipments) with applicable DOT Hazardous Materials Regulations (49 CFR 100-189) concerning shipping papers, labeling, marking, placarding, and transportation. Data are not available to estimate the number of transporters that would be affected by the tranporter regulations (see Appendix E).

As discussed below, the Subtitle C regulations would significantly curtail the 'midnight dumping' of hazardous wastes and would likely result in changes in the handling of transportation-related spills, in the distances over which hazardous wastes are transported, and in existing operational procedures and practices used for the transport of hazardous wastes.

Midnight Dumping. There are numerous reported instances of hazardous waste transporters dumping wastes surreptitiously rather than delivering the wastes to an environmentally acceptable storage, treatment, or disposal facility (see Appendix J). Because such illegal disposal often occurs at night, this practice has been termed midnight dumping. Data are not available to quantify the total number of such incidents, nor the amount of wastes disposed annually through midnight dumping; however, the following example illustrates the potential magnitude of the problem. New Jersey shut down its last legal land disposal site to chemical waste dumping nearly three years ago. The site was handling about one million gallons of chemical wastes per week when it was eliminated. At this time it is not known where most of the wastes that formerly went to such landfills are currently being disposed, but there are reported incidents of illegal disposal throughout New Jersey (Richards, 1978).

The manifest and reporting requirements discussed in Section 7.1.2.1 should significantly reduce, if not eliminate, the practice of midnight dumping. These requirements effectively transfer the opportunity for midnight dumping from the transporter to the generator and, to a lesser degree, to the receiving facility. To the extent that generators manifest all off-site hazardous waste shipments and truthfully indicate the type and quantity of hazardous waste being transported, midnight dumping should be nearly eliminated, providing the receiving facility accurately confirms the contents of wastes delivered.

Spills. Section 2.3 indicates existing laws for the reporting, prevention, and containment of transportation-related spills of hazardous substances. Only those hazardous wastes and other spilled materials which meet the definitions and criteria for hazardous materials under the DOT Hazardous Materials Transportation Regulations or which are specifically listed under Section 311 of the Federal Water Pollution Control Act as amended would come under these existing spill regulations. The Hazardous Materials Transportation Regulations require reporting, but not clean up or containment, of transportation-related spills of hazardous materials. These requirements, however, apply only to interstate commerce or to intrastate shipments in those states which have adopted the Hazardous Materials Transportation Regulations.

Section 311 of the Federal Water Pollution Control Act applies only to spills of the listed substances which threaten navigable waters and which are into or upon the navigable waters of the U.S., adjoining shorelines, contiguous zones, or which may affect applicable natural resources. Section 311 requires the reporting and clean-up of such spills by the responsible party.

The Subtitle C regulations extend reporting and clean-up requirements to all transportation-related spills of hazardous wastes or hazardous materials which become hazardous wastes under Section

3001 when spilled. In the case of a spill, transporters would have to immediately telephone either the National Response Center (U.S. Coast Guard) or the government official predesignated as the on-scene coordinator, pursuant to 40 CFR 1510; a written report would have to be filed within 15 days with the DOT Office of Hazardous Materials Operations. The transporter would also have to clean up all spilled hazardous waste or take such action as may be required by Federal, state, or local agencies so as to ensure that the spilled waste no longer presents a hazard to human health or the environment.

Transport Distances. The average distance over which hazardous wastes are transported would likely increase as a result of the Subtitle C regulations. This increase would result from several factors. First, the portion of wastes being shipped to off-site facilities for treatment and disposal, rather than remaining at on-site facilities, would most likely increase as discussed in Section 7.1.2.4. Second, all hazardous wastes would have to be transported to permitted facilities, not just to any nearby disposal site. Since it would not likely be economically or environmentally practical to site permitted facilities near every generator, the average distance wastes would have to be transported should increase. Third, increases in disposal costs resulting from the proposed regulations should increase the distance over which waste may be economically transported for resource recovery purposes.

According to a recent hazardous waste transport study (Arthur D. Little, Inc., 1978a), most hazardous waste transport is by truck with typical off-site transport distances ranging from 25 to 150 miles; most of the surveyed firms reported transport distances of about 50 miles. However, based on the limited number of firms replying to the survey, the study concluded that the reported truck transport distances might not be representative of the industry as a whole. Most hazardous wastes transported by rail or barge are reported to go to reclamation or resource recovery facilities; transport distances on-the-order of 1,000 or more miles are common for such shipments. Data are not available to determine by how much typical transport distances are likely to increase as a result of the Subtitle C regulations.

Existing Practices and Procedures. The Subtitle C regulations would modify existing practices that have in the past led to releases of hazardous wastes during transport and would impose additional procedural requirements on transporters to enable easier identification of both the transporter and the wastes being transported. For example, the regulations require that the transporter not accept shipments of hazardous wastes unless such shipments are accompanied by a manifest signed by the generator and are in containers which are not leaking or damaged and which are properly labeled and marked. In addition, the transporter (and any other subsequent transporter(s)) is to sign the manifest; insure that the manifest (or equivalent delivery document) accompanies the shipment at all times; placard and mark the transport vehicle; deliver the entire quantity of hazardous wastes to permitted facilities; and keep a copy of the manifest (or delivery document) for at least 3 years. If the transporter consolidates or mixes hazardous wastes from different generators or seoarate wastes from the same generator, the transporter would also have to comply with the generator regulations if the consolidated mixture was no longer adequately identified by the manifest.

Not all of the above requirements represent entirely new requirements on all transporters. For example, as discussed in Appendix E, most transporters presently keep delivery documents for at least 3 years due to various Federal and state regulations. In addition, common and contract carriers engaged in the interstate transport of hazardous materials, as defined in the DOT Hazardous Materials Transportation Regulations, have to comply with equivalent placarding requirements and are not to accept shipments of hazardous materials unless accompanied by shipping papers signed by the consignor (generator).

7.1.2.3 Storage. RCRA defines storage as the containment of hazardous wastes, either on a temporary basis or for a period of years, in such a manner as not to constitute disposal. The regulations applicable to storers (Section 3004 of Subtitle C) apply, except as noted below, to all storage at off-site storage, treatment, or disposal facilities and to all on-site storage by generators prior to on-site treatment or disposal; the regulations do not apply to on-site storage by generators who store their own wastes for less than 90 days prior to subsequent transport off-site, but do apply to any such on-site storage which lasts for 90 days or longer. Facilities specifically excluded from complying with the storage regulations include Publicly Owned Treatment Works (POTW) and ocean dumping barges and vessels. In addition, facilities that store only 'special wastes', and no other hazardous waste, would have to comply only with the General Facility Standards (e.g., manifest system, recordkeeping, reporting--see Appendix B, Subpart D, 250.43) and not with any other storage regulations. All regulated facilities would require permits under Section 3005 of Subtitle C. Section 7.1.3.5 contains estimates of the number of potential permittees. Data are not available to estimate the quantities of wastes that would be affected by the storage regulations.

As discussed below, the Subtitle C regulations would result in the elimination of current storage practices that lead to or become a form of disposal and would result in changes in the current design and operation of storage facilities.

Indefinite Storage. Currently there are few regulations, if any, that limit the time that hazardous waste may be left in storage. As a result, there are a number of reported incidents of hazardous waste being placed in storage for indefinite periods of time, sometimes in very large quantities (see Appendix J). In many such instances, the wastes in storage are ultimately abandoned, rather than being disposed in an acceptable manner, and are left to enter the environment.

Even when the wastes are not abandoned, overly long storage times have resulted in weathering and/or corrosion of containers and weathering of storage piles, causing the eventual release of the stored wastes into the environment.

The Subtitle C regulations contain provisions that would eliminate the indefinite storage of hazardous wastes. At facility close-out*, all hazardous wastes would have to be removed from all storage and treatment operations, including surface impoundments that do not meet the Subtitle C criteria for landfills, and would have to be disposed as required by the regulations (see Section 7.1.2.4). Facilities would have to post a bond that would be held until the completion of both closure and post close-out care to ensure compliance.†

Facility Design and Operation. The Subtitle C regulations would prohibit or restrict existing storage practices that result either in the discharge of hazardous wastes or in the storage of such wastes in an environmentally unacceptable manner. For example, the regulations require that storage operations be conducted in such a manner that no discharge occurs and such that storage facilities be monitored and inspected for the purpose of detecting any potential

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*Close-out is the point in time at which facilities stop accepting hazardous waste for treatment, storage, or disposal.

†Closure is the series of actions to be completed within 3 years following close-out during which a facility is to be secured pursuant to Subtitle C regulations. Post close-out is the period which need not exceed 20 years following closure during which required monitoring and maintenance activities are to be conducted.

discharge; that all storage areas be constructed so as to be capable of containing any run-off or spills that occur, plus have sufficient freeboard to allow for collection and containment of precipitation; that storage areas be constructed of materials that are compatible with the wastes to be contained; that incompatible wastes (see Appendix D, Subpart D, Annex 4 for examples) not be mixed together; and that facilities not be located on or near active fault zones or in areas where they could be inundated by a 500-year flood. As indicated by the reported incidences listed in Appendix J, such regulations would necessitate many changes both in the design and in the operation of hazardous waste storage facilities. Data are not available to estimate the number of facilities that would be affected, nor to determine the specific changes that would be required for most such facilities.

7.1.2.4 Treatment/Disposal. With the few specific exclusions noted below, the regulations applicable to treaters and disposers (Section 3004 of Subtitle C) apply to owners and operators of any facility that treats and/or disposes any quantity of any waste identified as hazardous under the Section 3001 regulations (Appendix B, Subpart A), except those wastes listed as 'special wastes'. All owners and operators of facilities that treat and/or dispose of 'special wastes', and no other hazardous waste, would have to comply only with selected General Facility Standards of the treatment and disposal regulations (see Appendix B, Subpart D, 250.43).

Certain disposal practices that are controlled under other Federal acts are not regulated under the treatment and disposal regulations of Subtitle C. These practices include underground (deep-well) injection, ocean dumping, discharges to municipal sewer systems, surfaces discharges under a National Pollution Discharge Elimination System (NPDES) permit, and all treatment and disposal activities at Publicly Owned Treatment Works (POTW). However, the treatment and disposal regulations would apply to above ground storage or treatment of hazardous wastes prior to underground injection, on-shore facilities associated with ocean dumping activities, and surface impoundments associated with NPDES permitted industrial wastewater treatment facilities and hazardous sludges from such facilities. All facilities regulated would require permits under Section 3005 of Subtitle C. Section 7.1.3.5 contains estimates of the number of potential permittees under the Subtitle C regulations.

As discussed below, the Subtitle C regulations would lead to the closing or modifying of many existing treatment/disposal facilities and to significant changes in current treatment/disposal practices. In addition, the regulations would likely affect the portion of hazardous wastes treated/disposed on-site and off-site.

Facility Closing or Modification. A major impact resulting from the Subtitle C regulations would be the closing of those hazardous waste management facilities (both off-site and on-site) that could not or would not comply with the treatment/disposal requirements and the modification of other hazardous waste management facilities to enable compliance with the requirements. Facilities requiring modifications would have to make such modifications in accordance with compliance schedules contained in permits issued to them under the Section 3005 regulations. The modifications would have to be made within 3 years from the original date of issuance of the compliance schedule; for compliance schedules exceeding 6 months, interim compliance requirements would also have to be met every 6 months.

Data are not available to estimate the number and type of hazardous waste treatment/disposal facilities that would have to close down or be modified as a result of the proposed regulations. However, based on the reported incidences in Appendix J and other available data discussed below, it is expected that a very large portion of existing facilities would require modification to be able to comply with the treatment/disposal requirements. For example, less than 10 percent of hazardous manufacturing wastes from 14 major generating industries are estimated to have been treated/disposed in an environmentally acceptable manner in recent years (see Table 5-7). While some of this environmentally unacceptable treatment/disposal could be made acceptable by the use of alternative treatment methods instead of by facility modification, it is likely that the vast majority of existing treatment/disposal facilities handling such wastes would require modifications in order to comply with the treatment/disposal requirements. For example, of 80 estimated hazardous waste management service industry landfills currently handling some form of potentially hazardous waste, it is estimated that approximately 20 could meet secure landfill standards (Foster D. Snell, Inc., 1976; Straus, 1977). Furthermore, according to the Industry Studies (1975-1978), the vast majority of hazardous industrial wastes that are disposed in landfills are disposed in general purpose landfills rather than secure landfills (see Appendix D). Additionally, about 16,000 land disposal sites accepted municipal wastes in 1976; most also received some industrial waste; it is estimated that only about 100 had impermeable linings and only about 200 had leachate collection systems (Waste Age, 1977). Appendix D discusses other examples of facilities that could require modifications.

Changes in Current Treatment/Disposal Practices. Those existing hazardous waste treatment/disposal practices that are environmentally unacceptable according to the Subtitle C regulations would be prohibited or restricted or would have to be modified; some practices could be replaced by other, more environmentally acceptable, practices.

Existing practices that are likely to be prohibited or severely restricted by the Subtitle C regulations include: open burning; uncontrolled incineration; road application of untreated waste oil; the use of landfills without leachate collection systems and groundwater monitoring systems; the use of surface impoundments without leachate detection systems and groundwater monitoring systems; landfarming of highly volatile wastes or wastes containing arsenic, boron, molybdenum and/or selenium in concentrations greater than soil background conditions; the location of landfills, surface impoundments, and landfarms within 150 meters (500 feet) of functioning public or private water supplies or livestock water supplies; and the mixing of incompatible wastes in surface impoundments and basins, except for the purpose of treatment. In addition, the Subtitle C regulations specifically prohibit such existing practices as open dumping; the placing of reactive wastes, ignitable wastes, and highly volatile wastes in landfills, surface impoundments, or basins; the mixing of incompatible wastes in landfills and landfarms; the use of waste application practices that allow the zone of incorporation of landfarms to become anaerobic; and the use of continuous feed treatment facilities without automatic waste feed cut-offs or by-pass systems that are activated when a malfunction occurs.

The Subtitle C regulations also impose specific requirements for the closure of treatment/disposal facilities. For example, at final closure all disposal operations would have to be completed and all wastes removed from treatment facilities and disposed in accordance with the regulations. Hazardous wastes and hazardous waste residues would also have to be removed from all surface impoundments that do not meet the standards for landfills and disposed according to the regulations. Any contaminated soil-filter medium at landfarms would also have to be removed. Monitoring and maintenance care would have to be provided for a period that need not exceed 20 years from close-out.

For the most part, data are not available to enable an estimate of the quantity of hazardous wastes currently treated/disposed by each of the above practices, the number of off-site or on-site treatment/disposal facilities that would be affected by such prohibition or restrictions, nor any potential shift likely to occur in the quantities of hazardous waste treated/disposed by various methods as a result of the regulations. Specific changes would be dependent upon such factors as treatment/disposal economics; waste characteristics; adequacy of available pollution control devices; availability and adequacy of alternative treatment/disposal methods; and site-specific conditions such as climate, soil characteristics, and groundwater characteristics.

As previously discussed, available data indicate that about 90 percent of the hazardous manufacturing wastes from 14 major generating industries are estimated to have been treated/disposed in an environmentally unacceptable manner in recent years. For each method used for treating/disposing of these wastes, the portion of the waste estimated to have been treated/disposed in an environmentally unacceptable manner using that method is as follows (see Table 5-7): surface impoundment--over 99.9 percent; dumping and landfilling--about 95 percent; incineration--about 65 percent; other (road application, landfarming, deep-well injection)--almost 100 percent.

Table 5-11 shows, for four of these 14 industries, the estimated percentage of hazardous wastes treated/disposed by environmentally inadequate methods in recent years. Between 95 and 100 percent of the hazardous wastes were treated/disposed by such methods in these industries. Battelle Columbus Laboratories (1978) has estimated, for selected hazardous waste streams from these 14 industries, the percentage of the generating facilities in the industry that have been using environmentally inadequate treatment/disposal methods in recent years. For most of the hazardous waste streams reviewed, 70 percent or more of the facilities were estimated to have used environmentally inadequate treatment/disposal methods.

Due to the enactment of more stringent Federal and state environmental regulations in the period since these 14 industries were surveyed (1973-1975), it is likely that a somewhat greater portion of hazardous waste is now being treated/disposed in an environmentally acceptable manner in these industries. For analysis purposes, based upon a hazardous industrial waste generation of about 40 million metric tons in 1984, and assuming, as an upper limit, that 90 percent of such wastes would continue to be treated/ disposed in an environmentally inadequate manner without the promulgation of the Subtitle C regulations, it is estimated that these regulations could result in up to an additional 36 million metric tons of hazardous industrial wastes being treated/disposed in an environmentally adequate manner annually by 1984.

Change in Hazardous Wastes Treated/Disposed On-site and Off-site. The Subtitle C regulations would likely lead to changes in the portion of hazardous wastes treated/disposed on-site by generators and off-site by the waste management industry. Based upon the Industry Studies (1975-1978), about 82 percent of all hazardous industrial wastes are typically treated/disposed on-site by the generator; about 15 percent are treated/disposed off-site; about 3 percent are reclaimed. The percentage treated/disposed on-site and off-site, however, varies widely from industry to industry (see Table 5-10).*

The trend in at least one industry is to increase the portion of hazardous wastes being treated/disposed on-site. A study of hazardous waste practices in the petroleum refining industry (Jacobs Engineering Company, 1976) indicated that on-site treatment/disposal was expected to increase from 44 percent in 1974 to 73 percent by 1983; most of the change was expected to be due to increases in on-site landfarming and landfilling. The major reasons reported to be given by the industry (prior to the enactment of RCRA) for the potential increase in on-site treatment/disposal are as follows:

- The emerging stringent water and air emission requirements dictate that increasing volumes of hazardous wastes may need to be discharged to the land since land disposal is not as stringently regulated at the present time;

*These percentages are based upon a survey of a limited number of establishments within each manufacturing industry. According to the Industry Studies, while the numbers for each industry are typical of those establishments which replied to the survey, they may not be representative of each industry as a whole.

- The legal protection surrounding the use of private property (as observed in a review of existing solid waste laws as they apply to private on-site versus public off-site disposal) sometimes allows industry to dispose of industrial wastes on its own property without the necessity of permit, monitoring, or supervision and control by regulatory agencies;

- The present trend is one of increasingly stringent requirements by regulatory agencies surrounding disposal of industrial wastes to outside municipal or private landfills;

- The closure of many dumps, lagoons, and sumps over the past few years has seriously reduced the availability of nearby disposal sites;

- The cost of transporting large volumes of wastes long distances to certified secure hazardous waste disposal sites would bring about significant economic and price dislocations to a segment of the industry and place certain refineries at an immediate disadvantage.

The Subtitle C regulations would likely reverse, or significantly reduce, such a trend to on-site treatment/disposal since the regulations contain stringent requirements for the treatment/disposal of hazardous wastes and apply these requirements equally to on-site and off-site treatment/disposal. Thus, one of the primary advantages given for on-site treatment/disposal--little or no regulation--would be eliminated.

Several factors would affect the portion of hazardous wastes treated/disposed on-site and off-site under Subtitle C. For the most part, these factors would be very industry, waste stream, and site specific and, as a result, it is not possible to accurately determine the extent of any shift that could occur under the Subtitle C regulations.

Factors that would tend to increase the portion of wastes treated/disposed off-site under the Subtitle C regulations are as follows:

- An indeterminable portion of the existing on-site treatment/disposal facilities would not be able to be modified to comply with the Section 3004 requirements and would have to cease operation;

- A portion of generators, especially small generators, who currently dump or otherwise dispose wastes on-site in an environmentally inadequate manner would not be able to afford permittable treatment/disposal facilities or would not want to construct such facilities and would have to ship wastes off-site;

- Certain existing practices would be prohibited or severely restricted and a portion of those on-site facilities employing such practices would likely send wastes off-site instead of using alternative on-site practices;

- In some states off-site treatment/disposal currently tends to be more stringently regulated than on-site disposal; enactment and enforcement of stringent regulations applicable both off-site and on-site treatment/disposal would tend to make on-site treatment/disposal less advantageous;

- Off-site hazardous waste management facilities in EPA Region IX have the highest capacity utilization rates in the U.S. for every type of treatment/disposal practice due to strict and uniform enforcement of treatment/disposal in the region compared to most other regions and due to siting problems resulting in restricted hazardous waste management capacity (Foster D. Snell, Inc., 1976).

Factors that could tend to limit any potential increase in the portion of hazardous wastes transported off-site include:

- Public opposition to siting of off-site facilities;

- The inability to locate permittable off-site facilities relative to generator needs and the inability to make sufficient treatment/disposal capacity available at such facilities;

- Potential increases in volume reduction and in resource conservation and recovery practices as a result of Subtitle C which could reduce the quantity of hazardous wastes requiring disposal.

To quantify the potential shift in the portion of hazardous waste disposed on-site and off-site, available state data were reviewed to determine whether such shifts have occurred in states that have enacted hazardous waste legislation and the extent of any such shifts. As indicated in Section 5.3.6, only a few states have accumulated, as of 1978, sufficient data to enable an estimation of the portions of hazardous wastes generated within the state that are being treated/disposed on-site versus off-site (see Table 5-14). Comparable historical data are not available from these states to enable a determination of any change in the portion of wastes treated/disposed on-site and off-site following enactment of the state's hazardous waste (or equivalent solid waste) legislation (personal communication with representatives of the following state agencies: California Department of Health, Vector Control Section, 1978; Florida Department of Environmental Regulation, Solid Waste Section, 1978; Illinois Environmental Protection Agency, Division of Land Pollution Control, 1978; Kansas Department of Health and Environment, Bureau of Environmental Sanitation, Solid Waste Section, Hazardous Waste Unit, 1978; Maryland Department of Health and Mental Hygiene, Environmental Health Administration, Division of Solid Waste, 1978; Massachusetts Bureau of Solid Waste Disposal, 1978; Minnesota Pollution Control Agency, Division of Solid Waste, Hazardous Waste Section, 1978; Rhode Island Department of Health, Division of Solid Waste Management, 1978; Texas Division of Solid Waste Management, 1978).

In Illinois, on-site disposal is reported to be down and off-site (including out-of-state) disposal up following enactment of the state's solid waste legislation; the percentage change is not available (Personal Communication, Illinois Environmental Protection Agency, Division of Land Pollution Control, 1978). In California, the hazardous waste going off-site is not expected to decrease as a result of the state's hazardous waste legislation (Personal communication, California Department of Health, Vector Control Section, 1978). Estimates of the direction of any other potential shifts are not available from the other states.

Of those states listed in Table 5-14, Illinois and Texas currently have hazardous waste regulations closest to those that would be promulgated under Subtitle C. In addition, the data for Illinois and Texas in Table 5-14 are based upon the required reporting of current practices; the data for all the other states are based upon less recent, limited surveys directed toward determining existing hazardous waste practices in each state and needed changes in the state's hazardous waste regulation. Furthermore, Illinois and Texas have permitted facilities both on-site and off-site while several of the other states, e.g., Kansas and Rhode Island, do not have permitted off-site facilities (most wastes go out-of-state in such instances).

For the reasons cited above, the Illinois and Texas data are used, solely for analysis purposes, to provide an estimated range for the portion of hazardous wastes that might be disposed off-site by 1984 under the Subtitle C regulations. It should be noted that these data are being used as a surrogate to analyze potential impacts that could occur from a shift in on-site and off-site disposal, should such a shift occur, and not as a firm estimate of the magnitude of any such shift.

Under this surrogate method, and assuming that the wastes whose disposal location is unknown in these two states are disposed on-site and off-site in the same ratio as those wastes whose disposal location is known (see Table 5-14), about 25 percent of the hazardous wastes in Illinois and about 13 percent of the hazardous wastes in Texas are estimated to be disposed off-site. For 1984, a range of 13 to 25 percent off-site treatment/disposal of hazardous industrial wastes is thus used to analyze the potential impacts that could occur from probable shifts in off-site and on-site disposal under the Subtitle C regulations. For 1980, it is assumed that 15 percent of hazardous industrial wastes would continue to be treated/disposed off-site. It should be noted that the range used for 1984 includes both eventualities previously discussed--a slight decrease or a moderate increase in the portion of hazardous wastes currently estimated to be shipped off-site for treatment/disposal.

7.1.3 Administrative Changes. Implementation of the Subtitle C regulations would necessitate a widesweeping series of administrative changes that would affect industry, state governments, and the Federal government. Potential effects are assessed in the following sections with regard to:

- State administration of programs;
- Overlapping Federal and state hazardous waste programs;
- Number of generators required to comply with the regulations
- Number of transporters required to comply with the regulations;
- Number of storers, treaters, and disposers required to obtain permits;
- Paperwork requirements under the regulations.

7.1.3.1 State Administration of Programs. As specified in Section 3006 of RCRA, states are to be encouraged to apply to the U.S. Environmental Protection Agency for authorization to administer and enforce their own hazardous waste program pursuant to Subtitle C. There would be three different types of authorization for which states could apply: full authorization, partial authorization, and interim authorization.

Full authorization would allow a state to carry out a hazardous waste program in lieu of the Federal program under Subtitle C. According to RCRA, a state application for full authorization must be approved unless the state program is determined: not to be equivalent to the Federal program; not to be consistent with the Federal program or with those programs authorized by EPA in other states; and not to provide adequate enforcement of compliance with the requirements of Subtitle C.

To be considered equivalent, a state program would have to have legislative authority, published criteria and standards, a permit mechanism, a manifest system, identification of resources, interagency delineation of responsibilities (if applicable), and public participation. To be consistent, a state program would have to allow for the free movement of hazardous wastes (e.g., no ban on the importation of hazardous wastes from other states) and would not be allowed to have standards that are more stringent than necessary (e.g., standards designed to discriminate against out-of-state wastes). Adequacy of enforcement would be judged on a state-by-state basis; no quantifiable standards have been set.

Partial authorization would allow a state to administer and enforce selected components of a hazardous waste regulatory program established pursuant to Subtitle C.* EPA would retain responsibility for the remaining components of the program. States would be considered for partial authorization only if state legislative authority

*Individual program components include a waste tracking system (manifest system); control of treatment, storage, and disposal of hazardous wastes through a permit system; conducting inspections and taking samples; and regulations governing hazardous waste generators and transporters and owners/operators of hazardous waste treatment, storage, and disposal facilities.

did not exist for all required program components. The state would be expected to run those program components for which it had legislative authority, providing the state program was enforceable, consistent with, and equivalent to the Federal program. In all cases, the combination of state and the Federal programs would have to meet the requirements of a fully authorized program. Before granting partial authorization, EPA would expect the state to agree to submit proposed legislation to the state legislature so as to remedy the deficiencies preventing full authorization. It is expected that partial authorization would not be available during the two year interim authorization period discussed below. Partial authorization would be granted for a period not to exceed five years, but could be renewed.

Interim authorization would allow a state to carry out a hazardous waste program in lieu of the Federal program under Subtitle C for a period not to exceed twenty-four months, beginning on the date six months after the date of promulgation of regulations under Section 3001. The purpose of interim authorization is to allow the state to make an orderly transition from its present program to a program eligible for full authorization. To be eligible for interim authorization, a state would have to have a hazardous waste program pursuant to state law in existence prior to the the date 90 days after the date of promulgation of regulations under Sections 3001 of

Subtitle C. To achieve interim authorization, the state program would have to be substantially equivalent to the Federal program and would have to provide an Authorization Plan which describes the addition or modifications necessary to qualify for full authorization together with the schedule for such additions or modifications. Substantial equivalency encompasses: legislative authority, identification of resources, a permit mechanism, surveillance and enforcement, and public participation. In addition, the state would have to agree with EPA on an oversight procedure which would allow EPA to monitor the state's program to ascertain that the program was being administered and enforced in accordance with RCRA.

To achieve full, partial, or interim authorization, a state must have prior legislative authority to provide the necessary program components. Chapter 2 contains a detailed description of the existing and proposed state hazardous waste legislation. As of 1978, 15 states have separate and specific laws governing the management of hazardous wastes; another 10 states and one territory have proposed hazardous waste legislation. Thirty-six states (including the latter 10) and two territories have currently addressed hazardous waste management as a separate section within their solid waste legislation. The state programs vary widely with regard to such factors as wastes controlled, published criteria and standards, on-site and off-site control of wastes, and importation bans.*

EPA staff estimates are that approximately 34 states and territories could qualify for interim authorization under the Subtitle C regulations. No states are believed to be currently able to qualify for full authorization. No states would be able to qualify for partial authorization before the end of the interim authorization period.

7.1.4.2 Overlapping State Programs. Although RCRA encourages states to administer their own authorized hazardous waste program in lieu of the Federal program, states are not required to administer such programs. If a states does not choose to administer a program under Subtitle C of RCRA, there would be a Federally run program in that state. RCRA, however, does not prohibit states without authorized programs from enacting and enforcing their own more stringent or non-consistent hazardous waste program to be run in the state in addition to the Federal program.

At this time, it is not known if any state would run such a program in addition to the Federal program or what regulations would be promulgated under any such overlapping program. Such additional

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*Six states currently have specific importation bans. These states are Louisiana, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. In addition, Oklahoma has legislation equivalent to an importation ban. Such bans preclude full authorization. A recent U.S. Supreme Court decision (No. 77-404; June 23, 1978; City of Philadelphia et al. v. New Jersey et al.) struck down New Jersey's statutory importation ban. It is not clear how importation bans in other states would be affected by this decision.

state programs, if enacted, would have the potential for creating various impacts. Some of the major potential problems that could result from the enactment of overlapping Federal and state programs are briefly illustrated below.

An overlapping state program would likely subject hazardous waste generators, transporters, storers, treaters, and disposers to conflicting and/or duplicative requirements and regulations. For example, storers, treaters, and disposers could be required to obtain two permits, with potentially different requirements, before they could construct or operate facilities. Generators could be required to fill out two separate manifests for each off-site shipment or could be required to manifest wastes that would not be considered hazardous under the Federal program. Everyone generating or managing hazardous wastes within such states could be required to prepare and store two different sets of overlapping reports or to prepare and store reports not required under the Federal program. Economic dislocations could result to firms located within such states if the more stringent standards significantly increased the firm's cost of doing business relative to that of firms in other states. Under such conditions some generators might choose to relocate to other states.

Increased transportation demands and distances could result if more wastes had to be shipped further distances within the state or to out-of-state facilities due to increased controls within the generating state, or if wastes formerly going to one state had to be shipped to a more distant state due to enactment of import bans. However, transportation demands and distances could also be reduced in some states if increased controls or import bans in adjacent states significantly reduced the amount of wastes being shipped out-of-state. Localized shortfalls in storage, treatment, and disposal capacity could result from or be exacerbated by stricter regulations and import bans. In the short run, there could be increased instances of illegal or less desirable disposal in states with such capacity shortfalls. In the long run, there could be additional waste treatment or process modifications.

Furthermore, while an overlapping state program would likely afford increased protection to the residents of that state, it would likely hinder the effectiveness of the Federal program on a national-scale and could result in a reduced level of protection for residents of other states. For example, importation bans or other regulations hindering the free movement and/or disposal of wastes could result in some hazardous wastes being managed in a less effective or less desirable manner than would otherwise have occurred.

7.1.3.3 Number of Generators Required to Comply with the Regulations. Potential hazardous waste generators within the scope of this EIS are expected to fall within the following SIC Codes:

- Agriculture, forestry, fishing (SIC 07-09);
- Manufacturing (SIC 20-39);
- Transportation and public utilities (SIC 40-46, 49);

- Wholesale trade (SIC 50-51);
- Retail trade (SIC 52, 54-55, 58-59);
- Services (SIC 72-73, 75-76, 78, 80, 82, 84, 88-89);
- Public administration (SIC 95-97).

Not all producers of hazardous wastes within these SIC Codes would be required to comply with the Subtitle C regulations. Section 7.1.2.1 delineates those hazardous waste producers who would be considered generators subject to the Subtitle C regulations.

Available data generally relate to the manufacturing industries and to selected other industry categories in which large numbers of establishments are likely to produce hazardous wastes. These industry categories are discussed below to illustrate the potential magnitude of both the number of hazardous waste producers and the number of generators required to comply with the regulations based on a generator limit of 100 kilograms per month.

Magnitude of Potential Generators of Hazardous Wastes.

Manufacturing Industries. There are over 313,000 manufacturing establishments in the United States (See Tables 7-3 and 7-4). While every one of these manufacturing establishments is not likely to be a potential producer of hazardous wastes, the limited data available preclude an accurate determination of the number that are. An estimate, solely for purposes of analysis, is made as described below.

A recent study (Fred C. Hart Associates, 1978) summarizes the available data as to the number of establishments generating

TABLE 7-3

NUMBER OF MANUFACTURING ESTABLISHMENTS BY 2-DIGIT SIC CODE*

Industry	SIC code	Number of establishments
Food and kindred products	20	28,185
Textile mill	22	7,204
Apparel and other textile	23	24,430
Lumber and wood	24	33,931
Furniture and fixtures	25	9,242
Paper and allied products	26	6,047
Printing and publishing	27	42,103
Chemicals and allied products	28	11,430
Petroleum and coal products	29	2,080
Rubber and plastics	30	9,271
Leather and leather products	31	3,206
Stone, clay, and glass	32	16,025
Primary metals	33	6,795
Fabricated metal products	34	30,299
Machinery, except electrical	35	40,795
Electric and electronic equipment	36	12,268
Transportation equipment	37	8,804
Instruments and related products	38	5,989
Miscellaneous	39	15,185
TOTAL	-	313,289

*Based on Appendix K.

TABLE 7-4

NUMBER OF MANUFACTURING ESTABLISHMENTS BY EPA REGION*

EPA Region	Number of Establishments†
I	23,258
II	52,302
III	28,213
IV	45,729
V	68,994
VI	24,360
VII	14,322
VIII	6,619
IX	38,126
X	11,366

*Based on Appendix K.
†SIC Codes 20, 22-39.

hazardous wastes within major industrial groups. That study cautions that the data provided on the number of hazardous waste producers can only be regarded as tentative because the data are based on many different reports in which different criteria were used for identifying hazardous wastes and hazardous waste generators. Table 7-5 shows the manfacturing SIC Codes considered in that study and indicates, by EPA Region, the estimated number of establishments and hazardous waste producers within the selected SIC Codes. Based on Table 7-5, an estimated 90 percent of the manufacturing establishments in the selected manufacturing SIC Codes generate some hazardous wastes. Assuming that this percentage holds for all manufacturing establishments, based on Table 7-3, it is estimated that about 282,000 manufacturing establishments produce some hazardous wastes.

Other Major Categories of Generators. Other than the manufacturing industries, industry categories in which there would likely be large numbers of hazardous waste generators include, but are not limited to, automotive service stations*, hospitals, medical laboratories, and research facilities.† It is estimated that there would be up to 283,000 potential generators within these categories (see Table 7-6).

*Automotive service stations include gasoline service stations, general automotive repair operations, and motor vehicle dealers.
†As discusssed in Section 7.1.2.1, any hazardous waste generator engaged solely in retail trade or farming would be considered a generator subject to the regulations only with regard to waste automotive oil. It is expected that as a result of this exclusion, there would be very few such generators subject to the regulations.

TABLE 7-5

POTENTIAL HAZARDOUS WASTE GENERATORS WITHIN SELECTED MANUFACTURING INDUSTRIES BY EPA REGION*

Industry	SIC codes	Number of establishments	Number of potential generators in EPA region										
			I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Organic chemicals, pesticides and explosives	2861, 2865, 2869, 2879, 2892	2,226	72	336	286	401	388	275	135	75	198	60	2,226
Ferrous metals	3312, 3313, 332, 3399	1,780	1	15	63	37	59	12	2	3	12	10	214
Electroplating													
Job shops	3471	2,254	326	277	176	157	861	99	115	31	163	49	2,254
Captive shops	N.A.†	12,000	1,741	1,476	936	827	4,584	528	612	168	863	265	12,000
Inorganic chemicals	2812, 2813, 2816 2819	1,600	2	16	15	27	21	34	4	4	9	6	138
Nonferrous metals	333, 3341	346	10	37	41	34	91	40	16	12	45	20	346
Textiles	22	5,300	258	367	206	998	71	30	15	4	49	9	2,007
Petroleum refining	2911	247	---	7	18	16	35	80	13	29	37	12	247
Plastics materials and synthetics	282	462	36	53	59	94	99	55	8	2	54	2	462
Special machinery	355, 357	4,610	439	715	322	528	990	192	147	47	538	130	4,048
Leather tanning	3111	517	103	71	15	11	42	4	5	5	15	6	277
Paint and allied products	2851	1,544	81	294	120	182	393	118	77	14	221	44	1,544
Contract-solvent recycling	N.A	90	5	17	7	10	23	7	4	1	13	3	90
Factory applied coatings	N.A.†	45,000	N.A.										45,000
Pharmaceuticals	2831, 2833, 2834	1,100	54	282	115	106	215	68	81	20	143	16	1,100
Petroleum re-refining and processing	2992 + others	1,544	---	23	15	37	37	23	15	9	33	14	206
Rubber	3011, 3021, 3031, 3041, 3069	1,539	178	186	128	193	495	82	47	18	187	25	1,539
Electronic components	367	2,855	367	588	230	173	524	132	78	36	694	33	2,855
Batteries	3691, 3692	262	17	17	24	44	52	24	18	7	41	13	257
TOTAL	-	85,276	3,690	4,777	2,776	3,875	8,980	1,803	1,392	485	3,315	717	76,810

*Modified from Fred C. Hart Associates, Inc., 1977.
† Not available. Captive shops are counted under the SIC Code of the parent establishment.

TABLE 7-6

ESTIMATED NUMBER OF POTENTIAL PRODUCERS OF HAZARDOUS WASTES WITHIN SELECTED CATEGORIES

Category	Number of potential producers
Service industry	
Hospitals*	7,200
Medical laboratories*	3,200
Research facilities*	5,700
Sub-total	16,100
Retail industry	
Automotive service stations†	267,000
Special wastes	
Cement manufacturing‡	100¶
Coal-fired utilities§	250-275¶
Oil drilling	Not available
Phosphate rock mining and processing	Not available
Uranium mining	Not available
Other mining	Not available

*Fred C. Hart Associates, Inc., 1977.
†Modified from Fred C. Hart Associates estimates based upon EPA staff estimates that only 90 percent of gasoline service stations would produce hazardous wastes; the other 10 percent are self-service stations which are not likely to produce hazardous wastes.
‡Holberger et al., 1978.
§Personal communications, National Ash Association, 1978.
¶This is the total number of plants generating the special waste. It is not known how many, if any, of these plants would generate special waste that would be identified as hazardous under the regulations.

With regard to 'special wastes', up to about 375 cement manufacturing plants and coal-fired utilities could potentially be producers of such wastes (see Table 7-6). Data are not available to estimate the total number of these plants that could generate wastes that would be identified as hazardous under the Subtitle C regulations. Data are also not available to estimate the number of potential producers of other 'special wastes' that could be identified as hazardous under the regulations; however, the number could be large. For example, 10,000 to 20,000 oil wells have been drilled annually in recent years with about 60 percent of these wells being successful (U.S. Department of the Interior, 1976); however, the number of currently producing wells generating potentially hazardous brines and muds is not known.

Number of Hazardous Waste Generators Required to Comply With the Subtitle C Regulations. The generator regulations provide that establishments producing and disposing of more than 100 kilograms per month of wastes are to be identified as hazardous waste generators subject to regulation. Table 7-2 shows, by EPA Region, the estimated number of manufacturing establishments producing less than 100 kilograms of hazardous wastes per month and the total amount of hazardous wastes produced annually by such establishments. Over 81,000 manufacturing establishments could potentially be excluded from complying with the regulations based upon a generator limit of 100 kilograms per month. While these establishments represent about 26 percent of all manufacturing establishments within the SIC Codes considered, they produce less than 0.1 percent of the total hazardous wastes produced by all manufacturing industries within these particular SIC Codes.

Based upon this information and a study by Fred C. Hart Associates (1976), the total number of manufacturing establishments generating hazardous wastes that potentially may not have to comply with the generator regulations is estimated to range between 81,000 and 112,000. The total number that potentially may have to comply is estimated to range between 201,000 and 232,000. The establishments required to comply are estimated to generate over 99.9 percent of all hazardous wastes produced by the manufacturing industries.

With regard to automotive service stations, EPA staff estimates are that about 35 percent of all gasoline service stations would be likely to generate 100 kilograms or less per month of hazardous wastes; thus, up to 210,000 automotive service stations could be subject to the generator regulations. However, EPA staff estimates are that approximately 75 percent of these automotive service stations would use transfer of liability contracts to avoid having to comply with the generator requirements. Thus, on the order of 50,000 automotive service stations could have to comply with the generator regulations. In addition, up to about 16,100 hospitals, medical laboratories, and research facilities could have to comply (see Table 7-6).

Thus, there would potentially be on the order of 270,000 to 300,000 generators within these three categories who could be subject to the generator regulations.

7.1.3.4 Number of Transporters Required to Comply with the Regulations. Hazardous wastes are transported by highway, rail, waterway, air, and pipeline, with the vast majority being transported by truck (see Appendix E). Hazardous waste transporters include hazardous waste generators, treaters, and disposers as well as establishments engaged solely in transport activities. According to a recent study of the hazardous waste transport industry (Arthur D. Little, 1978a), the number of firms currently transporting hazardous wastes is unknown, both for the industry as a whole and for each of its segments.

7.1.3.5 Number of Storers, Treaters, and Disposers Required to Obtain Permits. Sections 7.1.2.3 and 7.1.2.4 delineate those hazardous waste storers, treaters, and disposers who would be required to obtain permits. A study by Battelle Columbus Laboratories (1978) attempted to estimate the number of potential permittees under the regulations. Table 7-7 shows the Battelle Columbus Laboratories' estimate of the number of potential permittees for the manufacturing industries (for those industries listed in Table 7-5), Federal installations, hospitals, automotive service stations, and the existing hazardous wastes management service industry. There are estimated to

TABLE 7-7

ESTIMATED NUMBER OF POTENTIAL PERMITTEES*

Category	Number of potential permittees
Manufacturing industry	
Electronic components	325
Electroplating and metal finishing	
Job shops	744
Captive shops	4,000
Explosives	577
Inorganic chemicals	138
Leather tanning and finishing	30
Metals smelting and refining	549
Organic chemicals	845
Paint and allied products	235
Pesticides	512
Petroleum refining	143
Petroleum re-refining	7
Pharmaceuticals	421
Plastics	462
Rubber products	65
Special machinery	781
Storage and primary batteries	52
Textiles	190
Miscellaneous	11,659
Sub-total	21,735
Government	
Federal installations	241
Service industry	
Hospitals	7,174
Hazardous waste management	110
Sub-total	7,284
Retail industry	
Automotive service stations	0
Total	29,260

*Modified from Battelle Columbus Laboratories, 1978.

be about 29,000 potential permittees within these groups. According to that study, data are not available to estimate the number of potential permittees within other categories.

With regard to treaters, storers, and disposers of 'special wastes', there could be potentially a large number of permittees. For example, in Wyoming alone there are about 10,000 lagoons used for the disposal of oil drilling muds and brines. Data are not available to estimate the portion of 'special wastes' that would be identified as hazardous, nor the number of potential permittees managing such hazardous 'special wastes'.

7.1.3.6 Paperwork Requirements Under the Regulations. The Subtitle C regulations establish reporting and recordkeeping requirements for generators, transporters, storers, treaters, and disposers of hazardous wastes. Many of these reporting and recordkeeping requirements would be in addition to existing requirements.

Generators would be required to prepare a manifest for each off-site hazardous waste shipment, keep a copy of each manifest for 3 years, submit a quarterly report on manifested shipments for which the signed original manifest (or delivery document) is not returned, and submit an annual report based on the manifests or on wastes managed on-site. Transporters would be required to keep a copy of manifests (or delivery documents) for a perid of at least 3 years. Owners/operators of permitted hazardous waste management facilities (i.e., storers, treaters, and disposers) would be required to keep a copy of each manifest (or delivery document) for 3 years and also to prepare and keep for 3 years records of specified operating conditions, records of employee training, and records of groundwater monitoring. In addition, each owner/operator would be required to prepare and keep until facility closure a log containing: the location and types of wastes disposed at the facility, required waste analyses, required monitoring data, results of required visual inspections, and records of any human health or environmental damage caused by the facility. Each owner/operator would also be required to submit both an annual report based upon manifests received during the year and a quarterly report on groundwater and leachate monitoring, if applicable. Each owner/operator would also have to submit a permit application and appropriate supplemental material. In addition, within 90 days following promulgation of the Section 3001 regulations, all generators, transporters, storers, treaters, and disposers would be required to notify the EPA Regional Administrator (or an authorized state) that they fall into one of these categories.

Number of Manifests. Based on the assumptions stated in Section 7.1.4.1, it is estimated that there could be between 350,000 and 690,000 off-site shipments of hazardous industrial wastes annually by 1984, necessitating industrial generators to prepare between 350,000 and 690,000 manifests annually. An indeterminable number of manifests could also have to be prepared by other generators. The aggregated generators, transporters, and owners/operators of hazardous waste management facilities would each have to keep between 1.0 and

2.1 million manifests in storage on an annual basis. Most transporters currently keep at least 3 years worth of delivery documents in storage due to various state and Federal requirements (see Appendix E). To the extent that transporters use acceptable delivery documents in lieu of manifests or use manifests in lieu of existing delivery documents, this recordkeeping requirement would not constitute an additional burden on transporters. However, as indicated in Chapter 2, most states do not require generators or hazardous waste management facilities to prepare or retain records on hazardous waste shipments and, as a result, much of such recordkeeping under Subtitle C would represent an additional requirement.

Other Recordkeeping Requirements. Generators would also have to keep records on wastes managed on-site to enable preparation of annual reports. Each owner/operator of a permitted hazardous waste management facility would have to keep an operating log for the life of the facility, plus 3 years worth of those records specified above. Most of this recordkeeping would represent an additional requirement, based upon existing state regulations.

Number of Recurring Reports. Approximately 270,000 to 300,000 annual reports could potentially be prepared by the previously identified generators, assuming that generators who dispose wastes both on-site and off-site prepare one combined annual report for both types of disposal. Permittees would have to prepare annual reports only if they receive manifested wastes. Most of the potential permittees listed in Table 7-7 would be on-site facilities and would not have to prepare additional annual reports. Hazardous waste management service industry facilities and Federal installations could prepare about 350 additional annual reports. An indeterminable number of additional annual reports would also have to be prepared by other generators and hazardous waste management facilities such as generators or disposers of 'special wastes'.

Each permittee would also have to submit four monitoring reports annually, if there was a potential for discharge to groundwater from the facility. Based on Table 7-7, there could be up to 117,000 such monitoring reports submitted annually.

Thus, there could be upwards of 387,000 to 417,000 reports prepared and submitted annually by generators and hazardous waste management facilities. Most of these reports would represent additional reporting requirements, based upon existing state regulations.

Number of Non-recurring Reports. The previously identified generators and permittees would have to file about 270,000 to 300,000 notifications under Section 3010 with EPA or authorized states. An indeterminable number of transporter and other potential generators and permittees would also have to file such notifications.

Transporters could potentially have to file between 140 and 270 spill reports annually, based upon Section 7.1.4.1. Permittees would have to file an indeterminable number of incident reports annually. The potential permittees identified in Table 7-7 would have to submit approximately 29,000 permit applications and additional supplemental material. The permit application consists of two parts which may be submitted separately or together. Most of these submittals would represent additional requirements, based upon existing state regulations.

7.1.4 Air Impacts. This section discusses potential impacts that could occur with regard to air quality and climate as a result of promulgation of the Subtitle C regulations.

7.1.4.1 Air Quality Impacts. Current hazardous waste generation, transport, and storage, treatment, and disposal practices involve a variety of activities, each of which has the potential for releasing air pollutants to the environment. The potential for the release of air pollutants by each of these activities (e.g., landfilling, incineration, containerization) would be affected in different ways by the Subtitle C regulations. This section discusses current sources of air pollutants from each of these activities, incidents that have occurred from current practices, and the ways in which the baseline regulations could affect potential air pollutant releases from these sources and practices.

Air Quality Impacts Relative to the Generation of Hazardous Waste. The Subtitle C regulations would apply only to those air emissions, and resultant air quality impacts, that are produced by activities occurring after the generation of hazardous wastes. The regulations would not apply to those air emissions produced during the generation of hazardous wastes, nor to those air emissions produced from the reuse of hazardous wastes as an integral part of subsequent process steps without intervening storage. Thus, the Subtitle C regulations would not have a direct effect on air emissions resulting from hazardous waste generation. However, to the extent that the regulations change the economics of disposal or treatment, and thus result in process modifications engineered to recycle hazardous wastes or to reduce or alter the quantity and/or types of hazardous waste generated, Subtitle C could indirectly result in changes in process air emissions.

Air Quality Impacts Relative to Storage of Hazardous Wastes. Current practices in the storage of hazardous wastes can lead to the release of air pollutants in three major ways:

- Through fugitive emissions resulting from improper storage of hazardous wastes;
- Through emissions resulting from spills, fires, explosions, and other accidental releases of hazardous wastes and/ortheir constituents;
- Through emissions occurring as the result of storage becoming the ultimate form of disposal of hazardous wastes.

As discussed below, the Subtitle C regulations would reduce, to varying degrees, the existing potential for release of air emissions from each of these sources. In addition, any facility construction and/or modification required by the Subtitle C regulations would affect construction-related air emissions.

Fugitive emissions are currently likely to occur in a number of ways. The loading or placing of hazardous wastes into storage containers, storage piles, or surface impoundments currently results in the release of fugitive emissions containing the hazardous waste itself. For example, the loading of solid wastes, particularly fine waste materials, onto open storage piles is likely to result in particulate matter which contains hazardous waste constituents becoming airborne in the vicinity of the loading area. The loading of hazardous wastes containing volatile materials into tanks or other containers is also likely to result in the escape of fugitive air emissions. In both cases, the amounts of fugitive emissions emitted is dependent upon the characteristics of the specific wastes being stored, the degree of controls employed (e.g., dust or vapor recovery systems), and the adequacy of maintenance operations, particularly for pump seals, joints, flanges, and other equipment used with volatile wastes.

A major current source of fugitive emissions is the escape of air pollutants from hazardous wastes which have not been properly covered or containerized during storage. Such wastes may be subject to the release of particulate matter containing the hazardous waste as a result of wind erosion. Volatile wastes stored in containers without adequate controls are also a potential source of fugitive emissions. The quantity of fugitive emissions produced is dependent upon the volatility of the waste, the adequacy of the container and its seals, and the effectiveness of any control equipment present. Liquid wastes stored in surface impoundments and basins are also a source of fugitive emissions due to evaporative losses and/or volatilization of hazardous components.

While data are not available to estimate the magnitude of fugitive emissions presently occurring from hazardous waste storage, the following reported incidents illustrate the types of air quality problems that have occurred under current practices (see Appendix J for other incidents):

- Since 1867, asbestos product manufaturers have accumulated nearly 2 million cubic yards of assorted industrial wastes in open piles in a small Pennsylvania town. The original generator of the wastes went out of business in 1962. Since then two other companies have been responsible for enlarging the spoils piles. The air in the vicinity of the piles has been observed to contain asbestos fibers due to wind erosion. An air-monitoring program conducted by the U.S. Environmental Protection Agency in October 1973 indicated ambient background levels of asbestos in the area to be 6 ng/m^3. An asbestos level of 9.6 ng/m^3 was found at a playground near the largest waste pile. Values obtained near active disposal piles ranged from 114 to 1745 ng/m^3 (Office of Solid Waste Program, 1974a).

- A firm engaged in the disposal of spent chemicals was storing and disposing of toxic chemical wastes at two Louisiana locations. At one of these sites, several thousand drums of waste (some with and some without lids) were in storage. Many of the drums were popping their lids and leaking; visible vapors were emanating from the area. The pine trees beside the storage area were all killed as a result of this leakage (Office of Solid Waste Programs, 1974a).

The Subtitle C regulations contain provisions that should, to a large degree, reduce the potential for such fugitive air emissions from the storage of hazardous wastes. For example, the Section 3005 regulations would require that all owners/operators of hazardous waste storage facilities, except storage facilities operated by generators who store hazardous wastes for 90 days or less prior to off-site treatment/disposal in an approved facility, obtain a permit for such storage. To obtain and keep a permit, such storage facilities would have to comply with the Section 3004 storage regulations. According to these regulations, hazardous waste storage operations would have to be conducted in such a manner that no discharge occurs; these storage operations would also have to be monitored and inspected to detect any potential discharge. Hazardous wastes which could release air emissions that could adversely affect human health or the environment if stored in an open manner would be required to be stored in tanks or other closed containers. Hazardous wastes to which this requirement would apply include those which could potentially release air contaminants in concentrations, measured at the surface of the storage area, exceeding the Threshold Limit Values (TLV) listed in Appendix B, Subpart D, Annex 2. For example, the asbestos-containing wastes previously discussed would likely have to be stored in closed containers under the Subtitle C regulations rather than placed in open piles.

Furthermore, the regulations require that containers used to store hazardous wastes must not be opened, handled, or stored in any manner which could rupture the container or cause it to leak. Wastes in containers whose contents begin to leak would have to be recontainerized. Also, storage containers and tanks would have to be constructed of materials, or contain a liner, which are compatible with the wastes stored. These requirements would apply, for example, to the hazardous wastes stored in leaking containers at the Louisiana storage site previously discussed. Under the Subtitle C regulations, such wastes would have to be recontainerized and stored in another manner less susceptible to leakage.

In addition, volatile wastes--those with a true vapor pressure greater than 78 mm mercury at 25 C--would not be allowed to be stored in surface impoundments or basins under the Subtitle C regulations. Storage tanks with a capacity in excess of 19,000 liters (5,000 gallons) would not be allowed to be vented directly to the atmosphere if they contained such volatile wastes. Examples of listed hazardous waste constituents (Appendix B, Subpart A, Paragraph 250.14(a)) which have vapor pressures greater than that specified above and which have also been identified in hazardous industrial waste streams (see Appendix C) include: acrolein, benzene, chloroform, methyl bromide, trichloroethane, and vinyl chloride (Perry et al., 1973). The Louisiana landfill incident cited above illustrates one type of incident that has occurred from fugitive emissions from the storage of volatile wastes.

Spills, fires, explosions, and other accidents represent a second major source of potential air emissions from current hazardous waste storage practices. Improper storage and mixing of incompatible wastes and the improper storage and handling of potentially explosive or ignitable wastes have been major contributors to fires and explosions in hazardous waste storage areas in the past. Incompatible wastes are those wastes unsuitable for commingling with another waste or material because the commingling might result in:

extreme heat or pressure generation; fire; explosion or violent reaction; formation of substances which are shock-sensitive, friction-sensitive, or otherwise have the potential of reacting violently; formation of toxic dusts, mists, fumes, gases, or other chemicals; volatilization of ignitable or toxic chemicals due to heat generation. Appendix B, Subpart D, Annex 4 presents examples of potentially incompatible wastes.

Volatile wastes and wastes composed of fine materials are those most likely to release air contaminants emissions as a result of storage accidents. In addition, ignitable wastes which catch fire as a result of an accident are a further source of emissions. Fires could also create and release additional hazardous air contaminants not originally present in the hazardous waste itself (Appendix M describes some of the emissions that could occur from the combustion of hazardous wastes).

The following data illustrate the potential for such impacts under current practices. In 1976 there were, from sources other than transport activities, approximately 4,000 spills of hazardous materials (not generally wastes) reported under Section 311 of the Federal Water Pollution Control Act (see Section 6.4.). Over 1,300 of the total reported spills (transportation and non-transportation related) involved waste materials, primarily waste oil. In 1976 in Ohio there were another 160 reported spills involving potential air pollution problems (this includes spills of both hazardous wastes and nonwaste materials from storage and transportation). Of the 160 reported spills, 39 involved hazardous air pollutants such as ammonia, chlorine, acetone, hydrochloric acid, dimethoate, hexamethylene, parathion, vinyl chloride, propargyl alcohol, perchloroethylene, xylene, butyl acrylate, titanium tetrachloride, chlorinated hydrocarbons, hydrogen peroxide, ethyl ether, and nitric acid (State of Ohio, 1976).

The following incidents identify some of the types of accidents that have occured with a potential for releasing air pollutants. Additional examples of such incidents are discussed in the section on treatment/disposal of hazardous wastes and in Appendix J.

- In 1973, a major chemical company in Virginia contracted with a processing firm in Alabama to pick up, haul, and dispose approximately 10,000 drums of aramite waste, containing 30 to 80 percent sulfuric acid. Most of the wastes were shipped in 208 liter (55-gallon) steel drums and 190 liter (50-gallon) iber drums. The wastes brought to Alabama were never processed and remained in two open storage areas and in one enclosed warehouse. Due to weathering, physical stress, and the corrosive and harsh nature of the wastes, many of the drums stored in the two open areas disintegrated and their contents spread over the adjacent ground. In addition to contamination of local waters (chemical analysis of samples of drainage water from the storage site indicated very high acidity and high concentrations of heavy metals), the storage of waste at the three locations presented a great fire hazard. On March 9 and 10, 1976, a fire broke out at the site, and two firefighters became ill, presumably due to inhalation of toxic fumes.

- At a land disposal site in Southern California, a tanker unloaded a waste listed as "waste acid" into a subsurface, bottomless tank through an open stack above the ground. Shortly after the unloading operation commenced, yellowish-brown clouds of nitrogen dioxide began to emanate from the open stack. The reaction appeared to have subsided when the discharging of the wastes ceased. However, an hour later, additional nitrogen dioxide started to spew from the stack. The emission was halted by filling the stack with soil.

There were no reported injuries; however, there were many complaints from nearby businesses, and a factory was evacuated.

- The following incident while it did not involve wastes per se, illustrates the potential for combustion of wastes due to fire and the associated problems. In April 1971, a fire occurred in the warehouse in Okanogen County, Washington, where about 2 tons of pesticides were stored, including guthion, parathion, endrin, dieldrin, DDT, and other chlorinated hydrocarbons. Nearly 50 tons of fertilizer were also stored in the building. Toxic emissions from the burning of these chemicals forced the evacuation of nearby residents. Officials also feared the possibility of explosions caused by the fertilizers. Nearly 2 million gallons of water were required to extinguish the fire. Much of this water spilled into the street and flowed through gutters and storm sewers to the Okanogen River 1/2 mile away. Endrin at a level of 0.8 ppm was detected in the run-off into the river in early April. Also, a city well about 500 feet from the fire site showed a nitrate concentration of 34.4 ppm in early June. Expectant mothers and small children were cautioned to avoid drinking the city water for a period of 2 weeks after the incident.

The Subtitle C regulations contain provisions that should reduce the potential for fires, explosions, and other accidents at hazardous waste storage facilities and the potential for impacts from any accidents that do occur. For example, the Section 3004 regulations require that storage containers holding wastes that are incompatible would have to be separated from each other or protected from each other in order to prevent the wastes from mixing should the containers break or leak. Storage areas would have to be constructed to contain any spills that might occur. Explosive, ignitable, or highly reactive wastes (see Appendix B, Subpart A, Section 250.13) would not be allowed to be stored in surface impoundments or basins.

Incompatible wastes would not be allowed to be mixed in storage basins, nor in surface impoundments except for treatment purposes.

One of the major causes of the mixing of incompatible wastes or the improper storage of explosive, ignitable, or highly reactive wastes has been the lack of accurate information about the waste being provided to the waste handler (Office of Solid Waste, Hazardous Waste Management Division, 1978a). The manifesting and labeling requirements under Section 3002 would make such information more readily available and would further reduce the potential for accidents from the improper storage of such wastes.

In addition, owners/operators of storage facilities would have to inspect storage areas daily for rust, corrosion, cracks, and spills. Also, hazardous waste storage facilities would have to prepare contingency plans to minimize human health or environmental damage in the event of an accidental discharge of hazardous materials to the surrounding air, surface, or subsurface environment (see Appendix B, Subpart D, 250.43-4). To the extent that this latter requirement and the spill containment requirement reduce the time necessary to clean up spills or prevent additional accidental discharges, there would be a reduction in air pollutants and resultant impacts from any such accidental releases. Furthermore, other reductions in fugitive emissions, as previously discussed, would reduce the potential for fires and explosions from such emissions, especially from volatile wastes.

A third source of air emissions are current practices in which hazardous wastes are placed in storage for indefinite periods of time; in many such cases the hazardous wastes are ultimately abandoned rather than being disposed. Such wastes may be stored in containers or may be stored in an open manner. Due to such factors as weathering and/or corrosion, containers eventually rupture or leak, releasing their contents to the environment. As discussed above, volatile, flammable, or fine waste materials are the most likely sources of air emissions following such releases. Also, any such releases increase the potential for the mixing of incompatible wastes with the resultant consequences described above. Wastes which were not originally containerized would be subject to erosion and/or volatilization during the time that they were in storage.

Several incidents have previously been cited illustrating the potential problems from indefinite storage of hazardous wastes (i.e., asbestos storage piles in Pennsylvania and aramite waste in Alabama). The following incident further illustrates the potential problem:

- In 1971, a major chemical company in New Jersey contracted with an independent waste transporter to remove and dispose of 55-gallon drums containing petrochemical wastes. The wastes included acrylonitrile, acetone, epichlorohydrin, and a number of other chemicals possessing toxic, flammable, explosive, and oxidizing properties. A total of about 6,000 of these drums were hauled away and were to be disposed of at a landfill. However, approximately 4,500 of the drums were dumped by the transporter on a section of a former chicken farm in Dover Township, New Jersey. The land had been leased to the transporter under the assumption that he was in the drum salvaging business and empty drums were to be stored there. A few months later the owners detected unusual odors emanating from the leased land and discovered thousands of drums, many leaking, buried, and strewn about. In 1974, it was discovered that an unknown portion of the Cohansey Aquifer, a major groundwater table aquifer, had been contaminated by the wastes (State of Minnesota, 1977).

The proposed regulations contain provisions that should, to a large degree, reduce the potential for air emissions that result from the indefinite storage of hazardous wastes. The Section 3004 regulations require that at facility close-out, all hazardous wastes would have to be removed from storage operations and disposed as required under Subtitle C. In addition, the manifest requirements under Section 3002 would help to insure that wastes are delivered to permitted facilities and not stored or abandoned in an environmentally unacceptable manner. It should be noted that acceptable treatment/disposal methods would not necessarily exist for every hazardous waste (see Chapter 5 for a discussion of wastes that have required engineered storage in recent years), and any such wastes could have to be stored for indefinite periods until treatment/disposal methods were developed. However, any such storage would have to be in compliance with all the requirements previously discussed. Based upon Appendix D, large quantities of industrial wastes are known to be stored in surface impoundments; such storage quite often constitutes disposal.

One other source of air pollutant generation common to all hazardous waste management activities would be the construction of necessary hazardous waste management facilities and related conjunctive developments (e.g., roads, pipelines, power lines, reservoirs). To the extent that the Subtitle C regulations result in modifications to or the construction of additional hazardous waste storage, transportation, disposal, or treatment facilities, there would be an increase in construction related air emissions. The major emissions would include exhaust from motor vehicles, including construction equipment, and fugitive dust raised by such construction activities as grading, excavation, and movement of equipment.

Vehicle emissions during construction would consist primarily of nitrogen oxides, hydrocarbons, and carbon monoxide. The emission levels would be extremely site-dependent. The magnitude of fugitive dust emissions would depend upon such factors as soil and terrain characteristics, time of year, method of construction, size of the area disturbed, and type of control measures utilized. Cowherd et al. (1974) summarized the available information on emissions from fugitive dust sources and found that while activity levels significantly influence emission rates, the relationship cannot be quantified.

<u>Air Quality Impacts Relative to Transport of Hazardous Wastes.</u> Current practices in the transport of hazardous wastes have the potential to release air emissions in three major ways:

- Though fugitive emissions resulting from improperly covered, sealed, or containerized wastes;
- Through emissions resulting from spills or other accidental releases of hazardous wastes;
- Through emissions resulting from the operation of the transport vehicle.

As discussed below, the Subtitle C regulations would affect, to varying degrees, the potential for the release of air emissions from each of these sources. In addition, construction related air emissions could be affected by construction and/or modification of transportation facilities as a result of the Subtitle C regulations.

There are several potential sources of fugitive emissions from the transport of hazardous wastes. These include emissions released during the loading and/or unloading of hazardous wastes that have not been containerized or that have not been properly covered and/or containerized for transport. Appendices D and E indicate that a sizeable portion of hazardous wastes are typically transported without being containerized. Potential sources and types of fugitive emissions from the loading, unloading, and transport of hazardous wastes would be very similar to those discussed under storage and are not repeated here. In addition, solid hazardous wastes which are not properly covered or containerized during transport would be subject to wind erosion and would be a potential source of particulate matter emissions. Such particulate matter would be composed of the hazardous waste material itself.

Fugitive emissions during transport could result in adverse impacts in the vicinity of the route of travel, as illustrated in the following examples:

- A truck driver noticed that one of the drums he was hauling through the village of Mundelein was leaking titanium trichloride, a chemical that changes to an hydrocloric acid mist on contact with the air. Fourteen people were hospitalized for exposure to the fumes. The four drums of chemicals were neutralized and buried (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- In the San Francisco Bay Area, an attempt was made to recover alkyl lead from organic lead wastes. The wastes were transported by truck to a recovery plant. Toll collectors on a bridge along the truck route to the recovery plant became ill as a result of vapors escaping from the transporting truck (Office of Solid Waste Programs, 1974a).

The regulations contain provisions that should, to some degree, reduce the potential for fugitive air emissions from the transport of hazardous wastes. The Section 3002 regulations would require that every generator containerize his hazardous wastes in accordance with the Department of Transportation (DOT) regulations on packaging under 49 CFR 173, 178, and 179. If no specific packaging is required, the generator would have to place the hazardous waste in a package in accordance with the DOT regulations on standard requirements for all packages under 49 CFR 173.14(a), (b), and (c) (2-9). Since the DOT regulations currently apply only to interstate shipments of hazardous materials, the effect of the Section 3002 regulations would be to extend the DOT regulations to interstate shipments of hazardous wastes that are not identified as DOT hazardous materials and to most intrastate shipments of hazardous wastes (about 27 states have adopted the DOT Hazardous Materials Regulations in toto or have similar regulations; about twelve others have adopted parts of the Hazardous Materials Regulations). According to a study by Arthur D. Little, Inc. (1978a), about one-half of the hazardous wastes transporters surveyed did not transport wastes across state borders.

While the regulations do not contain specific provisions to reduce fugitive air emissions from the loading and/or unloading of uncontainerized wastes, nor from the placing of wastes in containers, the air human health and environmental standard would reduce the potential for the release of such emissions at permitted facilities.

A second major source of air emissions from hazardous waste transport are accidents which result in spills or other releases of hazardous wastes. The two most likely causes of such releases are accidents involving the transport vehicle itself and explosions occurring within the transport vehicle as the result of the mixing of incompatible wastes. Once the waste material has been released, those wastes which are relatively volatile or which are composed of fine particles are most likely to become sources of air emissions. In addition, wastes which are ignitable can catch fire following an accident and become the source of additional air emissions. Such combustion can create additional hazardous air contaminants not originally present in the waste itself and would serve to disperse those air pollutants generated.

The following incidents illustrate some of the types of air pollutant problems that have occurred during hazardous waste transport:

- An industrial waste truck exploded in a truck bin on the Dan Ryan Expressway in Chicago spewing barrels of flames over cars and across all eight lanes of the roadway. The chemical waste which exploded was believed to be sodium nitrate which was part of the load being carried by the truck (Office of Solid Waste, Hazardous Waste Management Division, 1978b.).

- In Richmond, California, a hazardous waste hauler mixed a liquid waste containing butyl acetate in xylene, with an etching waste containing sulfuric acid, nitric acid, and hydrofluoric acid. A hydrolysis reaction took place. Pressure was generated in the tank, and the safety relief valve was blown off while the truck was travelling through a residential area. A private residence was sprayed with the hazardous mixture. No one was injured, but considerable clean-up was required (DeVera et al., 1977).

The regulations contain provisions that should reduce the potential for explosions and spills resulting from the mixing of incompatible wastes during transport. The Section 3003 regulations contain the requirement that the transporter must load and stow hazardous wastes so that those which are incompatible would not come into contact with each other. The Section 3002 requirement that generators must label hazardous wastes and must furnish information about the general chemical composition of each hazardous waste on the manifest to be provided to the transporter would aid the transporter in identifying incompatible hazardous wastes. To the extent that transporters can increase the identification of incompatible wastes during transport, there would be a reduction in air incidents from the mixing of hazardous wastes during transport.

The baseline regulations do not contain provisions that would directly reduce vehicular accidents, and subsequent spills, of hazardous wastes during transport. However, the regulations do contain provisions that would reduce the potential for air emissions following such accidents and spills. The baseline regulations require that the manifest provide either immediate response information regarding what actions should be taken in an emergency situation or a 24-hour telephone number for obtaining such information. The manifest would also aid in identifying the general chemical composition of the spilled hazardous waste. This information would likely aid in cleaning up the spill. To the extent that the time for cleanup is reduced, the potential for the release of air emissions would be reduced. It should also be noted that any reduction in the mixing of incompatible wastes would also result in a decrease in accidents during hazardous waste transport and would result in fewer spills generating air emissions. Based upon an estimated spill rate of one transportation-related spill per 37,500 metric tons of hazardous waste transport (Office of Solid Waste, Hazardous Waste Management Division, 1978a) and 40 million metric tons of hazardous industrial waste generation in 1984, it is estimated that under the Subtitle C regulations these could be on the order of 140 spills annually with 13 percent off-site treatment/disposal and on the order of 270 spills with 25 percent off-site treatment/disposal. Based upon a typical transport vehicle size of 14.5 metric tons (Arthur D. Little, Inc., 1978a), approximately 2000 to 4000 metric tons of hazardous wastes could be involved in such spills. Data are not available to estimate potential air emissions likely to be released by such activities.

The spill rate used above is based upon reported incidents from the transport of hazardous materials which are predominantly not wastes. Such hazardous materials are currently subject to essentially the same containerization, labeling, and placarding regulations as would be required for hazardous wastes under the Subtitle C regulations. While the spill rate is a reasonable approximation of what could happen under the Subtitle C regulations, it is not a reasonable measure of what could happen without the Subtitle C regulations since there would likely be a higher rate of spills due to improper containerization and to the mixing of incompatible wastes. Thus, the reduction in the number of spills under the Subtitle C regulations cannot be estimated using this spill rate.

Another major source of air pollutants from hazardous waste transport are emissions from the transport vehicle itself. To the extent that the regulations shift hazardous waste transportation patterns, there would be a change in the total amount of vehicle emissions from hazardous waste transport. At present, the relatively high cost of long-distance transportation of hazardous wastes and the lack of hazardous waste treatment and disposal regulations combine to minimize the distances over which hazardous wastes are hauled. As discussed in Section 7.1.2.2, the regulations would likely increase transport distances involved in hazardous waste management.

Table 7-8 presents estimates of the potential magnitude of the change that could occur in vehicular emissions in 1984 as a result of promulgation of the Subtitle C regulations. The estimates are presented for both 13 and 25 percent off-site shipment of hazardous wastes in 1984 (see section 7.1.2.4). Since data are not available to determine the average transport distances likely to occur in 1984 under the regulation, the potential change in emissions is estimated for four possible transport distances.

TABLE 7-8

ESTIMATED CHANGE IN VEHICULAR EMISSIONS IN 1984 FROM TRANSPORT OF HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in emissions (metric tons)				
		Carbon monoxide	Hydrocarbons	Nitrogen oxides	Particulates	Sulfur oxides
13 percent	100	-160	-20	-110	-10	-20
	200	880	140	640	40	90
	500	4,000	630	2,900	180	390
	1,000	9,100	1,500	6,600	410	890
25 percent	100	780	120	540	40	80
	200	2,800	440	2,000	120	270
	500	8,700	1,400	6,300	390	850
	1,000	18,600	3,000	13,500	840	1,800

The estimates in Table 7-8 are determined as follows. According to the hazardous waste transportation study by Arthur D. Little, Inc. (1978a), most hazardous wastes shipped off-site are currently transported by truck with typical reported transport distances of 50 miles (100 miles round trip) and typical vehicle capacities of about 14.5 metric tons (18 tons). Typical on-site transport distances are about two miles round trip. These typical transport distances are assumed to be the baseline for estimating the changes in vehicular emissions. The change in the quantity of hazardous wastes transported on-site and off-site on an annual basis in 1984 is determined as discussed in Section 7.2.5. The estimated change is a decrease of 0.8 million metric tons in off-site shipments in the case of 13 percent off-site treatment/disposal and an increase of 4.0 million metric tons in off-site shipments in the case of 25 percent off-site treatment disposal. The change in the number of off-site and on-site hazardous waste shipments is determined based upon the typical vehicle capacity of 14.5 metric tons. For each of the four selected 1984 transport distances, the change in emissions is estimated based upon emission factors for heavy duty, diesel-powered trucks (U.S. Environmental Protection Agency, 1977a).

For purposes of comparison, total U.S. emissions of carbon monoxide, hydrocarbons, nitrogen oxides particulates, and sulfur oxides were 85.7, 26.1, 22.0, 14.3, and 25.9 million metric tons, respectively, in 1975. Total U.S. area emissions from heavy-duty diesel powered vehicles in 1975 were 0.7, 0.2, 1.5, 0.1, and 0.2

million metric tons of carbon monoxide, hydrocarbons, nitrogen oxides, particulates, and sulfur oxides, respectively (U.S. Environmental Protection Agency, 1978a). The emissions in Table 7-8 for the 1,000-mile round-trip distance with 25 percent off-site treatment/disposal represent an increase of less than 0.06 percent in each of the total U.S. emissions and of less than 3 percent in each of the total U.S. area emissions from heavy-duty, diesel-powered vehicles. The emissions for the 100-mile round-trip distance with 13 percent off-site treatment/disposal represent a decrease of less than 0.0005 percent in each of the total U.S. emissions and of less than 0.02 percent in each of the total U.S. area emissions from heavy-duty, diesel-powered vehicles.

Air Quality Relative to Treatment/Disposal. The major sources of air emissions from current hazardous waste treatment/disposal practices are as follows:

- Fugitive emissions from land-based treatment/disposal activities such as landfills, landfarms, and surface impoundments;
- Emissions generated by explosions, fires, and other accidents;
- Residuals from the combustion of hazardous wastes by incineration or open burning;
- Fugitive emissions from other treatment activities;
- Fugitive emissions from facility construction or modification.*

*These fugitive emissions are discussed under storage and are not repeated in this section.

The Subtitle C regulations would affect the potential for release of air emissions from each of these sources as discussed below.

Such land-based activities for the treatment/disposal of hazardous wastes as landfills, landfarms and surface impoundments currently release air contaminants through several mechanisms. Activities which result in soil disturbance, such as excavation, trenching, covering, grading, and compaction, generate fugitive dust. The magnitude of fugitive dust emissions depends upon such factors as soil and terrain characteristics, time of year, type of equipment utilized, size of the area disturbed, and type of control measures employed. Vehicles and equipment used in land disposal are a further source of emissions from such activities, as previously discussed. Fugitive emissions also occur when the hazardous waste is initially being deposited in the treatment/disposal site. Such fugitive emissions usually consist of the waste and/or its constituents and would be similar to those previously discussed under storage and transportation.

Following placement of the waste in the treatment/disposal site, gaseous materials that are potentially hazardous are often generated and released under current practices. Such emissions generally result from volatilization, sublimation, chemical reaction, and/or decomposition of the wastes. The rate of generation and release of such gaseous materials is a function of many factors including the nature, water content, and depth of any cover material; chemical characteristics and composition of the waste materials; and temperatures in the treatment/disposal site and temperature of the waste. With regard to volatilization, numerous instances of air pollution problems have been reported under current practices, as indicated below:

- An industrial solvent reprocessing firm in Maryland dumped large quantities of volatile organic liquid wastes, containing benzene, carbon tetrachloride, acetones, ketones, mythelene chloride, and other solvents into a sand and gravel quarry. The wastes, even though volatile, were often left open in an evaporating pool before being covered. Many of the solvents contained in the waste were detected in significant concentrations in the air in the vicinity of the quarry (see Section 7.1.6, Public Health) (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- In July 1977 several truckloads of organohalides, amines, and hydrocarbons were dumped by a waste disposal firm at a disposal site near San Francisco, California. The wastes were deposited in an evaporation pond, where they soon floated to the top and began to evaporate. A visible and odoriferous plume of white mist hovered over the area for several hours, provoking nausea and other complaints from residents downwind of the site. At least one building in the area had to be evacuated (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

Air quality problems from existing land disposal practices are also associated with the products of chemical and microbial transformations. Chemical reactions from the mixing of incompatible wastes have occurred on numerous instances and are described in the subsequent discussion of explosions, fires, and accidents. The disposal of organic wastes can produce gases through the decomposition and chemical reaction of the waste material. Gases produced usually include methane, carbon monoxide, carbon dioxide, hydrogen, and oxygen. Most studies of gas generation through decomposition of organic wastes have focused only on municipal solid wastes. Streng

(1976) is studying the effects on gas production from the codisposal of six industrial wastes with municipal solid wastes. Table 7-9 shows the gas composition data measured in the six industrial waste test cells and one municipal solid waste test cell at the time of the report. According to Streng, most of the study cells were progressing from an anaerobic nonmethanation stage to the early phases of methanation at the time of the report. However, the addition of refinery wastes to the municipal solid wastes appeared to have sped up the decomposition of the municipal solid wastes and the resultant production of methane. In a later report, Streng (1977) noted that the test cell containing the mixture of the solvent based paint sludge and municipal waste produced less than the theoretical minimum amount of gas expected to have been generated, indicating that this industrial waste exerted an adverse effect on gas production.

Migration of methane and other combustible gases resulting from current landfill practices has caused explosions and other problems. For example:

- A landfill in Deck Quarry, Montgomery County, Pennsylvania accepted municipal and industrial wastes until it closed in 1969. Two explosions and the contamination of residential drinking water resulted from the generation of methane gas and its migration through rock fractures. Residents have had to evacuate their houses permanently (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- Migration of gases from a landfill containing household and industrial wastes, along with sewage sludge, resulted in the deaths of over 70 peach trees in Glassboro, New Jersey between 1971 and 1975. Combustible gases and carbon monoxide were found along with low oxygen concentrations in the root zones of the trees up to 24 meters (80 feet) from the landfill (Flower, 1976). Many similar cases, some with the

TABLE 7-9

GAS COMPOSITION DATA*,†

Study cell contents‡	O_2	N_2	CH_4	CO_2	H_2
Municipal solid waste only	0.3	29.9	0.0	69.2	0.0
Refinery sludge	0.2	26.4	17.1	56.1	0.0
Battery reproduction waste	1.1	22.3	0.0	76.5	0.0
Electroplating waste	0.3	16.4	1.1	81.9	0.0
Inorganic pigment waste	0.2	2.9	0.0	96.9	0.0
Chlorine production brine sludge	0.1	16.6	0.0	83.3	0.0
Solvent based paint sludge	0.4	47.0	4.9	41.0	6.4

*Streng, 1976.
†Percent of gas produced by volume.
‡Contents in addition to municipal solid waste.

potential for explosions affecting homes have also been reported for municipal landfills (Flower et al., 1976, 1977; DeGeare, 1976; James, 1977).

The Subtitle C regulations contain requirements that should reduce the potential for fugitive emissions from the land-based treatment/disposal of hazardous wastes. For example, the Section 3005 regulations would require that all hazardous waste treatment/disposal facilities obtain a permit before construction and operation. To obtain and keep a permit, treatment/disposal facilities would have to comply with the applicable Section 3004 air regulations.

The objective of the Section 3004 air regulations would be to insure that treatment/disposal facilities are located, designed, constructed, and operated in a manner such that air emissions from such facilities do not adversely affect human health or the environment. The air regulations applicable to non-point emission sources (e.g., landfills, landfarms, and surface impoundments) would consist of two sets of requirements: mandatory standards with which all facilities must always comply and air human health and environmental standards which would be applicable, on a case-by-case basis, only when there is reason to believe (e.g., a third party challenge) that the mandatory standards are insufficient for human health and environmental protection. If a facility is in compliance with all applicable mandatory standards, it would be assumed to be in complaince with the air human health and environmental standards; the burden of proof would be on the permitting authority to show that the facility was actually in violation of the air human health and environmental standard.

The air human health and environmental standard would require that non-point sources of air emissions not contribute any listed air contaminant (see Appendix B, Subpart D, Annex 2) to the atmosphere, at the surface of the non-point source, in concentrations exceeding the listed Threshold Limit Value (TLV) for that contaminant, nor contribute two or more listed air contaminants in a manner which causes the sum of the individual concentrations divided by the individual TLV's to exceed unity. Examples of air contaminants from the previously discussed incidences to which the air human health and environmental standard could apply include acetone, asbestos, benzene, carbon monoxide, carbon tetrachloride, methane, and methylene chloride. However, the application of this standard could occur only after the standard was violated; it would not be a means to initially prevent release of air contaminants in violation of the standard. The mandatory standards discussed below would, however, prevent the initial occurrence of most such incidents.

All facility owners/operators would have to obtain an analysis of each type of waste to be treated/disposed for the purpose of identifying the principal hazardous components and characteristics of the waste so as to enable the waste to be treated/disposed in compliance with the Section 3004 requirements. All owners/operators would also have to sample waste shipments or batches received to confirm that the contents match the previous analysis. Owners/operators of all treatment/disposal facilities would also have to visually inspect the facility daily to determine if there were any fugitive emissions.

Volatile wastes--those with a true vapor pressure greater than 78 mm mercury at 25 C--would not be allowed to be treated/disposed in landfills, surface impoundments, or basins; such wastes could be landfarmed only if the facility owner/operator could demonstrate, before landfarming the wastes, that the air human health and environmental standard would not be violated. Examples of air contaminants from the previously discussed incidents which have vapor pressures greater than 78 mm mercury at 25 C and which could not be treated/ disposed under the Subtitle C regulations in the manner that caused the indicated incidents include acetone, benzene, carbon tetrachloride, methylene chloride, and vinyl chloride.

With regard to wastes that are landfilled, a minimum of 0.15 meters (6 inches) of cover material would have to be applied daily on active hazardous waste landfill cells. Cells which do not have additional wastes placed in them for at least one week would have to be covered with 0.3 meters (12 inches) of material.* Where gases are generated, a gas collection and control system would have to be installed in most instances to control the vertical and horizontal escape of gases. At facility closure, a final cover of at least 0.15

*Different thicknesses or rates of application could be used if the owner/operator could demonstrate that the air human health and environmental standard would not be violated.

meters of clay soil under a minimum cover of 0.45 meters (18 inches) of soil would have to be provided.* The facility would also have to be secured such that discharges of wastes harmful to human health or the environment would not occur. These requirements would reduce air emissions that occur under current landfill practices which often do not employ such measures (see Appendix J).

For example, emissions of hexachlorobenzene wastes are reported to be reduced from 317 kilograms per hectare per year when disposed uncovered to 4.564 kg/ha/yr. when covered with 0.02 meters of soil and to 0.07 kg/ha/yr. when covered with 1.2 meters of soil (Farmer et al., 1976). Other studies, however, have indicated that even covering some wastes may not completely prevent the release of air emissions. A study by Markle et al. (1976) indicated background air concentrations of about 0.1 to 0.3 ppm VCM exist at landfills where PVC sludge has been disposed for several years. Peak concentrations on the order of 1.0 ppm VCM were observed at normal breathing heights as long as 24 hours after the PVC sludge deposits were covered. The required gas collection and control system could remove such emissions as well as volatile gases generated by waste decomposition, including methane and carbon monoxide.

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*Different thicknesses or rates of application could be used if the owner/operator could demonstrate that the air human health and environmental standard would not be violated.

With regard to surface impoundments, the Subtitle C regulations would require that there be no discharges to the ambient air unless the facility owners can demonstrate, before treatment/disposal, that any discharges would not violate the air human health and environmental standard. Furthermore, at the time of closure, all hazardous wastes and waste residuals would have to be removed from surface impoundments which do not meet the requirements for landfills. Also after closure, surface impoundments would have to be secured such that discharges of wastes harmful to health or the environment would not occur.

It should be noted that the Subtitle C regulations do not cover all types of potentially hazardous fugitive air emissions from land-based treatment/disposal. The air human health and environmental standards only apply to those emissions for which there are TLV's listed in Appendix B, Subpart D, Annex 2. Other emissions which could consist of the hazardous waste itself or various hazardous constituents (e.g., trichloroethane) would not be subject to any emission standards. There are also no specific requirements aimed at reducing fugitive dust emissions from treatment/disposal activities which result in soil disturbance.

Explosions, fires, and other accidents represent another major source of air contaminants resulting from current hazardous waste treatment/disposal practices. The primary causes of most such explosions and fires have been the mixing of incompatible wastes and the improper treatment/disposal of ignitable or reactive wastes. Often wastes involved in such accidents are those whose identity or nature were not known prior to treatment/disposal. Resultant fires have led to the creation, release, and dispersion of additional air pollutants which have threatened persons living or working in the vicinity of the treatment/disposal facility. Appendix M describes types of emissions that can result from the combustion of hazardous wastes. A less obvious danger of fire occurring within an underground storage or disposal cell is the possibility of destruction of liners meant to protect groundwater. While this has not been documented, since most liner materials cannot withstand temperatures in excess of 150 to 200 C (300 to 400 F) it is theoretically possible (Office of Solid Wastes, 1977d).

Numerous instances of fires and explosions have been reported at hazardous waste disposal areas. The incidents presented below illustrate some of these occurrences and the subsequent problems.

- At a sanitary landfill near Dundalk, Maryland, a 2,000-gallon liquid industrial waste load containing iron sulfide, sodium sulfide, sodium carbonate, and sodium thiosulfate, along with smaller quantities of organic compounds was discharged into a depression on top of an earth-covered area of the landfill. When it reached eight to ten feet below the point of discharge, the liquid started to bubble and fume blue smoke. The smoke cloud quickly engulfed the truck driver and disabled him. Several nearby workers rushed to his aid and were also felled. During the clean-up operation, one of the county firefighters also collapsed. All six of the injured were hospitalized and treated for hydrogen sulfide poisoning. It was not determined whether the generation of hydrogen sulfide was due to the instability of the waste or the incompatibility of the waste with some of the landfill material (De Vera et al., 1977).

- At a dump in Contra Costa County, California, a large number of drums containing solvents were deposited in a landfill. In the immediate area were leaky containers of concentrated mineral acids and several bags containing beryllium wastes in dust form. The operators failed to cover the waste at the end of the day. The acids reacted with the solvents during the night, ignited them, and started a large chemical fire. There was possible dispersion of potentially hazardous beryllium dust (De Vera et al., 1977).

- In Los Angeles County, a tank truck emptied several thousand gallons of cyanide waste onto refuse at a sanitary landfill. Another truck subsequently deposited several thousand gallons of acid waste at the same location. Reaction between the acid and the cyanide evolved large amounts of toxic hydrogen cyanide gas. A potential disaster was averted when a local chlorine dealer was quickly called to oxidize the cyanide with chlorine solution (De Vera et al., 1977).

- A load of empty pesticide containers was delivered to a disposal site in Fresno County, California. Unknown to the site operator, several full drums of an acetone-methanol mixture were included in the load. When the load was compacted by a bulldozer, the containerized waste ignited, engulfing the bulldozer in flames. The ensuing fire involved dispersion of pesticide wastes (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- A disposal site in central California accepted a load of solid dichromate salts and dumped it in a pit along with pesticide formulations and empty pesticide containers. For several days thereafter, small fires erupted in the pit due to the oxidation of the pesticide formulations by the dichromate (De Vera et al., 1977).

- In October 1974, a bulldozer operator was killed in an explosion at an industrial landfill in Edison Township, New Jersey, as he was burying and compacting several 55-gallon drums of unidentified chemical wastes. The victim died as a result of burns covering approximately 85 percent of his body (Lazar, 1975).

The Subtitle C regulations contain provisions that should, to a large degree, reduce the potential for fires, explosions, and other accidents at hazardous waste treatment/disposal facilities. For example, one of the major causes of many such accidents has been the lack of accurate information about the identity or nature of the wastes being treated/disposed (Office of Solid Waste, Hazardous Waste Management Division, 1978a). The manifesting and labelling requirements under Section 3002 would make such information readily available. The requirement that facility owners/operators obtain an analysis of each type of waste handled from every source (e.g., generator) would enable a prior determination of how the waste should be treated/disposed. The requirement that the facility owner/operator sample shipments or batches received to confirm that the contents match the initial analysis would reduce the possibility of improper handling due to undetected changes in the waste composition. Furthermore, the requirement for training of all personnel in hazardous waste management procedures relevant to the facility operation would make such employees less likely to handle or mix wastes in a manner that could cause fires or explosions.

Incompatible wastes, both containerized and non-containerized, would also have to be disposed in separate landfill cells. Landfarms would have to be constructed and operated such that potentially incompatible wastes do not come in contact. Incompatible wastes would not be allowed to be mixed in surface impoundments and basins, except for treatment purposes, providing the treatment does not violate the air human health and environmental standard. Furthermore, highly reactive or ignitable wastes, as defined in Appendix B, Subpart A, would not be allowed to be disposed in landfills, surface impoundments, basins, or landfarms. Appendix B, Subpart D, Annex 4 lists examples of incompatible wastes. Appendix C describes potential sources generating many of these potentially incompatible wastes. Examples of wastes identified as potentially hazardous due to reactivity or ignitability (see Appendix C, Subpart D, 250.14) which have been disposed in landfills, landfarms, and surface impoundments in the past include slop oil emission solids and DAF sludge from petroleum refining (see Table D-7); semisolid wastes from toluene diisocynate production (see Table D-5); and solvent and still bottom wastes from the textile, paint, organic chemicals, special machinery manufacturing, and electronic components industries (see Tables D-1, D-4, D-5, D-14, and D-15).

Hazardous waste treatment/disposal facilities would have to prepare contingency plans to minimize human health or environmental damage in the event of an accidental discharge (see Appendix B, Subpart D, 250.43-4 for specific requirements). To the extent that the contingency plan would reduce both the spread of the discharge with a resultant reduction in the possible mixing of incompatible wastes and the time required to stop and clean up the discharge, there would be a reduction in the release of air contaminants and resultant impacts from such accidental discharges.

The intentional combustion of hazardous waste as a method of treatment, energy recovery, or disposal represents another major source for the release of air emissions. The combustion of wastes typically occurs either as open burning or as controlled or uncontrolled incineration.

Open burning is defined under Subtitle C as the combustion of any material without control of combustion air to maintain adequate temperature for efficient combustion, containment of the combustion-reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, or emission of the gaseous combustion products through a stack or vent adequate for both visual monitoring and point source sampling. Open burning of hazardous waste results in the uncontrolled release of hazardous gases and particulate matter (see Appendix M for potential emissions from combustion of hazardous wastes). In addition, open burning may result in the release of smoke (i.e., particulate matter) which can interfere with visibility. For example, smoke from open burning in a dump resulted in a chain accident on the New Jersey Turnpike several years ago (Lazar, 1975). Open burning is being phased out as a method of most hazardous waste disposal due to implementation of the Clean Air Act. It should be noted that open burning is currently used by the military to dispose of explosive wastes which cannot be incinerated or treated by other means (Shapira et al., 1978). Open burning is currently the method most commonly used for such disposal (TRW, Inc., 1976).

Incineration is defined by Subtitle C as an engineered process using controlled flame combustion to thermally degrade materials (e.g., hazardous wastes). Devices normally used for incineration include rotary kilns, fluidized beds, and liquid injectors (see Appendix D). To the extent that incineration produces an ash or residue which is hazardous under Section 3001, incineration is a treatment method (e.g., volume reduction) rather than a disposal method.

It is estimated that in the period from 1973 to 1975, over 15 percent of the hazardous wastes from 14 selected manufacturing industries were incinerated or open burned with over 60 percent of this incineration and open burning being uncontrolled (Office of Solid Waste, unpublished data). It should be noted that the percentage of controlled incineration is likely to be higher now due to requirements of the Clean Air Act, as amended. Tables 5-8 and 5-9 show the portion of hazardous wastes estimated to be incinerated by selected manufacturing industries during this period. Data are not available to estimate the quantity of air emission released by such incineration of hazardous wastes.

In addition to the release of potentially hazardous emissions, incineration of volatile, flammable, or explosive wastes have led to many instances of explosions and fires in the past:

- The Harrisburg, Pennsylvania incinerator, for example, has experienced explosions in both 1972 and 1975 as a result of the incineration of hazardous wastes (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

Appendix M contains a detailed discussion of destruction efficiencies achieved for the incineration of selected hazardous wastes, potential air residuals from such incineration, and the nature of solid residuals produced by the incineration. Based upon this discussion, a vast number of different hazardous waste materials, representing a broad spectrum of physical and chemical characteristics, can be essentially destroyed or used for energy recovery by incineration. Generally speaking, organic materials are the prime candidates for incineration. The amount of destruction of any specific hazardous waste is dependent to a large extent on the relationship of incineration temperature to dwell time (residence time in the incinerator) at that temperature and to a lesser extent on turbulence in the combustion zone and the amount of excess oxygen available. The higher the temperature used, the shorter the dwell time necessary to achieve a given destruction ratio. As a general rule, the principal components of most organic hazardous materials can be virtually completely destroyed at 1000 C (1830 F) with a dwell time of 2 seconds. Many are destroyed at lower temperature/dwell time conditions; a few require more rigorous conditions. However, the knowledge of specific incineration criteria for individual wastes is very limited.

Very limited information is also available as to the fate of hazardous waste constituents produced by the incineration. Most studies of emissions from the incineration of hazardous wastes have considered only the fate of the gross components of combustion, components for which regulations have been promulgated, or components for which historical data have been accumulated regarding harmful effects. Most studies have not given consideration to emissions which result from side reactions, such as the formation of polynuclear aromatics (PNA's) from the incineration of wastes containing chlorinated hydrocarbons, nor to the constituents of particulate matter entrained in stack gases. Also, little is known about the potential health effects from long-term, low-level exposure to many of the gaseous and particulate products of hazardous waste combustion.

The Subtitle C regulations contain provisions that should reduce the potential for the release of air contaminants from the combustion of hazardous wastes. As indicated, in recent years over 60 percent of the hazardous wastes that were burned (either by incineration or open burning) were burned in an uncontrolled manner. The Subtitle C regulations would require the use of controls for almost all combustion of hazardous wastes and would set standards for the release of many air contaminants. Open burning of hazardous wastes would be prohibited unless the facility owner/operator could demonstrate prior to such open burning that the air human health and environmental standard would not be violated. All facilities would also be required to comply with all applicable standards of the Clean Air Act, as amended, in order to maintain their permits.

The regulations also would set specific standards for the incineration of hazardous wastes. Incinerators used to thermally degrade hazardous waste containing more than 0.5 percent halogens would be required to be equipped with wet scrubbers capable of removing 99 percent of the halogens from the exhaust gases. Incinerators used to burn pesticide wastes or wastes which are hazardous due to toxicity would be required to maintain greater than a 1000 C combustion zone temperature, greater than 2 seconds retention, and greater than 2 percent excess oxygen during incineration. Such incinerators, except for pathological incinerators, would also be required to be designed, constructed, and operated to maintain a destruction efficiency of 99.99 percent of the principal toxic components of the pesticide or toxic waste going into the incinerator. All incinerators would be required to be operated at a combustion efficiency equal to or greater than 99.9 percent. All hazardous waste incinerators would also be required to be operated in a manner that assures that emissions of particulate matter do not exceed 270 milligrams per dry standard cubic meter (0.12 grains per dry standard cubic foot) at zero excess air. Compliance with this latter requirement could be achieved by having particulate emissions that when corrected to 12 percent carbon dioxide are less than 180 milligrams per standard cubic meter (0.08 grains per dry standard cubic foot).

In addition, incinerators would have to be designed, constructed, and operated such that fugitive emissions of unburned hazardous waste and combustion products are controlled and such that waste feed is automatically cut off if significant changes occur in flame, combustion zone temperature, excess air, or scrubber water pressure. Also, owners/operators of hazardous waste incinerators would be required to conduct trial burns for each hazardous waste that is significantly different than any one previously demonstrated under equivalent conditions. The trial burn would have to include: an analysis of the exhaust gases for concentrations of the principal hazardous components, hydrogen halides, carbon monoxide, carbon dioxide, excess oxygen, and total particulates; an analysis of the ash residue and scrubber effluent for the principal hazardous components; an identification of sources of fugitive emissions and their means of control; a measurement of the combustion temperature; and a computation of residence time, combustion efficiency, destruction efficiency, and scrubber efficiency in halogen removal.

Data are not available to estimate the extent to which the above regulations would reduce the overall release of specific air emissions from hazardous waste incineration. Any reduction would depend upon such factors as changes in types and quantities of hazardous wastes incinerated, changes in the types of incinerators utilized, and changes in control devices employed. As previously indicated, ignitable, volatile, and reactive wastes would, for the most part, be prohibited from landfills, landfarms, and surface impoundments. It is likely that a large portion of such wastes would be incinerated as an alternative means of treatment/disposal under the Subtitle C regulations. Such a shift would likely result in the increased release of combustion products from these wastes, but would also reduce the release of other emissions, such as particulates and volatile gases, that would have occurred from land disposal of these wastes. There would also be other shifts in the types of methods used to treat/ dispose other wastes under Subtitle C regulations compared to current practices. All such shifts could either enhance or reduce the potential for reductions in specific air emissions under the Subtitle C regulations. Furthermore, the construction of new facilities could lead to increased releases of air emissions in the vicinity of the facility and along any transport routes. Closure of existing facilities could lead to reduced releases of air emissions in the vicinity of the facility and along transport routes. The net result could be both a localized and/or nationwide reduction in the total release of many air contaminants from hazardous waste management and a localized and/or nationwide increase in the release of other air contaminants. This could cause both localized improvements in air quality and some localized degradation of air quality; however all emissions and any localized degradation would have to be in compliance with all applicable standards (e.g., Clean Air Act, OSHA Standards, RCRA Standards, State Standards).

It should be noted that the incineration standards set limits only for the destruction of the principal toxic components of the waste feedstock and on the emission of halogens and total particulates. As indicated in Appendix M, combustion of hazardous wastes can also generate and release other combustion products such as cyanides, sulfur compounds, hydrochloric acid, trace metals, nitriles, ammonia, pyrophosphates, cyanogen, polycyclic hydrocarbons, polynuclear aromatics, and other organics. While the regulations require that such combustion products from incineration be controlled, no standards are set for such control.* Thus, such combustion products would still likely be released, but in quantities less than those that would occur without the subtitle C regulations. Furthermore, there could be small releases of the hazardous waste and/or its principal toxic components; up to 0.01 percent of the principal toxic components originally present in the waste could be released. Little is currently known about the potential for adverse health effects or environmental effects from long-term, low-level exposure to such potential emissions from hazardous waste combustion.

Appendix M also indicates that while 99.99 percent destruction has been demonstrated for many hazardous wastes, such destruction efficiencies have not yet been reported to have been demonstrated for most hazardous wastes. Furthermore, in spite of the impressive performances of the incinerators reported in the literature in destroying hazardous wastes, it should be noted that most studies were performed under extremely controlled conditions and only specific products of combustion were sampled in many cases. Problems could occur due to requirements for frequent maintenance and extensive

*For example, as indicated in Appendix M, hydrogen cyanide is generated from the destruction of nitrogen-containing pesticides. Temperatures much higher than those required for 99.999 percent destruction of the nitrogen-containing pesticide are needed for destruction of this hydrogen cyanide.

operator education in order to ensure proper functioning. Maintenance could be an especially serious problem since many wastes burned in incinerators are either extremely caustic or produce caustic products when burned.

Other types of hazardous waste treatment constitutes a further source for the release of potential air contaminants. Such treatment can be classified as biological treatment, physical treatment, or chemical treatment (see Appendix D). Fugitive emissions represent a major source of emissions from such treatment. The potential for the release of fugitive emissions during treatment would be similar to that previously discussed and is not repeated here. In addition, some chemicals and/or reagents used in treatment processes are potential sources of fires and/or explosions if not properly stored and/or handled. The combustion of fuel to provide steam or energy to treatment processes is another source of emissions, primarily particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. The burning of coal could also result in aldehydes and trace elements being emitted. The following two incidents indicate potential problems from hazardous waste treatment processes (other incidents from treatment have been previously indicated):

- Organic lead waste from manufacturing processes for alkly lead in the San Francisco Bay area had been disposed in ponds at an industrial waste disposal site. Attempts to process this waste for recovery resulted in alkyl lead intoxication of plant employees in one case. In another instance, not only were plant employees affected, but employees of firms in the surrounding area were exposed to an airborne alkyl lead vapor hazard. Toll collectors on a bridge along the truck route to the plant became ill from escaping vapors from transport trucks (Office of Solid Waste Management Programs, 1974a).

- The Air Compliance Division of the Connecticut Department of Environmental Protection closed down two organic solvents recovery operations in Southington, Connecticut due to air pollution caused by incineration of the wastes. A similar operation in Beaver Falls, Connecticut was also closed due to air pollution problems (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

The Subtitle C regulations contain provisions that should reduce the potential for fugitive emissions from hazardous waste treatment processes. Most of these provisions and potential impacts have previously been discussed under storage, treatment, and disposal and are not repeated here. Additional requirements include the need for the treatment facility to demonstrate the capability to handle hazardous wastes during facility or equipment breakdown and for all continuous feed facilities to be equipped with an automatic waste feed cut-off or by-pass system which is activated when a malfunction occurs. All hazardous wastes would have to be analyzed prior to selection of a treatment process to determine if the waste contains components or contaminants which could cause the uncontrolled release of toxic gases or fumes or which could form highly toxic components with treatment chemicals or reagents. These requirements in conjunction with the previously discussed requirements would reduce the potential for air emissions from hazardous waste treatment. However, any increased treatment occurring as a result of promulgation of the Subtitle C regulations could offset the potential for such reductions to an unknown degree. There could also be other offsetting reductions in the release of air emissions if the treatment reduced the quantity of wastes requiring disposal.

7.1.4.2 Climate. The potential effect of specific actions on global, regional and local climates is not well understood at present. As a result, very few conclusions can be drawn as to the effect of various hazardous waste management related actions on the climate. Furthermore, even for those potential impacts that can be identified, the effect on climate conditions would be so site-dependent as to preclude quantification. The following discussion describes potential changes that could result both from any construction of additional hazardous waste management facilities and from changes in operational procedures as a result of the Subtitle C regulations.

Average temperatures could be slightly increased in the vicinity of a hazardous waste management facility as a result of both heat released from the facility and increased reflection of heat from cleared and paved surfaces on the facility site. Heat would be released by incinerators, auxiliary boilers, and various treatment processes. This heat would increase the temperature slightly in the immediate vicinity of each facility. The heat would also cause local convection currents, minor increased air turbulence, and slightly greater instability in the immediate layer of air over the facility.

Low-level wind patterns in the facility area could be slightly modified as a result of the facility structure and minor topographic changes. Wind speeds could be slightly decreased and air turbulence increased. Aerodynamic effects of buildings could cause wake and down-wash effects which could modify dispersion of low-level atmospheric emissions. Any such effects would be very localized in nature.

The creation of reservoirs and storage and treatment lagoons and ponds would increase the surface area of water exposed to the atmosphere and to solar radiation. This would cause increased evaporation which could influence the microclimate of the surrounding area. The significance of such changes is not well understood at present.

The precise role of airborne particulate matter and other aerosols emanating from hazardous waste management facilities with regard to weather modifications cannot be determined completely. Their influence on the amount of short-wave solar radiation is well established and has important implications both on a global scale (Mitchell, 1971) and on a regional scale. In principle, aerosol particles could also act as condensation nuclei and either enhance or inhibit rainfall. A considerable body of knowledge regarding cloud seeding has been built up over the past 25 to 30 years (Byer, 1974; Elliott, 1974) and numerous precipitation management programs are in progress, notably in the U.S., Australia, Israel, and the Soviet Union.

While certain aspects of intentional weather modifications are still regarded as controversial, it is generally recognized that artificial nucleation can be effective in producing increases or redistributions of precipitation under very specific meteorological conditions and through the use of appropriate techniques. A definitive answer as to whether or not a local change in the concentration of atmospheric aerosols resulting from dust or industrial emissions would cause a significant change in precipitation patterns cannot be given (Simpson and Dennis, 1974). A few instances of anomalous snowfalls have been recorded; industrial and urban emissions are thought to be instrumental in producing generally light snowfalls in these cases (Landsberg, 1974). An increase in cloudiness due partly to the aerosol condensation nuclei and partly to the heating effect of cleared surface areas appears to be a more likely phenomenon than persistent alterations in precipitation characteristics. No significant localized or regional impacts are anticipated from changes in hazardous waste incineration.

The most frequently cited factor associated with inadvertent climate modification is the increasing carbon dioxide content of the atmosphere (Machta and Telgadas, 1974; Massachusetts Institute of Technology, 1970). The steady growth observed in carbon dioxide concentration is attributed to the rapidly increasing use of fossil fuels since the turn of the century. Although the potential effects of atmospheric carbon dioxide on global temperature and climate have serious implications--the greenhouse effect through which the temperature could increase--no significant localized or regional weather effects from carbon dioxide emissions are anticipated from changes in hazardous waste incineration. This is due to the relatively small quantity of carbon dioxide expected to be produced from hazardous waste incineration in relation to the production from other sources.

7.1.5 Water Quality Impacts. The primary mechanisms by which surface water may be contaminated with hazardous wastes are spills (including deliberate dumping); surface runoff from storage, treatment, or disposal areas (including overflows from impoundments); direct discharges from generating or treating facilities; and discharge of groundwater contaminated by subsurface migration of pollutions. Groundwater contamination can occur with almost any facet of hazardous waste handling and disposal as now practiced. It may occur due to infiltration of spilled materials or wastes stored on permeable surfaces, due to percolation of leachate or runoff which has been in contact with wastes either in storage or in landfills, or due to leakage or infiltration of fluids from poorly sealed waste impoundments.

These mechanisms may be generalized into three major pathways through which contamination can occur: spills, other surface releases (including runoff and direct discharges), and underground discharges (primarily off-site movement of leachates). The following sections discuss the effects of the Subtitle C regulations on these pathways with respect to each of the steps in the hazardous waste management sequence.

A general discussion of the effects of the combined regulations on each pathway is followed by discussions of the effects of any specific parts of the regulations which further control one of the individual hazardous waste management activities (e.g., transportation).

7.1.5.1 Spills. The Subtitle C regulations would potentially result in a decrease in the number and size of hazardous waste spills. This would occur primarily as a result of the requirements for maintenance of adequate containerization, and indirectly, as a result of the increased awareness of the waste hazard due to the manifest system and labeling requirements. The regulations would not, however, significantly affect the frequency of major vehicular accidents during transport resulting in spillage (available data on the number and volumes of hazardous spills are presented in Chapter 6).

It is expected that the effects of any spill which may occur would be reduced as a result of the requirements for prompt reporting of all spills to the National Response Center and for immediate action to remove the spill in the most expedient manner. These provisions would complement those developed under Section 311 of the Clean Water Act, and in effect, would extend the National Contingency Plan to include upland spills as well as those into navigable waters.

One of the side-benefits of the regulations would be the quantification of the amounts of hazardous material spilled, a presently unknown figure, which is important for planning the size and deployment of emergency response teams as well as for assessing the need for more stringent transportation safety codes. At present it is estimated that there may be about 2,000 spills of hazardous substances, including wastes, per year (U.S. Environmental Protection Agency, 1977b).

Transportation. The effects discussed above would apply to all segments of the hazardous waste management sequence. As indicated in Section 7.1.2.1, the generator regulations (Section 3001) would further reduce the likelihood of spills through the imposition of specific containerization requirements for the transport of hazardous wastes. These requirements would reduce the likelihood of rupture and spillage of wastes during shipment. Further, the transporter regulations also prohibit transportation of containers of hazardous wastes which are leaking or appear to be damaged, or the transport or consolidation of incompatible wastes. However, any increases in the quantity of waste being shipped off-site or in the average distance over which hazardous wastes are transported could lead to an increase in vehicular accidents. This would off-set some of the potential for a reduction in spills. Increases in the quantity of wastes transported by barge would also increase the potential for marine accidents and spills. Most hazardous wastes transported by barge are reported to go to reclamation of resource recovery facilities (see Section 5.2.3.5) and, as such, would not be subject to the regulations.

The regulations could also prevent the types of incidents due to vehicle cleaning, as indicated below:

- An insecticide (endrin) applicator rinsed and cleaned his truck into the Cuivre River at Moscow Mills, Missouri. As a result, approximately 100,000 fish were killed, and the river was closed to fishing for one year by the Missouri Game and Fish Commission (Office of Solid Waste Management Programs, 1974a).

Storage and Disposal. Spillage or other unintentional releases from storage and disposal facilities would be decreased due to the requirements to maintain waste container integrity by recontainerizing the materials whenever their original container begins to fail. Additionally, any spills occurring at a storage or disposal facility would be contained at the site by dikes and impervious surfaces which would prevent migration of the wastes until cleanup operations can be completed.

7.1.5.2 Other Surface Releases. The regulations would significantly decrease the number of, and environmental damage resulting from, surface releases of hazardous wastes. Many parts of the regulations apply. All generators of wastes designated as hazardous would have to comply with all of the Subtitle C regulations. These stipulate that all hazardous wastes designated for on-site or off-site treatment, storage, or disposal would have to be sent to a permitted facility. The regulations would institute a manifest and reporting system to enable tracking of wastes to ensure compliance. All storage, treatment, and disposal facilities would have to use diversion structures to prevent runoff from upland areas from flowing onto active portions of the facilities. Further, such facilities would have to confine all runoff or any other discharge to a point source which complies with the regulations promulgated under the Clean Water Act of 1977. The combined effects of these regulations would be to eliminate most non-point surface discharge of wastes defined as hazardous. Specific effects of the various regulations are discussed below.

Characteristics, Identification, and Listing. A large number of hazardous wastes are either listed or fall under the characteristics contained in the Section 3001 regulations. Many have been involved in past damage incidents. The occurrence of such incidents would be reduced as a result of the regulations. However, many other potentially hazardous wastes are not listed and would not be included by the characteristics. At present, numerous potentially toxic, carcinogenic, or mutagenic organic chemicals would not be included by the toxicity characteristic that is based entirely on EPA Primary Drinking Water Standards. At present, Primary Drinking Water Standards are promulgated for nine inorganic contaminants and six organic contaminants (all pesticides). Although the number of contaminants regulated under the Drinking Water Standards will probably increase in the future, it is likely that many potentially hazardous wastes would escape regulation under this characteristic. The Environmental Protection Agency plans to expand the toxicity characteristic at a later time.

Generators. As mentioned above, generators of hazardous wastes would not be allowed to dispose such wastes without also receiving a permit as a disposal facility. However, there would be a few exemptions to these regulations. Generators engaged solely in retail trade or principally in farming would be regulated only with respect to waste automotive oil. Household wastes would be entirely exempted. Further, generators who generate less than 100 kilograms per month of hazardous wastes would not be subject to regulation, but would be expected to dispose their wastes in a responsible manner. These exclusions would allow a small quantity of hazardous wastes to escape regulation. However, it is expected that the regulations issued by EPA under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1972 would control pesticide wastes from farmers; and it is estimated that the 100 kilogram per month generation limit would exclude less than 30,000 tons of hazardous industrial waste per year annually by 1984, less than 0.1 percent of the total hazardous industrial waste. Wastes from these excluded generators could be disposed as a nonhazardous waste using current practices, could go into sewer systems or any other allowable disposal area, and could conceivably eventually contaminate surface waters. The impacts of this generation limit are difficult to define. However, it is likely that the excluded wastes would continue to cause essentially the same types of impacts as they currently are causing, modified by the Subtitle C requirements. With proper disposal of the regulated wastes, the total impact of hazardous wastes on surface waters should be significantly reduced. Thus, although it is true that some unregulated releases of hazardous wastes could continue to occur and that some hazardous wastes may cause significant damage in any amount, such occurrences would be much less frequent and, generally, less severe than those which occur in the present uncontrolled case.

<u>Transportation.</u> The transporter regulations would require that transporters deliver all manifested hazardous wastes to a designated permitted storage, treatment, or disposal facility. In addition, transporters could not transport containers which are leaking or appear to be damaged. These requirements would eliminate willfull dumping of hazardous wastes by transporters. A typical incident of 'midnight dumping' which could be precluded by the proposed regulations is as follows:

- In March 1972 a considerable amount of xylene was dumped into a drainage ditch along the Pennsylvania Turnpike. The liquid waste flowed down the ditch, across a field, and into a nearby stream causing a fish kill (Cartwright and Lindorff, 1976).

As discusssed previously, the Subtitle C regulations would reduce the likelihood of spills of hazardous wastes and their associated surface water contamination by extending the DOT Hazardous Materials Regulations to cover intrastate as well as interstate transportation.

<u>Storage, Treatment, and Disposal.</u> The human health and environmental standard for surface water would require that all facilities be located, designed, constructed, and operated so that no discharges from the facility violate the Water Quality Standards promulgated under Section 303 of the Clean Water Act, or constitute a spill of hazardous substances under Section 311 of that Act. As previously indicated, more specific regulations (General Facility Standards) would require the use of diversion structures to prevent surface runoff from flowing onto the facility and the use of dikes or other

contaminant structures to collect runoff originating on the facility. All discharges from such facilities, including discharges from leachate and/or runoff collection systems, would have to be confined to point sources and must comply with the regulations promulgated under the Clean Water Act. Further, siting limitations would restrict facility siting on floodplains and in wetlands. Additionally, each type of facility (storage, treatment, and five types of disposal facilities--incineration, landfills, surface impoundments, basins, and landfarms) would have to meet other standards which are discussed in following sections.

These regulations would constitute a substantial improvement over the present unregulated situation and should result in a significant decrease in the number of pollution incidents resulting from hazardous waste storage and disposal. However, even though a discharge may meet all presently promulgated standards (including those under the Clean Water Act), it could still decrease receiving water quality up to the maximum allowable limit for each regulated constituent. Since these limits were picked to ensure adequate protection of the environment and human health, such an impact would likely be minimal. In addition, there are many potentially hazardous constituents of these wastes for which no standards have yet been promulgated. This may be due to lack of adequate substantiation of suspected human health effects, or to lack of information on tolerable levels to ensure the absence of chronic health effects. It is possible that some potentially harmful properties of other contaminants are not even suspected at this time. In this respect, waste discharges could conceivably meet all applicable standards and still contribute to environmental degradation with potential human health effects. It must be emphasized, however, that such effects are now occurring to a much greater degree without the controls that would be instituted by the baseline regulations. In addition, where the permitting agency is able to document such a threat, they could stipulate additional permit requirements on the authority of the human health and environmental standard.

The potential impacts of regulating the various types of facilities are as follows:

Storage. The Subtitle C regulations would require that hazardous waste storage operations be conducted, monitored, and inspected in order to ensure that no discharge occurs. Specific requirements include impervious construction and the use of diversion and containment structures, such as dikes or trenches, to prevent the release of runoff or spills. Provisions are included requiring leakproof construction of storage tanks and containers and for recontainerization of leaking wastes. Records of the identity and location of all stored wastes must be kept during the entire storage period. In addition, the baseline regulations would require that all hazardous waste facilities receive a permit and be subject to inspection at any time to ensure that they were being properly maintained.

Since there are presently no requirements to report the locations or amounts of hazardous waste in storage, there is no way of quantifying even the existing pollution problems due to waste storage, let alone the potential improvement due to the regulations. In the current unregulated situation, hazardous waste may be stored in drums, sacks, or even in piles or unlined ponds. The waste might be housed in warehouses or sheds, or left in the open, occasionally covered with tarpaulins or other materials. In addition, hazardous waste may be stored for extended periods of time because all available methods have been considered too expensive to be utilized without the legal requirement to do so. As a result, water pollution incidents from improper storage of hazardous wastes are common. A typical incident that could have been prevented by the baseline regulations is described in EPA files:

- A herbicide manufacturer stored many tons of arsenic salt wastes on his plant site in Wisconsin. As a result, both the Menominee River and local groundwater have been contaminated with water containing up to 1.0 ppm arsenic (The National Interim Primary Drinking Water Standard is 0.05 ppm) and sediment containing up to 35 ppm arsenic (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

Other incidents have occurred in which unregulated storage piles have produced surface water contamination as a result of fires. The following incident, while it did not involve wastes per se, illustrates the potential for surface water contamination due to combustion of hazardous waste in storage:

- One and a half million gallons of water were used to extinguish a warehouse fire in Oroville, Washington where two tons of various chlorinated pesticides and 50 tons of fertilizer were stored. Much of the water flowed through storm sewers to the Okanogen River, where 0.8 ppm endrin was detected.

> Elevated levels of nitrate and pesticides were also detected in the groundwater (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

Incidents such as this would be addressed under the regulations only if the warehouses contained waste, outdated, or off-specification pesticides awaiting disposal.

Treatment. The specific regulations for treatment facilities stipulate that all facilities must have the capability to safely handle hazardous wastes in the event of an emergency or equipment failure of any sort. Such capabilities include automatic cut-off or by-pass systems on continuous feed processes, emergency transfer of reaction vessel contents, and emergency storage capacity. Further, all treatment chemicals, reagents, and wastes must be stored in compliance with the regulations for storage; any basins used for treatment must comply with the regulations for basins; and the entire facility must be designed, constructed, operated, and maintained in accordance with the human health and environmental standards. Any wastes produced from a treatment facility would also be subject to the Subtitle C regulations. If such a waste is hazardous in accordance with the characteristics or listing regulations, the treatment facility would have to comply with all other standards promulgated under Subtitle C, including initiating a manifest and ensuring proper disposal. At the time of closure, all hazardous wastes and residuals would have to be removed from treatment facilities and properly disposed.

With one exception, Publicly Owned Treatment Works (POTW's) would be exempted from compliance with the Subtitle C regulations. The exception is that for the wastes received at POTW's by truck or rail, the POTW would have to comply with reporting and recordkeeping requirements. While sludges from POTW's would be exempt from the Subtitle C regulations, the POTW's would still have to comply with the regulations promulgated under Section 405 of the Clean Water Act. Industries which discharge wastes into municipal sewer systems would not need to comply with manifest requirements, but would have to meet all applicable pretreatment standards under the Clean Water Act, and would have to obtain the approval of the municipal sewer system authority. Application of these regulations could eliminate the following type of incident:

- In Louisville, Kentucky in March 1977, a wastewater treatment plant was shut down after receiving large amounts of hexachloro-cyclopentadiene and octachlorocyclopentene. Concentrations of "hexa" reached 47,000 ppm in sewer sediments, and 32 plant employees experienced watering eyes, respiratory ailments, or other ill effects due to the heavy vapors associated with the contaminants. As a result, 105 million gallons per day of raw sewage was discharged to the Ohio river for more than two months. It was estimated that the total diversion amounted to over 9 billion gallons of raw sewage while clean up costs reached over $450,000 (State of Minnesota, 1977).

Many similar, though less spectacular, incidents have also occurred but would likely be avoided following implementation of the baseline regulations. In such cases, wastes introduced to sewer systems often travel through municipal treatment plants without affecting the plant and without being affected by treatment. These then flow out with the discharge and may cause fish kills or water supply contamination downstream, as illustrated below:

- Two fish kills were noted in August and November 1975 in the Crow River near Hutchinson, Minnesota. It was determined that they were caused by cyanide levels as high as 0.31 mg/l in the stream. The source was identified as the Hutchinson wastewater treatment plant which received ferrocyanide from a local industry. Ferrocyanide dissociates in the presence of sunlight to release ionic cyanide which forms highly toxic hydrocyanic acid. This dissociation process is accelerated with decreasing pH; therefore, the fish kills were only noticed during periods when the pH of the river or sewage effluent was lower than normal (State of Minnesota, 1977).

Incineration. In terms of potential to cause water pollution, disposal facilities using incinerators are essentially the same as treatment facilities. Accordingly, the regulatory approach for prevention of water contamination from the two types of facilities is similar. Both are treated as temporary facilities which would have to comply with storage regulations, treat any residuals in accordance with the Subtitle C regulation, and remove all wastes at the time of closure. Since incinerators have little direct impact on water quality, except possibly with regard to cooling water discharges, this segment of the regulations would not likely constitute a significant improvement over existing conditions. However, application of the general facility standards (including the storage regulations) would help eliminate incidents such as one reported by the State of Minnesota (1977), where sloppy housekeeping at a hazardous waste incineration facility resulted in a fire and in possible water contamination.

Landfills. Pertinent features of the Subtitle C regulations applicable to surface water pollution from landfills include the requirement that landfills be located or designed, contructed, and operated to prevent direct contact between the landfill and navigable water, and that all active portions of landfills must be at least 150 meters from any public, private, or livestock water supply. The regulations also specify that diversion structures would have to be constructed to prevent surface runoff from entering the landfill and to collect all runoff originating on the landfill for treatment, if necessary. The regulations would allow the use of one of several designs. Where natural conditions allow, the bottom and sides of the landfill would have to consist of at least three meters of natural in-place soil exhibiting a permeability equal to or less than 1×10^{-7} cm/sec and which satisfies certain other plasticity, pH, composition, and grain size requirements. Such facilities would not require a leachate collection system if it could be demonstrated that liquids would not accumulate in the landfill to the extent that they might be discharged to the surface in any manner or to the groundwater in a manner that violates the groundwater human health and environmental standard. Where naturally occuring soils do not meet the above criteria, the regulations would require the use of either a 1.5 meter soil liner and a leachate collection system; or a one meter soil liner, a 20 mil synthetic liner, a leachate collection system, and a leachate detection system. Other designs would be acceptable if it could be demonstrated that they could provide equivalent containment. Further, all landfills would have to either include leachate collection systems or demonstrate that liquids would not accumulate in the landfill such that they may be discharged to the surface in any manner (or to the groundwater in violation of the groundwater human health and environmental standard). Upon closure, the landfill would have to be graded such that water would not pool over the landfill and such that erosion would be prevented.

These regulations should result in a significant decrease in surface water contamination from landfills. Quantification of the magnitude of the impact is not possible since neither the number nor areal distribution of landfills receiving hazardous waste nor the magnitude of environmental problems associated with them are known with any degree of accuracy.* However, the Office of Solid Waste Management Programs (1977) estimates that there are about 18,500 land disposal sites in the United States which accept municipal wastes, most of which also receive some industrial wastes. In addition, the number of unauthorized and uncontrolled dumping grounds may reach 150,000 (TEMPO, 1973). Most of these were located without concern for potential environmental contamination and, as a result, many of them probably cause some degree of water pollution. Examples of situations which could be avoided are numerous. Many such incidents are included in Appendix J. The following example illustrates a typical incident which would likely be avoided as a result of implementation of the baseline regulations:

*EPA is currently expecting to develop an inventory of industrial landfills during the second year following the publication of its hazardous waste disposal criteria (Office of Solid Waste, 1977a).

- In 1974, an investigation sparked by the deaths of three head of cattle near Byron, Illinois, discovered an abandoned disposal area for many industrial wastes, including cyanides, arsenic, cadmium, chromium, petroleum products, acids, and other wastes. Soil, surface water, and groundwater contamination along with extensive damage to wildlife, aquatic life, and local vegetation were documented. U.S. Drinking Water Standards were violated by at least five constitutents in surface water entering Rock Creek, 1.5 miles from the site: arsenic, 60 ppb; cadmium, 340 ppb; chromium, 17,200 ppb; cyanide, 365,000 ppb; and phenols, 8 ppb (standards for these contaminants are 50 ppb, 10 ppb, 50 ppb, 200 ppb, and 1 ppb, respectively) (State of Minnesota, 1977, Cartwright and Lindorff, 1976; Office of Solid Waste, Hazardous Waste Management Division, 1978b).

Surface Impoundments. Pertinent features of the regulations regarding surface water pollution from surface impoundments include a mandate against any direct connection with navigable waters; a minimum separation of 150 meters from any public, private or livestock water supply; a requirement for impervious natural or artificial liners and leachate detection systems; and a system of dikes which would prevent seepage of wastes either vertically or horizontally. Design parameters for the liner and dike systems are specified which include minimum thicknesses and permeabilities of liners as well as minimum freeboard and capacities of dikes. In addition, periodic monitoring and inspections and rapid correction of any deterioration are required. At the time of closure, all wastes must be removed, unless the impoundment meets the criteria for, and is closed in accordance with, the regulations for landfills.

As in the case of landfills, surface water contamination due to failure of hazardous waste impoundments would be greatly reduced by the implementation of these regulations. Quantification of the magnitude of the impact is not possible since neither the total number of existing lagoons nor the number of leaking lagoons is known.* It is currently estimated that there are a total of 100,000 industrial impoundments in the U.S. and that 1.7 trillion gallons (6.4 billion cubic meters) per year of industrial wastewaters (not necessarily hazardous) are pumped to oxidation ponds or lagoons in the U.S. (Office of Solid Waste Management Programs, 1977). It has been further estimated that 100 billion gallons per year of the wastes placed in the secondary treatment lagoons leak to the ground-water (Office of Solid Waste Management Programs, 1977). The total leakage from all lagoons is unknown, but is probably significantly larger. It is known, however, that numerous incidents have occurred. Many of them are described in Appendix J. A typical incident, described in EPA files, is as follows:

- A copper reclamation company located in a mid-Atlantic state from 1965 to 1969 bought industrial wastes from other plants, extracted the copper and stored the remaining liquids in cement lagoons. Three of the lagoons developed open seams and leaked toxic pollutants into an adjacent creek, killing all its aquatic life. After an injunction was issued requiring the wastes to be treated, the company defaulted, leaving 3.5 million gallons of toxic wastes on the site. Heavy rains in April, 1970 overflowed the lagoons into a tributary of the Delaware River, forcing county officials to build a dike around the area. The wastes were finally neutralized and ocean dumped at the state's expense of $400,000 (Office of Solid Wastes, Hazardous Waste Management Division, 1978b).

*EPA is developing an assessment of surface impoundments and their potential for contaminating water. The assessment will fulfill EPA's mandates under the Safe Water Drinking Act and RCRA (Office of Solid Waste, 1977a).

Basins. The baseline regulations would define basins as uncovered devices constructed of artificial materials, used to retain wastes as part of a treatment process, usually with a capacity of less than 100,000 gallons, e.g., open mixing tanks, clarifiers, and open settling tanks. Such structures are generally temporary, and operated in conjunction with other treatment facilities. The regulations would require impermeable construction and mechanical integrity sufficient to prevent discharge of wastes to navigable water; daily monitoring or inspection, and immediate repair of any damages; and removal of all waste upon final closure. As in the case of surface impoundments, these regulations would result in a decrease in surface water contamination compared to that occurring in the present unregulated situation. Due to the lack of data on the number of basins in use, the degree of the impact cannot be determined.

Landfarms. Pertinent sections of the baseline regulations concerning the potential for water pollution from landfarms include the prohibition against the use of landfarms for certain water soluble toxic inorganics; the requirement that landfarms shall be located, designed, constructed, and operated to prevent direct contact between the treated area and navigable water; and a minimum separation of 150 meters between the treated area and any public, private, or livestock water supply. Other requirements are that the potentials for standing water or erosion are both minimized and that waste application shall not occur when the soil is saturated, or when its temperature is at or below 0 C. The general facility standards would further require that all runoff from landfills be collected and confined to a point source which is in compliance with the regulations promulgated under the Clean Water Act.

Although the concept of landfarming has been applied to municipal sludges for many years, experience with, and data on landfarming of hazardous industrial sludges are sparse. The regulations contain several provisions to reduce pollutant migration. They would limit application of arsenic, boron, molybdenum, selenium, and volatile wastes; require the use of fine grained soils consisting primarily of silts and clays; require maintenance of a minimum pH of 6.5 and prevention of anerobic conditions in the zone of incorporation; require semi-annual soil monitoring; and restrict the growth of food chain crops. While these requirements would certainly reduce water contamination relative to existing uncontrolled disposal methods, the regulations would not address rates of application; they would not specifically require runoff monitoring; and they would not address other toxic elements or organic wastes, some of which have caused concern in land application facilities for municipal sludges.

Although it is true that most municipal sludge landfarming operations were oriented towards agricultural crop production, and that under aerobic conditions and at a pH greater than 6.5, most toxic inorganics are relatively insoluble, the potential for water degradation would still exist. (It should be noted that the transformation of Cr^{+3} to Cr^{+6} is favored by oxidizing conditions and high pH; and that $CrO_4^{=}$, the predominant ionic form under those conditions, was not adsorbed by the common clay minerals tested by Griffin et al., [1976].) Additionally, the presence of acidic wastes and wastes which exert high oxygen demands may make it difficult to maintain the required pH and aerobic conditions, which could allow dissolution of some previously precipitated toxic elements.

7.1.5.3 Underground Discharges. Groundwater pollution is possible in any situation in which hazardous wastes are placed in or on the ground with a hydraulic connection to an aquifer. Such a hydraulic connection consists of a permeable pathway from the wastes to an aquifer. It may be composed of unconsolidated sands and gravels, permeable bedrock such as some sandstones, or a system of fractures or joints in the bulk rock. A more complete discussion of groundwater and its contamination is contained in Appendix L.

There are no existing estimates of the amount of hazardous wastes which presently contaminate groundwater. However, it is estimated that there are about 18,500 land disposal sites in the United States which accept municipal wastes, most of which also receive some amount of industrial waste (Office of Solid Waste Management Programs, 1977). It is further estimated that these disposal areas cover a total of approximately 500,000 acres and that they receive approximately 135 million tons of refuse per year. Based on average infiltration rates, it is estimated that these sites generate a total of 90 billion gallons of leachate per year (Office of Solid Waste Management Programs, 1977). In addition, the number of unauthorized and/or otherwise unregulated dumping grounds in the U.S. may reach 150,000 (TEMPO, 1973). EPA is currently planning to inventory industrial landfills beginning the second year following promulgation of its hazardous waste regulations (Office of Solid Waste, 1977a).

It is estimated that there are a total of 100,000 industrial impoundments in the U.S. (Office of Solid Waste Management Programs, 1977). Data are insufficient to estimate the total volume of wastes sent to all impoundments, but is has been estimated that secondary treatment lagoons, such as oxidation ponds, receive 1,700 billion gallons of industrial, though not necessarily hazardous, wastes per year and leak 100 billion gallons (approximately 6 percent) (Office of Solid Waste Management Programs, 1977). Other types of surface impoundments may contribute additional hazardous leachates.

Tables 7-10 and 7-11 summarize some of the hundreds of reported incidents of groundwater contamination due to waste disposal in impoundments and in landfills. Table 7-10 summarizes incidents due to leakage of wastewater from surface impoundments and lists the major resultant pollutants, and Table 7-11 summarizes incidents due to landfill leaching. The fact that Table 7-11 lists more municipal landfills than industrial landfills is due to a lack of data regarding the location and operation of industrial landfills and to the

TABLE 7-10

ORIGINS AND POLLUTANTS IN 57 CASES OF GROUND WATER CONTAMINATION IN THE NORTHEAST CAUSED BY LEAKAGE OF WASTE WATER FROM SURFACE IMPOUNDMENTS *

Type of industry or activity	Number of cases	Principal pollutant(s) reported
Chemical	13	Ammonia Barium Chloride Chromium Iron Manganese Mercury Organic chemicals Phenol Solvents Sulfate Zinc
Metal processing and plating	9	Cadmium Chromium Copper Fluoride Nitrate Phenol
Electronics	4	Aluminum Chloride Fluoride Iron Solvent
Laboratories (manufacturing and processing)	4	Arsenic Phenols Radioactive materials Sulfate
Paper	3	Sulfate
Plastics	3	Ammonia Detergent Fluoride

TABLE 7-10 (Continued)

Type of industry or activity	Number of cases	Principal pollutant(s) reported
Sewage treatment	3	Detergents Nitrate
Aircraft manufacturing	2	Chromium Sulfate
Food processing	2	Chloride Nitrate
Mining sand and gravel	2	Chloride
Oil well drilling	2	Chloride Oil
Oil refining	2	Oil
Battery and cable	1	Acid Lead
Electrical utility	1	Iron Manganese
Highway construction	1	Turbidity
Mineral processing	1	Lithium
Paint	1	Chromium
Recycling	1	Copper
Steel	1	Acid Ammonia
Textiles	1	Chloride

*Miller et al., 1974.

TABLE 7-11

SUMMARY OF DATA ON 42 MUNICIPAL AND 18 INDUSTRIAL CONTAMINATION CASES *

Findings	Type of landfill	
	Municipal†	Industrial
Assessment of principal damage		
Contamination aquifer only	9	8
Water supply well(s) affected	16	9
Contamination of surface water	17	1
Principal aquifer affected		
Unconsolidated deposits	33	11
Sedimentary rocks	7	3
Crystalline rocks	2	4
Type of pollutant observed		
General contamination	37	4
Toxic substances	5	14
Observed distance traveled by pollutant		
Less than 100 feet	6	0
100 to 1,000 feet	8	4
More than 1,000 feet	11	2
Unknown or unreported	17	12
Maximum observed depth penetrated by pollutant		
Less than 300 feet	11	3
30 to 100 feet	11	3
More than 100 feet	5	2
Unknown or unreported	15	10
Action taken regarding source of contamination		
Landfill abandoned	5	6
Landfill removed	1	2
Containment or treatment of leachate	10	2
No known action	26	8
Action taken regarding ground water resource		
Water supply well(s) abandoned	4	5
Ground water monitoring program established	12	2
No known action	26	11
Litigation		
Litigation involved	8	5
No known action taken	34	13

*Miller et al., 1974.

†Many of these municipal landfills also accept some industrial sludges and liquids in addition to septic wastes and sewage sludges.

comparatively large number of well documented studies of municipal landfills. In fact, it is estimated that, at least in the northeast, industrial landfills are far more abundant than municipal landfills (Miller et al., 1974).

The fact that many currently operating landfills are leaking and that this leakage may not be detected for significant periods of time is amply illustrated by a recent study performed for EPA (U.S. Environmental Protection Agency, 1977c). The study selected 50 landfill sites representing a variety of geohydrologic and climatic conditions, disposal methods, and a wide range of industrial wastes. The sites were a minimum of three years old, with no history of known or suspected contamination. Four of the sites had some kind of leachate control system. Thirty-two sites had existing monitoring systems. Five others had water supply wells near enough to be used for monitoring. At sites where no monitoring system existed, or where the existing system was not considered adequate, new wells were placed. Each site was covered by several monitoring wells and at least one background well. The results of sampling are summarized in Table 7-12. It was determined that at 43 sites definite migration of hazardous constituents had occurred. The seven other sites were also contaminated by hazardous materials, though it could not be shown that their contamination was due to the disposal sites. At 26 sites, hazardous inorganic constituents in water from one or more monitoring wells exceeded the EPA drinking water limits. Only one of the four

TABLE 7-12

GROUNDWATER CONTAMINATION FROM INDUSTRIAL WASTE LAND DISPOSAL SITES*

Contaminant	# of Wells Which Exceeded Background	# of Wells Above EPA Drinking Water Standards	Max Conc. Observed (mg/l.)
Arsenic	5	3	5.8
Barium	29	3	3.8
Chromium	12	3	420
Cobalt	15	+	0.22
Copper	19	2	2.8
Mercury	5	1	0.0008
Molybdenum	2	+	0.24
Nickel	18	+	0.67
Lead	3	3	19
Selenium	28	23	0.59
Zinc	13	2	240
Light Volatile Organics	18	+	1000
Heavy Volatile Organics	9	+	0.59
Halogenated Organics	21	+	0.006
Alkyl Benzenes	2	+	Detected
Benzene	2	+	Detected
Butyl Alcohol	1	+	Detected
Camphor	1	+	Detected
Chlorinated Phenols	2	+	0.003
Cyanide	20	+	14.0
Heptachlor	1	+	Detected
Methyl Ethyl Ketone	2	+	Detected
Napthalene	1	+	Detected
Polychlorinated Biphenyls	1	+	0.002
Trichloroethylene	2	+	0.3
Toluene	3	+	Detected
Xylenes	4	+	Detected

*Complied from data presented in U.S. Environmental Progection Agency, 1977c. This study examined 50 disposal sites using a total of 112 monitoring wells in addition to background wells at each site. Eighty-six wells at 43 sites contained one or more hazardous substances which were determined to have migrated from the site. Wells at 26 sites contained hazardous inorganic contaminants which exceeded EPA Drinking Water Standards. The wells ranged from 10 to 1500 feet from the disposal sites.

NOTE: Three additional wells were contaminated by heavy metals, one with light volatile organics, and one with halogenated organics; however, no background data was available for comparison.

+Not presently covered by EPA Interim Primary Drinking Water Standards.

"controlled" landfills showed no contamination greater than background levels; one showed a slight increase in one constituent above background levels; and the remaining two showed significant increases of several contaminants. Both of the leaky controlled landfills had design failures which allowed portions of the leachate to escape. The conclusions reached by the study group were that:

- Groundwater contamination at industrial waste land disposal sites is a common occurrence;
- Hazardous substances from industrial waste land disposal sites are capable of migrating into and with groundwater;
- Few hydrogeologic environments are suitable for land disposal of hazardous waste without some risk of groundwater contamination;
- Continued development of programs for monitoring industrial waste land disposal sites is necessary to protect groundwater quality;
- Most old industrial waste disposal sites, both active and abandoned, are located in geologic environments where groundwater is particularly susceptible to contamination;
- Many waste disposal sites are located where the underlying aquifer system can act as a pipeline for discharge of hazardous substances to a surface water body;
- At sites presently monitored, the use of wells as an aid in evaluating groundwater conditions is generally poor, due to inadequacies with respect to one or more of the following parameters:
  --number of wells
  --distance of wells from potential contamination source
  --positioning of wells in relation to groundwater flow
  --sealing against surface water contamination, or inter-aquifer water exchange
  --completion methods, such as development, maintenance, and protection against vandalism;

- At sites presently monitored, the sampling program is generally poor due to inadequacies with respect to one or more of the following parameters:
  --obtaining a sample representative of aquifer water
  --sample preparation
  --frequency of sampling
  --availability of background water-quality data
  --selection of constituents to be analyzed
  --availability of laboratories
  --maintaining records in usable form.

These conclusions emphasize the care with which hazardous waste landfills must be located, constructed, and monitored.

With respect to surface releases, the Subtitle C regulations would allow no surface or subsurface discharges of hazardous wastes by generators, transporters, or storers. The specific regulations applicable to storers would require impervious construction and monitoring to ensure that no groundwater contamination occurs. Compliance with these regulations would effectively eliminate contamination of groundwater with the regulated hazardous wastes originating from generators, transporters, and storers. Many of the incidents reported in Appendix J could be avoided under the regulations. The existence of the Section 3002 manifest system could make the following type of incident highly unlikely to occur:

- In 1971 a major chemical company contracted with a trucker to haul approximately 5,000 drums of petrochemical wastes, including acrylonitrile, acetone, epichlorohydrin, and a number of other toxic, flammable, explosive, and/or oxidizing chemicals for disposal in a landfill. Instead, approximately 4,500 of the drums were transported to an abandoned chicken farm in Dover Township, New Jersey where they were stockpiled and subsequently dumped. Although the drums and some contaminated soil were removed under court order in 1972, in 1974 it was discovered that a large but unknown portion of the Cohansey Aquifer, a major regional aquifer, had become contaminated with petrochemicals, resulting in the condemning of approximately 150 private wells. The cost of extending public water supply into the area was about $300,000. Moreover, this incident resulted in adverse impact on local building and development. The exact magnitude of the environmental and economic damage has not yet been determined (Office of Solid Waste Management Programs, 1976; State of Minnesota, 1977).

The regulations for the other potential sources of groundwater contamination (i.e., treatment and disposal facilities) are more intricate. The groundwater human health and environmental standard for the proposed treatment and disposal (Section 3004) regulations states the objective that no facility shall degrade groundwater such that Underground Drinking Water Sources (UDWS) anywhere off the facility property would at any time be endangered. The proposed regulations would define UDWS as an aquifer which currently supplies a public water system; has less than 10,000 mg/l total dissolved solids; or is designated as a UDWS by the Administrator of EPA after a public hearing. The proposed regulations would consider a UDWS endangered if operation of a facility caused the violation of a National Primary Drinking Water regulation; made it necessary to treat or increase treatment of the water for any present or future use; or, if such practice could otherwise adversely affect the health of persons, such as by adding a substance that would make the water unfit for human consumption.

The general facility standards for hazardous waste treatment and disposal would require that discharges to groundwater not occur unless the facility owner/operator can demonstrate that the discharge will not violate the groundwater human health and environmental standard. Additional general standards would prohibit location of facilities in the recharge area of sole source aquifers, would require periodic groundwater monitoring for all facilities except landfarms, and would require leachate monitoring for landfills and surface impoundments. Additional specific requirements that would affect each type of disposal facility are discussed below.

Landfills. The proposed regulations for landfills would require a minimum separation of 1.5 meters between the bottom of the liner or natural barrier and the historical mean water table, unless the landfill owner or operator can demonstrate that no direct contact will occur between the landfill and the water table. Further, the proposed regulations would not allow disposal of bulk liquids or sludges containing less than 20 percent solids; they would require a minimum separation of 150 meters from any public, private, or livestock water supply; and they would specify certain design characteristics, including minimum thicknesses, permeabilities, and other characteristics of liner systems. Where natural geologic conditions permit, landfills would be allowed to use in-place soils (meeting certain thickness, permeability and structural requirements) without a leachate collection system. Otherwise, a leachate collection system would be required. In some cases, a double liner system (one synthetic and one soil liner), with a leachate collection system and a leachate detection system would be required. Other designs would be acceptable if it could be demonstrated that they provide equivalent containment. The choice of design would have to be approved before construction of the facility began.

Successful implementation of these regulations would result in a significant reduction in groundwater contamination caused by hazardous waste landfills. As discussed at the beginning of this section, the extent of the reduction cannot be quantified since the amount of contamination presently occurring is unknown. However, many examples of situations which could have been prevented by these regulations are summarized in Appendix J. A prominent example of the effects of no control is as follows:

- Between 1960 and 1968, a large landfill near Llangollen, in New Castle County, Delaware, accepted industrial wastes of unknown character and origin, in addition to residential and commerical wastes. The wastes were placed in an abandoned sand quarry underlain in part by a thin layer of sandy clay which separated it from the unconsolidated Potomac Aquifer, a major source of water supply for the area. It turned out that the clay layer was absent beneath part of the site and that some of the clay was excavated for cover material at the landfill. Groundwater contamination was first noted in 1972 in a well 800 feet from the fill. The resulting investigation discovered a large plume of contaminated groundwater moving towards a well field producing 4 to 5 million gallons per day (mgd) located about 5,000 feet from the hill. A massive pumping operation now removes 3 mgd from the aquifer, while the well field is pumping at a reduced rate of 2 mgd, the deficit made up by other sources at the County's expense. Presently a dozen wells are pumping contaminated water to create a cone of depression near the site, and 35 wells are monitored monthly. So far, expenses have reached $800,000 for monitoring, pumping, and replacing water supplies. It is expected that is will cost more than $20 million if the dump must be moved, and that it will require 10 years to restore full usage of the aquifer (Cartwright and Lindorff, 1976; Garland and Mosher, 1975).

Surface Impoundments. The regulations specific to surface impoundments would require the facility to be designed, constructed, operated, and maintained such that no discharge to ground or surface water would violate the respective human health and environmental standards. Other requirements would prevent direct contact between the impoundment and the water table; maintain a separation of 150 meters from any public, private or livestock water supply; and would specify certain design parameters, including the minimum thickness and characteristics of liner systems. Two types of design are cited, though others could be acceptable if they provided equivalent containment. Where natural conditions allow, the bottom and sides of the impoundment would consist of at least three meters of natural, in-place, clay-rich soils having a maximum permeability of 10^{-7} cm/sec and certain structural characteristics.

A leachate monitoring system would also be required. Under other conditions, the impoundment would require a double liner system and a leachate detection system. The regulations would allow an artificial liner meeting given specifications. If an impoundment meets the landfill standards, the baseline regulations would allow its closure as a landfill, providing all bulk liquids, semi-solids, and sludges were solidified in accordance with the regulations. Otherwise, the hazardous wastes would have to be removed at the time of closure.

Implementation of these regulations would significantly decrease the occurrence of groundwater contamination by hazardous wastes. As in the case of landfills, the extent of the decrease cannot be quantified due to the lack of information on the extent of present contamination by improperly located and operated impoundments. However, as discussed in the beginning of this section, the problem is known to be significant. Numerous incidents of contamination have been observed, some of which are summarized in Appendix J. The following example illustrates the potential magnitude of a single incident:

- An aircraft plant, operating in South Farmingdale on Long Island during World War II, generated large quantities of electroplating wastes containing chromium, cadmium, and other metals. It has been estimated that 200,000 to 300,000 gallons per day of these wastes were discharged into unlined disposal basins throughout the 1940's. A treatment unit for chromium was built in 1949, but discharge of cadmium and other metals continued. The local groundwater occurs in three unconsolidated aquifers resting on crystalline bedrock. The uppermost aquifer consists of beds and lenses of fine-to-coarse sand and gravel and extends to within 15 feet of the land surface. Groundwater contamination by chromium was first noted in 1942 by the Nassau County Department of Health. Extensive studies in 1962 indicated that a huge plume of contaminated groundwater had been formed, measuring up to 4,300 feet long, 1,000 feet wide, and extending from the surface of the water table to depths of 50 to 70 feet below the land surface. Maximum concentrations of both hexavalent chromium and cadmium were about 10 mg/l in 1962. (Hexavalent chromium had been measured as high as 40 mg/l in 1949.) This huge contaminated plume cannot be removed or detoxified without massive efforts and will take many more years of natural attentuation and dilution before it becomes usable again. Meanwhile, it is still slowly moving, threatening a nearby creek and other wells in the area (Tinlin, 1976; State of Minnesota, 1977.)

Landfarms. The regulations for landfarms would prohibit direct contact with the water table; would require the use of fine grained silts and clays chosen to prevent vertical migration of the wastes more than three times the depth of waste incorporation; would require closing any caves, wells, or other direct connections to the subsurface environment; would require grading to prevent water from ponding on the facility; would require maintenance of aerobic conditions and a pH of 6.5; and would prohibit waste application when the soil is saturated or frozen. With respect to surface waters, implementation of these regulations would help reduce both ground and surface water contamination by hazardous wastes. However, the regulations would not require groundwater monitoring on the theory that any waste migration towards the groundwater would be detected by the required semi-annual soil core analyses. Further, although the baseline regulations specify soil types and certain structural characteristics (liquid limit greater than 30, and plasticity index greater than 15), they do not specify permeability or compaction of the soils or require liners or other base preparation. While the soil types that would be required are generally relatively impermeable and although the regulations include the constraint that vertical migration of hazardous constituents must not exceed three times the depth of waste incorporation, the possibility of groundwater contamination would still exist. Such contamination could occur due to variabilities in soil permeability (e.g., due to the inclusion of local sandy zones within the silts and clays) or due to variations in the thickness or compaction of the soils. Additionally, although most toxic elements are relatively immobile at the required pH and in oxygen rich environments, formation of the hexavalent form of chromium ($CrO_4^{=}$) is favored under those conditions. Although the chromate ion may be precipitated by the presence of a few other metals (e.g., lead), chromate is not adsorbed by two of the major clay minerals--the only two tested by Griffin et al. (1976).

Other Treatment and Disposal Methods. Discharges to groundwaters would be allowed from treatment facilities and basins, providing that such discharges would not violate the groundwater or surface water human health and environmental standards. The regulations would also require facility maintenance to avoid leaks and emergency releases due to equipment malfunctions and would require compliance with applicable standards for storage facilities or surface impoundments. These regulations would contribute to the reduction of water contamination with hazardous wastes, though, as discussed previously, quantification of the improvement is not possible.

The regulations do not specifically deal with underground injection or ocean disposal of hazardous wastes. It is anticipated that these activities will be regulated by standards promulgated under the authority of the Marine Protection, Research, and Sanctuaries Act and the Safe Drinking Water Act. This exclusion does not preclude use of these techniques, and any storage or transportation of hazardous wastes in conjunction with these activities would be subject to the appropriate RCRA regulations.

Taken collectively, the baseline regulations would eliminate most of the pathways by which hazardous wastes presently contaminate both surface water and groundwater. The regulations would, therefore, result in a substantial reduction in the number of incidents in which such contamination occurs. However, a few pathways would remain, as discussed in the previous sections. The following incident serves to point out the potential for contamination by hazardous wastes which could escape regulation:

- In May 1972, a private commercial well was dug for a new office of a small contractor in Perham, Minnesota. Within the same month, 5 of 13 employees became ill with gastrointestinal ailments. Six other employees also became ill within the next 10 weeks, two requiring hospitalization including one who lost the use of his legs for six months due to severe neuropathy. After several weeks it was discovered that the well was located 20 feet from a site where approximately 50 pounds of grasshopper bait had been buried between 1934 and 1936. The bait, which consisted of arsenic trioxide, bran, sawdust, and molasses, had been buried at a depth of 7 feet, while the affected well was 31 feet deep. Well samples contained up to 21 ppm arsenic (U.S. Interim Primary Drinking Water Standards are 0.05 ppm). Soil samples contained up to 12,600 ppm of arsenic in the vicinity of the burial spot. To date the affected well has been capped and an alternate water supply obtained at a cost of about $300. Twelve nearby wells are also monitored periodically to establish the threat to the Perham municipal well field three-fourths of a mile away. It has been estimated that removal of the contaminated soil would cost up to $25,000 (Walker, 1973; Office of Solid Waste Management Programs, 1975a; Cartwright and Lindoroff, 1976; State of Minnesota, 1977).

During two years only 50 pounds (about 23 kg) of wastes were disposed, and 40 years later 11 people became seriously ill as a result. The quantity of waste involved in this incident would easily qualify for exclusion from the regulations under the generator limit even if it was generated in one month. Wastes thus excluded was essentially unregulated, and may be disposed in conventional landfills, sewers, or by other less-controlled methods. As a result, although incidents due to the disposal of large quantities of wastes would be reduced by the regulations, the potential for incidents, such as that which occurred at Perham, Minnesota, would still exist.

Disposal of small amounts of wastes does not necessarily result in discrete identifiable incidents. Perhaps a more serious problem is the widespread increase in non-specific environmental contamination by hazardous substances which has been occurring across the nation, as evidenced by the following example:

- In May 1975, the U.S. Food and Drug Administration halted an interstate shipment of carp taken from Lake Pepin (located on the Mississippi River on the border between Minnesota and Wisconsin) by a commercial fisherman. About 20,000 pounds of fish were destroyed when analysis revealed that some of the fillets exceeded the FDA limit of 5 ppm PCB. At about the same time, an Inter-Agency Task Force on PCB's was formed to investigate PCB contamination in the Mississippi River. Their results indicate variable concentrations of PCB in the water; concentrations of up to 500 ppb in sediments in Spring Lake and up to 1000 ppb in sediments in Lake Pepin; concentrations in individual fish ranging from 0.03 to 33 ppm; and average concentrations for fish species ranging from 0.04 to 3.97 ppm, with the highest concentrations in white bass, carp, and channel catfish. Significant damages have been sustained by both commercial fishermen and mink farmers. The task force concluded that the contamination was probably caused by a large number of small inputs including municipal wastewater treatment plants, industrial discharges, resuspension of bottom sediments during dredging, leachate from landfills, and fallout from the air after burning PCB contaminated materials (State of Minnesota, 1977).

Following successful implementation of the Subtitle C regulations and associated regulations under FWPCA and other acts, the only unregulated sources of hazardous contaminants to surface waters would be resuspension of bottom sediments; leachate from presently leaking landfills or other dumps which are inactive when the regulations go into effect, or are inadequately sealed following enactment; leachate or other discharges from facilities receiving nonregulated wastes; and spilled materials which escape clean-up attempts. Thus, although several of the major sources of contamination would be eliminated, situations like this one may continue to occur due in part to uncorrected existing problems (e.g., abandoned dumps and contaminated river and harbor sediments), and in part to unregulated waste streams (e.g., those from households and from generators not producing more than 100 kilograms per month, and unlisted, potentially toxic wastes).

The problem of dealing with existing sites which cannot be modified to qualify for a permit is not specifically addressed in the regulations. These sites include marginal operations which may be abandoned rather than complying with the closure procedures outlined in the regulations. It is likely that these facilities cannot be properly closed without removing all the waste materials and the contaminated soils from the site, as illustrated by the following example:

- During the 1960's, chromium from a waste lagoon in New Jersey contaminated several wells and a nearby stream. The contamination continued for about 10 years before the problem was recognized in 1970. By then, the total chromium concentration was 150 ppm at a well 700 feet from the lagoon. Since then, the source of contamination has been eliminated, but

> the plume of polluted groundwater is still there. As a result, a former municipal drinking water well is currently used for industrial purposes only (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

In such cases, the regulations would provide the beneficial impacts of identifying the unacceptable facilities and preventing their continued use, although the procedures for preventing the on-going pollution from wastes already in place at such sites are not clear.

An analogous situation is the problem of former disposal sites which have already been abandoned. These sites may or may not even have been recorded. Due to the often long time periods required for groundwater contamination to progress to the point where it is identified, such sites have the potential for creating severe problems over the next few years. This problem is particularly important in light of the recent EPA study (U.S. Environmental Protection Agency, 1977c) reporting that at least 43 out of 50 randomly chosen landfills which had never been suspected of leaking, were, in fact, contributing to groundwater contamination, with wells at 26 of the sites exceeding U.S. Drinking Water Standards. The major impact of the regulations would be to prevent the creation of such problems in the future, though discoveries of groundwater pollution due to improper hazardous waste disposal in the past would probably continue to occur for some time to come.

7.1.6 Public Health Impacts. Inadequate hazardous waste management practices have frequently led to cases of injury to human health. The two major pathways by which public health may be affected by hazardous wastes are direct contact (e.g., occupational exposure) and secondary contact (through the media of contaminated air, water, or soil). The severity of the potential impacts is illustrated by the numerous incidents described in Appendix J. This appendix documents 49 separate instances of traceable public health effects, including deaths, and 84 instances of contamination of drinking water, including major water supplies.

From the way in which most of the reported incidents have come to light, it is very likely that the vast majority of such incidents go unreported. Factors which contribute to under-reporting are the long periods of exposure and/or gestation often required before health effects are noted, the difficulties in establishing direct causative relationships, and the synergistic effects of exposure to pollutants from other sources in addition to hazardous wastes.

As discussed in Chapter 6, the quantities of potentially hazardous waste generated are expected to increase both as a result of expanding industrial outputs and the progressive implementation of air and water pollution control programs, ocean dumping bans, and associated environmental legislation. Thus, in the absence of specific regulations, inadequate hazardous waste management could be expected to continue to result in numerous cases of potentially severe health effects.

Further, as witnessed by the examples cited in Appendix J, there is often a considerable time lag between the occurrence of a contamination event and the time at which its impact becomes evident. Since virtually all the reported incidents were discovered only after damage had already occurred, there is, nationally, a very significant potential for many similar public health impacts to be detected from wastes that have already been or currently are being improperly transported, stored, treated, or disposed.

A major incident recently came to light which illustrates the magnitude of the potential health effects which can occur in the absence of regulatory control. Although the incident was only recently brought to national attention, its history dates back to 1947, when a chemical company in Niagara Falls, New York used Love Canal as an industrial toxic waste dump:

- Thousands of drums containing toxic chemicals were dropped or buried into the receding water of Love Canal and its banks. The site was last used as an industrial dump in 1952. In 1953, the surrounding land was sold and a school and homes were built on the site. During the construction of the La Salle Expressway to the south of the original landfill site, noxious fumes, corrosive waters, and oily materials were encountered, according to State personnel and local residents. When other locations within the 16-acre site were also developed, drums were exposed during excavation work allowing the release of noxious fumes and oily liquids, causing several work stoppages. Noxious fumes and hazardous liquid chemicals were also detected in various storm sewers throughout the site. To date, land subsidence in the grammar school playground, located over the actual canal and landfill, occurs regularly. The subsidence holes are periodically filled with soil. School personnel have reported to the County Health Department that children have received burns while handling waste phosphorus (Fred C. Hart Associates, Inc., 1978). Organic contaminants have surfaced over the fill of the canal and in residential backyards. All through the 1970's, residents have experienced unpleasant odors in their cellars, particularly after rains during the summer. Basement sump pumps have also been affected by oily liquids.

In 1976, after six years of abnormally heavy rains, the canal overflowed its underground banks and at least 82 different compounds, 11 of them suspected carcinogens, began percolating upward through the soil into backyards and basements of the homes and school along the canal site. Air monitors placed by the EPA in the basement of surrounding homes have detected significant levels of benzene and 24 halogenated organic compounds, with concentrations of total halogenated organics ranging from 8 to almost 1800 micrograms per cubic meter in seven locations (Fred C. Hart Associates, Inc., 1978).

The more common contaminants have been identified and measured in the analytical work done by several private contractors. Several of the chemical compounds detected are listed on the U.S. Environmental Protection Agency's list of priority Toxic Substances, as established by the Natural Resources Defense Council Consent Decree in 1976, and identified as potentially carcinogenic, teratogenic, and/or mutagenic. Among the substances identified in samples of ponded water by the Division of Laboratories and Research, New York State Department of Health were trichlorophenol, lindane, hexane, methyl cyclopentane, benzene, toluene, chlorobenzene, benzychloride, dichlorobenzene, ortho-dichlorotholuene, trichlorobenzene, and tetrachlorobenzene (Fred. C. Hart Associates, Inc., 1978).

Although the site has not been used as an industrial dump in over 25 years, the recent adverse effects to human health have been numerous. Children and dogs have been burned while playing in the fields, people have had the soles of their shoes corroded through, backyard trees have been killed by chemical action, gardens have been destroyed, fence posts have been eaten away, and local residents have indicated that many persons in the neighborhood have died of rectal, blood, and breast cancer. New York State Department of Health studies of the residents of the area indicate a prevalence of problems in the areas of fetal malfunctions, miscarriages, and liver disfunctions (Fred C. Hart Associates, 1978). In the area to the south of the canal, four out of 24 children were born with malfunctions. Malformations in the female children included subcleft palate, deformed ears and teeth, hearing defects, mental retardation, abnormalities of the renal pelvis, and ureters with reflux. In the male children, congenital deafness occurred.

Data collected by the City of Niagara Falls identified 20 homes where wastes were volatilizing and infiltrating into basements. Further investigation has indicated that an additional 10 homes are also affected. According to Calspan Corporation (1977b), extensive abatement measures will be necessary to protect the health of the residents of these homes. The recommendations include the installation of sealed sump pumps, and the sealing of basement walls and floors with an epoxy paint.

The specific causes of the health and safety hazards that have occurred at Love Canal are numerous; however, the subsurface migration of hazardous pollutants continues to pose the major problem. On June 21, 1978, an Emergency Health Declaration under the State Public Health Law, Section 1303, was issued for the Love Canal site. Further investigation on this area is planned.

One of the major stated objectives of the Resource Conservation and Recovery Act is to promote the protection of health and the environment. Implementation of the baseline regulations would result in the institution of a program of responsible hazardous waste management which would decrease the incidence of uncontrolled releases of hazardous wastes to the environment. This program is designed to meet the above objective by limiting both direct and indirect public exposure to hazardous wastes. Direct exposure would be reduced by requirements for treatment, storage, and disposal in permitted facilities with minimum separation distances from buildings, roads, and water supplies; by facility personnel training requirements; and by facility security requirements. Indirect exposure would be reduced by limiting the movement of hazardous constituents of the wastes through air, water, and soils, as discussed previously.

The following sections briefly describe the public health impacts of some of the specific sections of the regulations.

7.1.6.1 Generation. Except for incidents due to occupational exposure, few health incidents have been documented as having occurred during the generation stage of hazardous waste management. Most health incidents are related to subsequent transport, storage, treatment, or disposal.

Generators of hazardous wastes would not be permitted to dispose of such wastes on-site without also receiving a permit as a disposal facility and complying with the Section 3004 regulations. Further, any on-site storage for 90 days or more would also require a storage permit. As discussed previously, these requirements would effectively reduce environmental contamination with hazardous wastes due to illicit disposal activities or improper storage procedures by generators. However, as also discussed in previous sections, a small quantity of potentially hazardous wastes would escape regulation due to exemptions and exclusions for households, retailers, and farmers, and due to the generator limit of 100 kilograms per month. Although it is expected that regulations promulgated under other Acts would partially control these wastes, the uncontrolled fractions could be disposed as nonhazardous wastes using practices such as discharge to sewer systems or any other conventional disposal method (though such disposal would have to conform to regulations promulgated under Section 4004 of RCRA). However, the reduced degree of control for this fraction could conceivably result in the eventual contamination of some surface waters and in subsequent potential human exposure. However, the effects of these exclusions would be much less harmful to public health than those which occur now in the absence of any hazardous waste regulations. Thus, although it is true that some unregulated releases of hazardous wastes could continue to occur, and that some hazardous wastes may cause significant damage in any amount, such occurrences would be much less frequent, and generally less severe than those which occur in the present, uncontrolled case.

7.1.6.2 Transport. The regulations regarding the transport of hazardous wastes could be expected to favorably affect public health by reducing the potential for incompatible wastes to be combined for transport, by requiring use and maintenance of adequate containerization, by extending the DOT regulations to specifically include intrastate, international, and interstate transport of hazardous wastes, and by providing for spill notification and abatement procedures. These regulations would enhance the measure of protection afforded to persons involved directly with the transport of a waste and to the general public.

Without the promulgation of regulations for the transport of hazardous wastes, incidents similar to those described in Appendix J could be expected to continue to occur. One of the more serious current problems associated with the transport of hazardous wastes is that, in the absence of a manifest tracking system, willful dumping is very difficult to control. Such dumped material is frequently placed in a location where environmental degradation can occur, with resultant adverse public health effects. Both Sections 7.1.4 and 7.1.5 discuss the types of environmental degradation that can occur in the absence of hazardous waste regulation during transport. The institution of a manifest system would allow enforcement agencies to relatively easily locate the responsible parties for any dumping incidents involving hazardous wastes subject to these regulations. These regulations, in combination with hazardous spill regulations to be promulgated under the newly amended Section 311 of the Clean Water Act, would act as a deterrent to anyone contemplating such activities.

Any increase in the amount of hazardous wastes transported to off-site facilities, or in the distance over which the wastes are moved, would create a potential for increased health effects due to hazardous spills from transport accidents. Although the containerization and other requirements would reduce spillage en route due to leakage or poor packaging, the regulations would not significantly affect accidents due to collisions or derailments.

7.1.6.3 Treatment, Storage, and Disposal. It is in this area that the regulations would provide the most significant benefits to public health. The Section 3004 regulations would effectively insulate the public from regulated wastes by requiring all storage, treatment, and disposal to be restricted to permitted facilities that would be designed and operated to prevent harmful discharges. As in the case with transporters, implementation of a manifest system and periodic reporting requirements would facilitate tracking the wastes to ensure that they are received at a permitted facility. The regulations would require periodic inspections by facility personnel and would give the Regional Administrator authority to perform additional inspections to ensure that the facility does not violate its permit conditions. Restrictions on siting, including a minimum separation of 200 feet between the active portions of a facility and its property line, and 500 feet between active portions of disposal facilities and public, private, or livestock water supplies would further contribute to the reduction of adverse public health effects. Rules for segregating wastes within a facility and prohibiting the mixing of incompatible wastes, as well as rules requiring employee training programs for hazardous waste facility personnel, would reduce some of the adverse health effects due to occupational exposure.

Public health would be further enhanced by the increased public awareness of the potential dangers of hazardous wastes. The labeling requirements for containers and transport vehicles used in connection with hazardous waste and the public participation procedures which would be required under the Subtitle C regulations, as well as other related regulations, would act to reinforce the mounting publicity given to the potential dangers associated with the improper management of hazardous waste. Thus, though these regulations specifically exclude households, most retailers, and most farmers from the requirements, the regulations may indirectly provide some reduction of the harmful effects associated with wastes from these generators as well. The following subsections discuss specific public health benefits with respect to storage, treatment, and disposal of hazardous wastes.

Storage. Although numerous reported incidents of environmental contamination have resulted from improper storage of hazardous waste, most reported incidents have not been directly identified as causing adverse health effects. However, there have been several reported cases of health effects due to occupational exposure. A typical example of an occupationally-related incident from improper handling procedures at a storage facility is as follows:

- An employee was transferring two 5-gallon cans of waste vinyl cyanide and water from a still to a supposedly empty waste drum. As the employee rolled the drum to a storage area across the road, it exploded. The exothermic reaction catapulted the drum into a steel guard post, spraying the contents, causing thermal and possible chemical burns to the employee (DeVera et al., 1977).

- In another incident 18 persons were exposed to deadly fumes from a stored canister of rat fumigant. The stored canister was leaking a mixture of methyl bromide and chloropicrin. At least 21 persons were affected by the incident including seven firemen who were hospitalized. Two of the firemen have since retired with permanent disabilities. Among the effects suffered from the gas incident are permanent lung damage to two individuals, and possible brain damage to another (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

As can be seen from these incidents, the lack of regulation over the storage of hazardous wastes has resulted in impairment to the health of many persons. Stored wastes have often been forgotten or abandoned. The regulations for storage should significantly reduce the possibility for stored wastes to be abandoned or forgotten for extended periods of time. In compliance with the regulations, any generator who stores hazardous wastes for a period exceeding 90 days, and all off-site storage facilities would have to obtain a permit and would be subject to recordkeeping and reporting requirements. As discussed in Section 7.1.5, no discharges would be permitted from storage facilities. Without these regulations, various occurrences resulting in fires, explosions, the emission of toxic fumes or dusts, and ground and surface water degradation due to reactions, corrosion, or leaks have resulted. Each such unexpected occurrence would have the potential to impact public health. See Section 7.1.4 for the sources of emissions that may occur as a result of storage activities and Section 7.1.5 for the related sources of water contamination that may affect public health.

Treatment/Disposal. The most common method of treatment for hazardous wastes involves the use of lagoons or stabilization ponds. This method of treatment relies on the process of settling and evaporation. Prior to the implementation of regulations, wastes have been treated in unlined ponds or lagoons, or in otherwise unacceptable containment areas. Such treatment areas have frequently been subject to seepage and subsequent groundwater contamination; overflow or rupture, and subsequent surface water contamination; and/or air emissions of potentially harmful volatile substances. The potential for, and interactions between, these occurrences are discussed in previous sections. Many such occurrences have considerable potential for public health problems.

An example of the type of health effects which have occurred as a result of both direct and indirect exposure to hazardous wastes during unregulated treatment is as follows:

- A chemical company dumped chemical solvent wastes at a quarry in Maryland between 1960 and 1974, often leaving the chemicals open to evaporate before covering them up. Residents in the quarry area as well as company employees had complained of headaches, nausea and vomiting, chronic fatigue, weight loss, and memory loss--classic symptoms of chemical fume exposure. One doctor found that seven out of eight area residents he had examined had abnormalities of the liver and/ or pancreatic functions. Another doctor found carbon tetrachloride, which is highly toxic to the liver and kidneys, in the blood of three area residents. Cancer deaths from lymphoma malignancies were found in the quarry area and among employees to be 44 times higher than the national incidence. The death rate was 2.2 times greater than that of the rest of the county. The death rate due to cancer was seven times greater than that for the county, the victims usually living within direct proximity to the chemical plant. Among the solvents dumped at the site were benzene, which is known to damage blood-forming organs and to cause leukemia; carbon tetrachloride, acetone, ketones, and methylene chloride. Many of these substances, when measured, were found to be present in abnormal amounts in the air at the site. The company was ordered to cease dumping at the quarry in 1974, and by 1975 had removed most of the wastes (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

The Subtitle C regulations would control such activities under the requirements for surface impoundments and ponds. As discussed in the sections dealing with air and water impacts, the regulations would significantly decrease the release of hazardous contaminants to the environment from such facilities. Such decreases would result in corresponding decreases in the adverse impacts of hazardous wastes on public health.

Other forms of treatment addressed by the regulations include incineration; landfarms (if wastes are removed at closure); and chemical, physical, and biological treatment facilities. Except for landfarms, each of these treatment methods is to be regulated in much the same way. Each must comply with any other applicable regulations, such as those for storage facilities and basins, and those affecting facility siting, security, and personnel training; each must manifest its wastes if they meet the Section 3001 regulations; and each must remove all wastes at the time of facility closure.

The effects of these regulations on air, water, and soil contamination are discussed elsewhere. Any decrease in the contamination of these media would result in corresponding decrease in adverse impacts on public health. Additionally, the regulations would directly affect the health of facility personnel, through improvements in employee training, standards for facility design, requirements for documentation and verification of waste composition, and through the requirements for the creation of emergency contingency plans to deal quickly and knowledgeably with any accidents.

Two graphic examples of occupationally-related incidents that occurred during the treatment of hazardous wastes resulted in fatalities which might have been avoided if the personnel were adequately trained:

- Two youths were cleaning scale from a cyanide plating waste tank at a treatment plant. When they were checked during the afternoon, they were using their safety equipment, the cyanide level in the tank had been checked, there was positive purge in the air lines, and work was progressing normally. Later, both were found dead, the compressor for the purge had been turned off, and the gas masks had been removed. Apparently a cyanide pocket had been encountered (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- Two men died as a result of fatal burns received at a metal processing plant. One employee was working off an elevated work platform while the other man was operating a forklift. The resulting injuries were caused by contact with the extreme temperatures of a hydrogen explosion and zirconium fire. The explosion and fire were caused when zirconium shavings, contaminated with oil and dirt, were dumped from an unlined 55-gallon steel drum into an unlined steel hopper to be scrubbed in water and detergent. Ignition of the shavings through friction resulted in a violent explosion and fire that engulfed the two workmen (State of Oregon, Accident Prevention Division, 1975).

Landfarming may be considered as a treatment (if the wastes are removed during closure), or as ultimate disposal (the proposed regulations would not require removal of the wastes if the landfarm can be closed so that food chain crops could be grown on the treated area without violating specified human consumption standards). In evaluating the use of land application for hazardous wastes, consideration must be given to the potential for offensive odor nuisances and public health hazards that are peculiar to the use of spray irrigation systems. Groundwater quality is a primary consideration; however, the effect of aerosols, physical contact with the waste by the public or facility employees, insects and rodents, isolation from the public, stormwater runoff and erosion from the site, and contamination of crops and potential for bioaccumulation, are all important effects that are possible in any disposal method.

Odors generally result from the spraying of industrial wastewater that has been inadequately treated or has not been treated at all prior to land application or lagooning. The condition may be compounded by excessive ponding at the irrigation site. Sludge application to the land potentially poses a relatively more serious odor problem if not handled properly. At this time almost all states either prohibit or strictly regulate the use of this method of land disposal in areas where crops are grown for human consumption (Wasbotten, 1976). Information on the causes of groundwater contamination, the resulting discharges to the environment, and on the impacts of the regulations on such discharges can be found in Section 7.1.5. To the extent that the regulations for landfarms would reduce the potential for water contamination, they would also reduce the potential for adverse public health effects.

Disposal. The types of ultimate disposal facilities addressed in the proposed regulations are landfills, some surface impoundments, and some landfarms. The public health effects of the regulations concerning surface impoundments and landfarms are discussed above. Additional requirements affecting public health include minimum separations from water supplies, maintenance of permanent records of waste types and locations, restrictions on the types of wastes which may be landfilled, application of daily cover on active cells, and requirements for postclosure maintenance.

These regulations should effectively prevent the creation of future health disasters such as that which occurred at Love Canal. Additionally, the regulations should also contribute to an overall decrease in exposure to low concentrations of hazardous substances resulting from environmental dispersion of hazardous wastes.

Several sources of potentially adverse health effects would remain unaffected by these regulations. As previously discussed, some potentially hazardous wastes would not be regulated under the Subtitle C regulations. Further, EPA does not have the authority to promulgate regulations concerning inactive and abandoned hazardous waste disposal sites. From the incidents discussed in this chapter and those presented in Appendix J, it is apparent that there may be many hundreds of such sites scattered around the country, whose locations may not even be recorded. The potential for health disasters caused by these sites is considerable.

However, in spite of these omissions, it is evident that the regulations would result in substantial benefits to public health through the reduction of both chronic and acute exposure to contamination resulting from improper handling and disposal of hazardous wastes. The regulations have the potential to control and require the safe disposal of nearly 40 million metric tons of hazardous wastes per year by 1984. In the absence of the regulations, these wastes would have a significant potential to cause environmental degradation and subsequent severe human health effects.

7.2 Potential Secondary Impacts

The potential secondary impacts from implementation of the baseline regulations include impacts to the following areas:

- Physiography and soils;
- Biological environment;
- Social impacts;
- Hazardous waste management facility capacity;
- Land use;
- Water use;
- Resource conservation and recovery;
- Energy use;
- Special interest points.

7.2.1 Impacts to Physiography and Soils. The principal areas of environmental concern pertaining to physiography and soils include:

- o Alterations of topography;
- o Loss and physical disruption of soils;
- o Soil contamination.

Physiography and soils are impacted by hazardous wastes in many ways. In the existing unregulated situation, the major adverse effects resulting from the management of hazardous waste relate to soil contamination through indiscriminate disposal. If the baseline regulations are implemented, adverse effects to soils and physiography would still occur, though their nature and severity would change. For instance, soil contamination would still occur, but in more controlled situations where the physical area affected is limited and contaminants are retained at one location. Erosion of disposal sites would be reduced, though physical disruption of the soils may increase during construction of facilities.

As a result of the regulations, it can be anticipated that there would be considerable effort made to upgrade and expand existing process capacity and physical capacity and also to develop new treatment and disposal facilities. The effects of such activities would be site specific in nature and would have to be addressed on a case-by-case basis. However, the types of potential impacts that could result can be discussed generically in terms of facility construction, facility operation, and facility closure.

7.2.1.1 Facility Modification and Construction. The modification or construction of hazardous waste management facilities would involve several types of effects on physiography and soils:

- Alteration of site topography;
- Alteration of off-site topography due to excavation of materials for liners and soil barriers;
- Loss of soil through erosion;

- Alteration of soil physical properties by disturbance and compaction;
- Degradation of soil quality by pollutants generated by construction vehicles, equipment, and materials.

Most of these impacts are inevitable consequences of construction operations in general and are thus not unique to hazardous waste facilities. Any such impacts would be extremely site-dependent.

The Subtitle C regulations would require the use of natural or artificial liners of specific thicknesses and structural characteristics for landfarms and surface impoundments. Storage facilities and basins would be required to use impermeable, continuous bases. All facilities would have to have diversion structures capable of diverting the runoff from a 24-hour, 25-year storm* and would also have to construct some means of containing any runoff from the site. Landfarms would have to be graded such that their slope would be between zero and 5 percent, and such that no ponding of water occurs. All of these regulations would involve alteration of off-site and/or on-site topography, and alterations of physical properties of the soil.

In most cases, the adverse environmental impacts of such actions would be negligible. The most significant impacts would occur during the construction of large landfills or surface impoundments which cannot use the natural in-place soils as liners. A two acre landfill not using a synthetic liner would require about 8,000 cubic yards of silty clay soils for its liner, plus about 1,000 cubic yards of

*A storm of 24-hour duration whose frequency of occurrence is once in 25 years.

permeable materials for the leachate-drain layer. Additional soils would be required for daily operation and closure. Surface impoundments would require a larger amount of clayey soil for construction of dikes around the impoundments.

7.2.1.2 Facility Operation. Principal impacts on physiography and soils that may result from the operation of hazardous waste facilities include:

- Erosion, sedimentation, and other geomorphic processes;
- Soil contamination by hazardous materials during the course of normal operations or as a result of accidental discharges;
- Alteration of the physical properties of soils by equipment usage and other operational maintenance activities;
- Induced geological instability (e.g., micro-earthquakes).

Soil contamination would be an especially important concern, especially because soils are widely used as an ultimate sink for the disposal of hazardous wastes (Davidson, et al., 1976). Numerous instances of soil contamination by accidental discharges of hazardous wastes have been documented. Many of the incidents of hazardous waste impacts that are cited in the sections of this chapter dealing with impacts to air, water, and the biological environment pertain to soil and soil contamination and are not repeated here. Suffice it to note that the soil contamination is a frequent result of current hazardous waste management practices.

The Subtitle C regulations that would specifically address physiographic and soil aspects of facility operation include the following:

- Groundwater and leachate monitoring systems are to be installed at all hazardous waste treatment, storage, and disposal facilities (except landfarms) that have a potential for groundwater pollution;

- Soils of the treated area of landfarms are to be monitored for vertical migration of the waste or its consituents;

- Landfills and landfarms are to be located, designed, constructed, and operated to prevent erosion, landslides, and slumping;

- Landfarms are to be sloped at less than 5 percent to prevent erosion, but greater than zero percent to prevent wastes or water from ponding or standing;

- All earthern dikes used for surface impoundments are to have an outside protective cover to minimize erosion by wind or water.

- Contingency plans are required at treatment, storage, and disposal facilities to minimize adverse impacts of subsurface discharges of hazardous materials;

- Soils contaminated by accidental discharges from hazardous waste facilities are to be considered to be a hazardous waste and are to be managed accordingly.

The regulations are expected to have the following impacts:

- A substantial reduction in the contamination of soils in areas surrounding treatment, storage, and disposal facilities owing to specific provisions pertaining to soils as well as measures designed to prevent contamination of air and water quality, including accident contingency plans;

- A substantial reduction in soil contamination resulting from disposal of hazardous wastes at unauthorized and unsuitable sites;

- A reduction in erosion, sedimentation, and landslides at landfarms, landfills, lagoons, and ponds;

- Substantial upgrading of the disposal of soils subject to accidental exposure of hazardous wastes discharges from treatment, storage, and disposal facilities.

7.2.1.3 Facility Closure. The impacts on physiography and soils that would occur as a result of facility closure are similar to those which would occur during construction. Basins, storage facilities, treatment facilities, some surface impoundments, and some landfarms would have to be emptied of hazardous wastes, including any soils rendered hazardous during operations. The primary impacts that these facilities would have on physiography would be due to the requirement for filling the empty impoundments and resultant changes in topography. The removal of wastes from these facilities could increase the potential for impacts at the ultimate disposal site.

Landfills, some surface impoundments, and a few landfarms would be the ultimate disposal sites for hazardous wastes. The minimum final cover depth for a landfill would be 15 centimeters (6 inches) of clay soil under a minimum cover of 45 centimeters (18 inches) of soil capable of supporting indigenous vegetation. If deep-rooted vegetation is to be planted on site, the minimum cover thickness would be at least 1 meter (3 feet) of compacted soil. Surface impoundments would have to be treated to render their solids content greater than 20 percent, and then closed in accordance with the requirements for landfills. It is probable that a very large volume of soil would be needed to adequately cover and contain such a semi-solid mixture of hazardous wastes. Landfarms would have to be closed such that food chain crops could be grown on the treated area without resulting in human consumption of substances listed in the EPA Primary Drinking Water Standards, or food additives banned by the U.S. Food and Drug Administration. Since the landfarm design and operation regulations would prevent waste migration from the site (i.e., all wastes would remain at the site), meeting the closure requirements without removing the wastes could be difficult. Closing such a facility would probably (at a minimum) require burial with sufficient soil to prevent the roots of the crops from ever reaching the wastes. Additionally, a protective impermeable layer may be necessary to prevent leaching of wastes by percolating irrigation waters.

7.2.1.4 Transportation of Hazardous Wastes. Provision for the extension of existing interstate safeguards to all intrastate transport of hazardous wastes could reduce the relative frequency of accidental spills and associated incidents of soil contamination. Conversely, increases in the distances over which hazardous wastes were to be transported could off-set some of this benefit. Manifest requirements should eliminate most incidents of dumping and improper disposal and their resultant impacts to soils. Contamination incidents due to improper cleaning of vehicles could be greatly reduced and improved spill contingency measures could reduce soil exposure to hazardous wastes.

7.2.2 Biological Impacts. This section addresses potential impacts of the proposed regulations in terms of: 1) the welfare and status of non-human biota, ecological systems, and habitats; 2) the human amenities that are derived from these resources. The scope of the section includes agricultural as well as natural systems.

Of particular importance from the perspective of biological effects is the nature of hazards posed by waste materials to living systems. Two relevant aspects are the hazardous nature of the material in question, and the degree to which environmental systems may be exposed to the hazard. The latter factor is dependent on the particular conditions under which hazardous materials are handled and disposed. As shown in Table 7-13, intrinsic harmful properties of hazardous wastes to living systems include: flammability, reactivity, toxicity, bioconcentration, and genetic change.

An equally important consideration is the response of biological and ecological systems to the stresses imposed by hazardous wastes and their management. The specific responses would depend on the amounts and types of hazardous materials involved, the modes by which living systems were to be exposed, and other sources of environmental stress, as well as the organisms involved. Because of the wide range of materials and methods involved in hazardous waste management, and of tolerances of different types of organisms, effects on living systems vary substantially and would be situation dependent. However, as shown in Table 7-14, it is possible to generalize about the ways

TABLE 7-13

PROPERTIES OF WASTES THAT ARE HAZARDOUS TO LIVING SYSTEMS*

Hazardous roperty	Types of wastes involved	Hazards to living systems
Flammability	Contaminated solvents Oils Pesticides Plasticizers Complex organic sludges Off-specification chemicals	An acute and latent danger to organisms and habitats. Kill radii of 115 ft. and 230 ft. may be associated with ignition of 9,000 gal. and 30,000 gal. tank cars of flammable liquid. Because of large volumes of wastes, danger at disposal sites may be greater than in transportation. Secondary fires and detonations may occur. Flammability is a hazard during all phases of the hazardous waste cycle.
Reactivity	Explosive manufacturing wastes Contaminated industrial gases Old ordinance	An acute and latent danger to organisms and habitats. Detonation may be caused by thermal or mechanical shock, electrostatic charge or contact of incompatible materials. Kill radius is typically less than for comparable volumes of flammable liquids. Detonation may result in secondary explosions or fire. Reactivity may occur at all phases of the hazardous waste cycle and may pose a greater danger after disposal if sufficient amounts of reactive material are accumulated.
Toxicity	Toxic wastes may be derived from any industry. (Toxicity may result from pure compounds, combined effects of more than one component or combined action of two individually non-toxic materials).	The capability to produce injury upon contact with a suitable site on or in the body. Wastes may be acutely or chronically hazardous to plants or animals. Phytoxic wastes may reduce chlorophyl production, retard growth or interfere with specific chemical processes when present in soil, atmosphere or water. In mammals, acutely toxic wastes may cause damage via inhalation, ingestion, or skin contact. Chronic toxicity may occur for materials that are bioaccumulated or that cause cumulative irreversible damage. In aquatic organisms, toxicity often results from the transfer of toxic materials across the gill membranes. Water is probably the most common vector, but atmospheric emissions may be more readily dispersed. Direct contact is the most easily controlled route of exposure. Exposure of organisms to toxic substances may occur in all phases of the hazardous waste cycle.
Bioconcentration	Various elements and compounds including: cadmium, lead, mercury, polychlorinated biphenyls, carbon tetrachloride	The hazard posed by materials that are concentrated in an individual organism or magnified at successive levels of the food chain until toxic concentrations are reached. Threshold levels of toxicity often occur in vertebrates, including man, and may result in death. Bioconcentration generally occurs when a contaminant is present in low ambient levels and is probably of greatest danger following the disposal of waste materials.
Genetic Change Potential	Dye plant wastes Petroleum sludges	Carcinogenic, mutagenic or teratogenic effects on organisms, as evidenced by mitotic or meiotic malfunction. Exposure is usually by direct and continuous route.

*Battelle Pacific Northwest Laboratories, 1973 .

TABLE 7-14

GENERALIZED PATTERNS OF THE RESPONSE OF BIOLOGICAL SYSTEMS TO INCREASED LEVELS OF ENVIRONMENTAL STRESS*

Degree of Stress	Response at indicated level of organization: Individual organism	Population	Species	Community
Moderate	-Some metabolic and behavioral interference. -Reduced competitive ability. -Reduced resistance to parasites and predators. -Reduced capacity for reproduction.	-Reduced competitive ability of most sensitive individuals. -Some genetic selection for more tolerant individuals.	-Most sensitive populations undergoing selection for hardiest individuals, hence losing genetic diversity. -Most tolerant populations little affected.	-Noticeable shifts in relative species abundance as the most sensitive species suffer reduction in numbers while more tolerant competitor species remain the same or increase in abundance.
Heavy	-Individual under heavy stress load. -Survival not in jeopardy, but individual weakened and susceptible to parasites, disease, and predation. -Reproduction greatly curtailed.	-Elimination of most sensitive individuals. -Increase in more tolerant individuals. -Population level may or may not be affected. -Reduction in genetic diversity.	-Most sensitive populations eliminated. -Most tolerant populations losing sensitive individuals, hence losing genetic diversity.	-Significant shifts in species composition as sensitive species are eliminated and hardy competitors remain and often increase. -New hardy species may enter from elsewhere.
Severe	-Severe metabolic and behavioral interference. -Individual survival in question. -Reproduction no longer possible.	-Survival of only the most tolerant individuals. -Population level may or may not be reduced. -Severe reduction in genetic diversity.	-Only the hardiest individuals of the most tolerant populations still survive.	-Great shifts in species composition. -Most species reduced or eliminated. -Hardy species may become very abundant. -Total system greatly simplified. -Community metabolism greatly modified. -Stability severely reduced.
Total	Death	Elimination	Extinction	Collapse

*Darnell, 1976.

in which living systems, from individual organisms to biological communities, would respond to various levels of environmental stress. A moderate degree of stress, such as that which might be caused by air emissions from a treatment/disposal site, could affect the behavior of individual organisms, reduce the competitive ability of various population segments and species, and ultimately lead to a shift in species composition of the community. At the other end of the spectrum, extreme stress, as represented by the massive discharge of toxic wastes into a stream, could result in the elimination of some species along a large stretch of the affected stream (see Section 7.1.5.2 for examples of such incidents).

On the basis of available literature, present knowledge regarding the effects of current non-radioactive hazardous waste management practices on biological systems are based largely on scattered reports of individual incidents rather than comprehensive surveys or investigations. Moreover, available reports deal largely with acute effects from direct exposure of organisms to high concentrations of hazardous substances and rarely consider chronic effects resulting from long-term exposure to low concentrations. The focus of most reports has been directed to individual organisms or populations rather than to communities or ecosystems.

Determination of hazardous waste effects is complicated by various phenomena, including:

- Synergistic or antagonistic interactions between waste constituents that could enhance or modify overall effects;

- The importance of the physical and chemical form of the waste on the mobility of toxic substances;

- The physical and chemical conditions of the receiving waters (such as pH, existing oxygen demand and availability, and the presence of ions or materials which could immobilize toxic substances by precipitation or adsorption or could combine with them to increase their toxicity);

- Unpredictable nature of interactions between biological systems (e.g., bacteria) and hazardous wastes such that the end point is more dangerous than the original waste;

- Accumulation by mammals of persistent toxic substances such that low ambient concentrations may be magnified in tissues (Office of Solid Waste Management Programs, 1974a). It has also been established that most pollutants are capable of crossing the placenta of mammals; cross effects on features have been demonstrated for high mercury and PCB exposure (Susten and Raskin, 1976).

Despite limitations, the available information is sufficient to establish that current hazardous waste management practices may pose a substantial threat to biological systems. Appendix J and the previous sections of this analysis describe many incidents in which improper management of hazardous wastes has resulted in damage to ecological systems. Analysis of these incidents indicates that the major routes of hazardous waste transport to biological systems are as follows (Lazar, 1975): groundwater contamination via leaching, surface water contamination via runoff or spills, air pollution, poisoning via direct contact, poisoning via the food chain, and fire or explosion.

The potential effects of the proposed regulations on biological species and processes can be perceived in terms of principal stages of the hazardous waste cycle, discussed below:

7.2.2.1 Generation. Improper handling or containerization of hazardous wastes by generators could expose biological populations and habitats to hazardous residuals. Such exposure may result in death and injury to organisms, the dispersal of hazardous materials, and the degradation of aquatic, terrestrial, and atmospheric environments.

The Subtitle C regulations would require all generators of hazardous wastes to treat, store, or dispose hazardous waste in a permitted facility in accordance with the regulations. A manifest and reporting system would be instituted to track the wastes and ensure compliance. All generators designating wastes for transport to an off-site facility must containerize that waste in accordance with DOT hazardous materials transportation regulations in 49 CFR. The generators managing wastes in on-site facilities must obtain a permit under the Section 3005 regulations and must comply with the standards under Section 3004.

These regulations would result in a decrease in the release of hazardous wastes to the environment from generators covered by the regulations. This decrease would result in reduced air, soil, and water contamination as discussed earlier, and subsequently in reduced exposure of biological systems. To the extent that some potentially hazardous wastes would remain uncontrolled (see previous sections), some adverse ecological impacts could continue to occur as they are at present.

7.2.2.2 Transportation. Principal biological considerations associated with hazardous waste transportation include:

- Emissions from improperly containerized wastes that may degrade habitat values;
- Leakages and spillages of transported wastes that kill or injure organisms, degrade habitats, and create odors and other nuisances to organisms;
- Accidental large-scale discharges of hazardous wastes resulting in fires and detonation;
- Vehicular emissions;
- Vehicular collisions with wild and domestic animals.

The regulations would require all transporters of hazardous wastes to comply with the manifest system and to ship all hazardous wastes to a permitted facility. They would require specific labeling and containerization procedures, and prohibit the transport of leaking or damaged containers. Further, the regulations would extend certain DOT hazardous material regulations to intrastate transportation and would reinforce and expand hazardous spill notification procedures established by DOT and EPA through the National Response Center.

As discussed previously, these regulations would have the potential for reducing air, water, and soil contamination from uncontrolled transportation of hazardous wastes. Additionally, the potential for hazardous spills caused by improper containerization during transport would decrease. To the extent that these regulations would reduce air, water, and soil contamination, there would be a corresponding reduction in ecological degradation and other associated adverse biological impacts.

7.2.2.3 Storage. The principal hazards to biological systems associated with hazardous wastes storage may result from:

- Aerial emissions and effluent seepages from improperly stored wastes;
- Accidental spills, fires, and explosions of stored hazardous wastes during handling.

The impacts resulting from such events would depend on the nature and amounts of materials involved and on site specific characteristics. The regulations would allow no discharge from any storage facility. They would require periodic monitoring and inspection to detect any potential discharges to air or water. They would require construction of an impervious, continuous base for the storage facility and of sturdy, leak-proof tanks and containers. The regulations would also require diversion of upland runoff and containment of runoff and spills in the facility. With respect to water quality, these regulations would reduce the potential for water pollution from regulated hazardous waste storage facilities. Any reductions in water pollution would result in a corresponding decreased potential for adverse ecological and biological impacts.

7.2.2.4 Treatment. As with other phases of the hazardous waste cycle, the potential effects of hazardous waste treatment facilities on living systems would be site-specific and would depend on the types and amounts of materials handled, the processes employed, and the ecological setting of the facility.

Any increased treatment of hazardous waste that could result from the regulations should reduce the dangers associated with hazardous waste disposal, but could increase those associated with the treatment. Adverse effects that are principally associated with hazardous waste treatment are:

- The substantial land requirements for lagooning and resultant pre-emption of habitat and displacement of biological populations;
- Leachate and overflow problems for lagoons and ponds that are improperly sited, constructed, or managed and resultant impacts on aquatic systems;
- Air emissions from incinerators that may degrade habitats.

All hazardous waste treatment facilities would be subject to any applicable section of the standards for hazardous waste storage, treatment, and disposal facilities. To the extent that these regulations would reduce or eliminate hazardous discharges from facilities subject to regulation, adverse biological or other ecological effects due to improperly conducted treatment operations would be reduced or eliminated.

7.2.2.5 Disposal. The ultimate disposal of hazardous wastes poses unique and substantial environmental problems. Major site-specific problems associated with the handling and disposal of hazardous wastes include:

- Leachate contamination of surface and groundwaters resulting in hazards to biota and ecological systems;
- Air pollution hazards to vegetation and fauna due to fugitive emissions and uncontrolled or incomplete incineration;
- Exposure of environmental systems to hazardous materials due to indiscriminate or illegal dumping of wastes because of insufficient or expensive disposal facilities (Washington State Department of Ecology, 1977).

Improper land disposal of hazardous wastes could result in a wide range of effects depending on the types and amounts of wastes involved, site characteristics, and facility safeguards. The principal single site-specific concern would likely be the contamination of surface and groundwater systems, and resultant impacts on organisms and communities, due to leaching of toxic effluents. In terms of future changes, an increase in the number of facilities or in the volume of wastes handled would be expected to increase the potential for localized environmental problems while improvements in facility safeguards and more stringent disposal standards would significantly reduce the potential for adverse effects. It is recognized that hazardous wastes by their nature pose a potential threat to the environment, during either short periods prior to their destruction or over very long periods for those materials not subject to detoxification.

A universal impact of hazardous waste disposal facilities, regardless of types of wastes or site environment, is their preemption of land from other uses including habitat for natural and agricultural biota. An EPA study has determined that land disposal of hazardous wastes is increasing because of the implementation of air and water quality standards and legal limitations on other disposal methods such as ocean dumping (Office of Solid Waste Management Programs, 1974a). Legislation of particular importance in this regard includes the Clean Air Act of 1973 as amended, the Federal Water Pollution Control Act Amendments of 1972, and the Marine Protection, Research, and Sanctuaries of 1972, as amended. Thus, it is likely that terrestrial biological systems may be subject to increasing potential stress. This stress would be greater without the Subtitle C regulations.

The regulations would eliminate discharges from hazardous waste storage, treatment, and disposal facilities to groundwater unless it can be demonstrated that the discharge would not endanger an underground drinking water source (UDWS). The regulations would require that all waterborne effluents including runoff and leachates must be confined to point sources, and that all point source discharges to navigable waters must comply with the regulations of the Clean Water Act. Since almost any aquifer which could be used as a water source for wildlife would be classifed as a UDWS, and since navigable waters is quite broadly defined, these regulations would greatly reduce the occurrence of waterborne contamination of biological and other ecological systems by hazardous wastes. One incident which is illustrative of the type of impacts which could be avoided by these regulations is as follows:

- Near the Rocky Mountain Arsenal in Colorado, complex hazardous wastes (consisting of by-products of pesticides, herbicides, and chemical warfare agents) stored in unlined holding ponds infiltrated a shallow water table aquifer and migrated through groundwater. As a result, crops on 6.5 square miles of farmland were damaged and water fowl were killed. Results of the groundwater contamination were still evident 24 years following the initial report of damage and 15 years after remedial action was taken.

Additional regulations would require specific design parameters for landfills, surface impoundments, and basins that would minimize leakage and emphasize structural integrity. Monitoring, inspection, reporting, and permit requirements would reinforce these regulations. This group of regulations would decrease the potential for environmental damage and adverse biological impacts from failure of inadequately designed and constructed containment structures. Two prominent examples of the type of incident which have occurred in the current unregulated situation are as follows:

- In Pennsylvania the rupture of refining waste lagoons near the Allegheny River resulted in the death of approximately 4.5 million fish in one incident, and the death of about 450,000 fish along a 60-mile stretch in another incident (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- A waste pond dike ruptured at a phosphoric acid plant at Fort Meade, Florida, releasing 28 billion gallons of slime composed of halides and phosphatic clays. The discharge contaminated the adjacent creek, the Peace River, and the estuary of Charlotte Harbor. Extensive mortality of benthic biota occurred, and no live aquatic organisms were found in the Peace River up to 8 miles downstream of the adjacent creek (Office of Hazardous Waste Management Programs, 1974a).

These latter wastes are specifically listed as hazardous under the Section 3001 regulations, and are classifed as 'special wastes' under the Section 3004 regulations. Since the Section 3004 'special waste' standards for phosphate were not developed as of the time of this document, their impact is uncertain. However, definition of these wastes as hazardous and implementation of specific disposal standards would certainly reduce the potential for adverse biological impacts due to these wastes.

Other parts of the Section 3004 regulations would restrict open burning of hazardous wastes and require compliance with the regulations developed under the Clean Air Act. These provisions would reduce the potential for adverse biological impacts caused by air pollution. Additional requirements and permit restrictions would prevent the growth of food chain crops where they may contact hazardous wastes, and would require fencing around active portions of facilities. Further, implementation of the manifest and facility permitting system in general would result in a large decrease in uncontrolled open dumping of hazardous wastes. The combined effect of these provisions would greatly reduce the potential biological impacts caused by ingestion or other contact with hazardous wastes. An example of the type of incident which could likely be avoided is as follows:

- In September 1971, six or seven cows died from arsenic poisoning, resulting from improper disposal of a cotton defoliant in a Texas City landfill. Approximately 100 boxes, each containing four "empty" plastic containers holding a small amount of residual arsenic, had been placed at the landfill by a warehouseman of a chemical company. The grazing cattle had entered the landfill from nearby pasture lands.

In summary, the baseline regulations for preventing or minimizing the degradation of air, surface waters, subsurface waters, soils, and other physical features, could substantially reduce the stresses imposed on living systems by current hazardous waste management practices. The implementation of such regulations would reduce the direct exposure of biota and habitats to hazardous wastes. The overall benefits accrued would generally correspond to the amounts of hazardous wastes brought under control, to the rate and uniformity at which such control is implemented, and to the degree to which the release of air, soil, and water residuals were reduced.

The regulations would result in the closing of some existing environmentally inadequate hazardous waste storage, treatment, and disposal facilities; the modification of other existing facilities; and the construction of new facilities that would be in compliance with the regulations. This would have the following types of impacts:

- Biological systems that occur in the vicinity of existing sites which would be closed could be subject to a reduced level of risk if the site were closed in accordance with the regulations;

- The construction of new hazardous waste facilities would result in localized destruction and displacement of biota and the temporary degradation of local habitats due to noise, emissions, effluents, and other construction impacts;

- Any increased transportation of hazardous wastes would expose biota and habitats along transportation routes to increased outputs of vehicular emissions and increased road kills; there could also be an increased frequency of spills as a result of increased transport distances;

- The establishment of new hazardous waste facilities and the expansion of existing suitable facilities could reduce the habitat available to wild and domesticated biota by a presently indeterminable amount; a shift from on-site to off-site disposal could result in the placement of some new facilities in largely remote and rural areas, and thus could preempt habitats that support fish, wildlife, and other natural biota in addition to exposing new communities to hazardous waste management activities.

Although these regulations would afford a significant amount of protection from contact with hazardous waste to the larger terrestrial animals in the immediate vicinity of facilities and to biological systems in a particular group of habitat types (e.g., critical habitats of endangered species and wetlands), the baseline regulations do not include any special provisions for the protection of waterfowl that may be attracted to hazardous wastes surface impoundments. Thus, incidents such as that reported by Snyder et al. (1976), in which migratory waterfowl were killed by alighting on storage lagoons containing residues from a waste oil refinery plant, could continue to occur.

Additionally, the regulations apply only to safeguards at the facility site itself. No provisions are specified for the siting of facilities in relation to many other land use or habitat types that may be of value to wild or domesticated biota (e.g., prime agricultural lands; upland wildlife habitats, habitats and ranges of state designated rare and endangered species, areas in major migratory routes, commercially valuable forests, unique plant communities, etc.). It is likely, however, that permit application and review procedures would provide a mechanism for considering such impacts prior to facility approval. The regulations also make no specific provision for compensation or mitigation of losses of habitat and biota that may occur as a result of the installation or operation of hazardous waste facilities or as a result of accidents that may result during their operation.

7.2.3 Social Impacts. Two major types of impacts could occur as a result of promulgation of the Subtitle C regulations: demographic changes and changes in existing social conditions.

7.2.3.1 Demographic Impacts. Potential sources of demographic changes from the promulgation of the Subtitle C regulations include closings or relocations of industrial plants; construction or modification of hazardous waste management facilities; changes in operational requirements of hazardous waste management activities; and administrative requirements for program management.

As indicated in the Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement), promulgation of the Subtitle C regulations would likely cause some plant closings and job losses in a number of industrial segments (e.g., textile industry, inorganic chemicals industry, organic chemicals industry, metals smelting and refining industry, electroplating and metal finishing industry). Such plant closings and job losses would have the potential to cause relocations of some of the affected workers and their families. The nature and extent of any such relocations and population shifts would be site-specific and dependent upon such factors as number of workers affected, local and national unemployment rates, number and types of jobs available, worker skills, age of affected workers, and willingness of workers to relocate. There would be a potential for large-scale out-migrations from any communities or areas for which plants being closed constituted the primary source of employment.

The Subtitle C regulations would result in modifications to existing hazardous waste management facilities and the construction of new facilities. Due to the small number of construction workers who would be required at any individual facility, it is unlikely that there would be a significant amount of relocations or population shifts due to construction requirements. However, there could be some localized instances of worker relocations, especially in the case of facility construction in rural or undeveloped areas. Any such relocations would likely be of a temporary nature.

Operational requirements for hazardous waste management under the Subtitle C regulations would likely result in additional workers being required to track the hazardous waste (due to the manifesting, reporting, and recordkeeping requirements), to transport the wastes (in the case of increased off-site disposal), and to store, treat, or dispose the wastes both off-site and on-site. Additional workers would also be required to administer and enforce the regulations at both the state and Federal levels.

Some population shifts could occur if the required number of workers were not available where needed, particularly in the case of treatment/disposal sites being located in rural or undeveloped areas. Any such shifts in population are expected to be relatively small on a national scale; however, there could be localized instances of a relatively large influx of workers, particularly for facilities located near small towns or in rural areas.

Based upon a study of the hazardous waste management service industry (Foster D. Snell, Inc., 1976), it is estimated that about 500 workers (including clerical and professional employees) are required to handle a million metric tons of hazardous wastes per year. Using this requirement as the minimum number of workers likely to be required under the Subtitle C regulations,* it is estimated that at least 20,000 such workers could be required by 1984 to handle hazardous wastes. Approximately 2,600 to 5,000 of these workers could be required at off-site facilities, and approximately 15,000 to 17,400 could be required at on-site facilities. Based upon Section 7.2.4, this would represent a decrease of 400 workers at off-site facilities in the case of 13 percent off-site shipment and an increase of 2,000 workers at off-site facilities in the case of 25 percent off-site shipment (there would be equivalent, but opposite, changes at on-site facilities). It should be noted that changes in employment at off-site facilities would be more likely to cause

*This number does not include the additional workers that would likely be needed to track the hazardous waste under the Subtitle C regulations. Some additional operational employees could also be required.

population shifts than changes at on-site facilities. In 1975 approximately 2,000 workers were employed off-site at hazardous waste management service industry facilities (Foster D. Snell, Inc., 1976). Data are not available as to the number of workers employed at on-site facilities, nor to estimate the increase in the total number of employees that would be required at all facilities under the regulations.

7.2.3.2 Social Conditions. Impacts to existing social conditions could result from changes in the siting and operation of hazardous waste management facilities and from any population shifts caused by the regulations.

The increased public health protection that would be derived from the regulations would provide significant social benefits. Many of the social costs related to the exposure of workers and the general public to hazardous wastes and their residuals under current practices would be reduced or eliminated. This exposure is known and/or suspected to have caused numerous instances of adverse health effects, including death (see Section 7.1.6). Much of the individual grief and suffering associated with such incidents, as well as the resultant economic losses, would be reduced or eliminated.

The regulations, while not applying to household wastes, could focus more public attention on the problems associated with the improper treatment/disposal of hazardous wastes. This could result in increased care in the disposal of hazardous household wastes and a further reduction in public health impacts from such disposal. A few examples of health problems that have resulted from the improper disposal of hazardous household wastes are presented in Appendix J. This awareness could also result in more citizen pressure on authorities to see that hazardous waste is properly managed and that generators, transporters, storers, treaters, and disposers comply with the regulations.

On the other hand, an increased public awareness of problems that have been associated with improper disposal of hazardous wastes could add to opposition to local siting of hazardous waste management facilities. Citizen reaction to the siting of hazardous waste facilities has been mostly negative. A number of communities and states have been unable to overcome citizen opposition in attempts to site hazardous waste landfill or treatment facilities. Such opposition is not usually centered upon specific data regarding the adequacy of the proposed facility with respect to public health or the environment. Rather, it is usually based upon reported incidents and the belief that such incidents could not be prevented from reoccurring, regardless of the precautions to be taken. For example, residents in Bordentown, New Jersey, have recently shown extremely strong opposition to the siting of a chemical waste landfill whose construction specifications appear to be well in excess of specific requirements under Subtitle C regulations (Waldron, 1978). This type of opposition represents an educational and attitudinal problem which solid waste management officials could find to be a pivotal constraint and issue in the development of alternatives and solutions. Any inability to effectively site or to provide necessary treatment or disposal facilities would render other steps less effective in providing environmentally adequate hazardous waste management (Office of Solid Wastes, 1977a). However, promulgation of the regulations accompanied by increased public awareness and participation in the facility siting process, and specific demonstrations that the objectives of the regulations can be achieved, could also serve to lessen such opposition in the future and could lead to more effective siting of facilities.

Other social impacts could also result from the expansion or construction of hazardous waste management facilities and from any increased off-site transport of hazardous wastes. The construction and operation of new facilities would have aesthetic impacts and could result in localized noise impacts. Construction of new facilities, especially off-site facilities, and conjunctive developments such as road construction would create new jobs, but would also represent an intrusion on the existing aesthetic environment. This intrusion would consist of visual, auditory, and olfactory alterations. Forms, colors, lines, textures, sounds, and smells could be changed. The perception of these alterations would depend upon many variables including the context in which the alteration appears, the terrain masking the alteration, the distance from which the alteration is viewed, the magnitude of the alteration, and the weather conditions at the time of perception. Proper planning, while not able to eliminate these aesthetic and noise impacts, could make them less perceptible.

Facility construction and operation, including the additional truck traffic associated with new or expanded facilities, could increase noise levels in the vicinity of such facilities, especially in the case of off-site facilities, and also along transport routes. Changes in noise levels would be extremely site-specific and would depend upon such factors as existing noise levels in the area, type of facility constructed, increase in truck traffic, distance to population centers, local topography, and local meteorological conditions. Active portions of facilities would have to be located at least 200 feet from the facility's property line under the Subtitle C regulations. Any changes in off-site shipments of hazardous wastes or in the distances such wastes are transported would also change the potential for accidents from such transport. Assuming that the average round trip haul distance would increase to 200 miles and that there would be 8.9 truck accidents per million vehicle miles (National Safety Council, 1975), based upon Section 7.2.4 there could be about 270 additional vehicular accidents annually in 1984 in the case of 13 percent off-site shipment and 850 additional accidents in the case of 25 percent off-site shipment.

The Subtitle C regulations do not contain specific provisions for planning the siting of hazardous waste management facilities or transportation routes. However, the Section 3005 permit application review procedure, including the opportunity for public hearings on the permit application, would provide a means for consideration of such factors at the state and local levels. Other Federal laws, such as OSHA noise regulations, and state and local laws and ordinances could also serve to mitigate potential noise and aesthetic impacts.

Implementation of the regulations could potentially have long-term beneficial impacts through the establishment of a framework of "equivalent" and "consistent" state programs. This could reduce the likelihood for a state to implement importation bans or overly strict standards directed towards preventing the entry of wastes into any particular state. This could prevent states from becoming isolated in terms of their ability to dispose of hazardous wastes. This consistency between states could, in turn, reduce the potential for geographic shifts by industry to escape strict regulations. However, as previously discussed, in the near term there could be individual plant closings or relocations from the enactment of the regulations.

Any shifts in population that result from the Subtitle C regulations would have the potential to cause social impacts. The magnitude of any such impacts would be site specific and would depend upon such factors as the size of the shift relative to the size of the existing population in affected areas, the rate of the shift, the existing infrastructure in the affected areas, and the adequacy of advanced planning.

Large, rapid, population outfluxes could be unavoidable within some areas if the regulations caused industrial plant closings or relocations, especially if the plant were the primary source of employment for the area. Such out-migration could have a deflationary impact on the local area; however, the remaining residents could also be hard-pressed to maintain existing public services and facilities, and local tax rates could have to be increased. Unemployment would increase in the retail and service sectors, and the number of people requiring financial assistance programs would also likely increase. Daily living patterns could be drastically changed for many of the remaining residents. Stress would likely increase and could lead to increases in mental and physical health problems.

Large, rapid, population influxes associated with relocation of industrial plants or with construction of new hazardous waste management facilities could create inflation, social tensions, and a shortage of housing and necessary infrastructure. Provision of necessary services and facilities could result in increases in local tax rates. Large, rapid, population influxes could also create tensions and disputes between the existing population and the newcomers, especially if the existing residents were forced to modify their daily living patterns to accommodate the changes in their environment. Increases in crime and in mental health related problems (e.g., alcoholism, drug abuse, child abuse, divorce) have at times accompanied large, rapid, population influxes (Institute for Social Science Research, 1974). On the otherhand, any growth could also provide increased job opportunities and an expanded local tax base in the long term.

Population shifts need not necessarily result in adverse impacts. Small shifts, which would be the more likely occurrence in the case of construction or closure of hazardous waste management facilities, could have beneficial impacts or no noticeable impacts. For example, a small population influx could provide additional income, tax revenues, and jobs in the local community without placing any noticeable strains on the existing infrastructure or daily living patterns. A small population decline could reduce any existing unemployment and strains on public services and facilities without noticeably affecting local income, tax revenues, employment, or daily living patterns.

7.2.4 Hazardous Waste Management Facility Capacity. There are two measures of hazardous waste management capacity--process capacity and physical capacity. Process capacity represents the throughput capability of the hazardous waste management facility for handling hazardous wastes (e.g., tons per day, gallons per year). Physical capacity, on the other hand, represents the constraint imposed by the facility site itself on the total amount of wastes that can ultimately be stored, treated, or disposed at the facility (e.g., landfilling of a total of 100,000 metric tons to a depth of 5 meters over the life of a landfill).

7.2.4.1 Process Capacity. The impact of the Subtitle C regulations on the availability of sufficient on-site and off-site process capacity is addressed below.

Off-site Capacity. A recent study of the hazardous waste management service industry (Foster D. Snell, Inc., 1976) indicated that at the end of 1974, the process capacity for the industry as a whole was nearly 7.3 million metric tons per year, with up to approximately 5.3 million metric tons being considered environmentally adequate.* The study further estimated that the process capacity would expand to 8.2 million metric tons by the end of 1977, with up to about 6.2 million metric tons being considered environmentally adequate. This represents a 4.0 percent annual growth rate for total process capacity and a 5.5 percent annual growth rate for environmentally adequate process capacity.

Assuming that the 4 percent annual growth rate for total process capacity would continue between the end of 1977 and the start of 1984 if the Subtitle C regulations were not promulgated, it is estimated that there would potentially be 8.9 and 10.4 million metric tons of total process capacity at the start of 1980 and 1984, respectively.

Assuming that "environmentally adequate", as defined in the Foster D. Snell study, is compatible with the requirements of the regulations and that the 5.5 percent annual growth rate of such capacity would continue between the end of 1977 and the start of

*It should be noted that all capacity considered environmentally adequate by the Foster D. Snell Study may not be considered environmentally adequate under Subtitle C. Thus, the Foster D. Snell numbers should be viewed only as an upper limit on environmentally adequate capacity.

1984, it is estimated that under the regulations there could potentially be as much as 6.9 and 8.5 million metric tons of environmentally adequate process capacity available at the start of 1980 and 1984, respectively.

Currently, about 15 percent of all hazardous industrial wastes are shipped off-site for treatment/disposal (see Table 5-10). For purposes of analysis, it is assumed that any shift in off-site treatment/disposal under the Subtitle C regulations would occur gradually and that approximately 15 percent of the hazardous industrial wastes would continue to be shipped off-site in 1980 (the first year the regulations would be in effect). As discussed in Section 7.1.2.4, for 1984, the fifth year the regulations would be in effect, a range of 13 to 25 percent off-site shipment for treatment/disposal is assumed for analysis purposes.

Approximately 35 and 40 million metric tons of hazardous industrial wastes could be generated annually in 1980 and 1984, respectively. Thus, it is estimated that about 5.3 million metric tons of hazardous industrial wastes could be shipped off-site in 1980 and that between 5.2 and 10.0 million tons could be shipped off-site in 1984. This would represent no change in off-site shipments under the Subtitle C regulations in 1980. The change in off-site shipments in 1984 under the regulations would range between a decrease of 0.8 million metric tons and an increase of 4.0 million metric tons.

Assuming that treatment/disposal facilities would utilize on an annual basis an average of about 90 percent of the available process capacity, approximately 6.2 and 7.7 million metric tons of the environmentally adequate capacity could be utilized nationwide in 1980 and 1984, respectively. The estimated 6.2 million metric tons of environmentally adequate capacity that could potentially be utilized on a nationwide basis in 1980 would be sufficient to handle the estimated 5.3 million metric tons of hazardous industrial wastes shipped off-site. Even if there was no growth in environmentally adequate capacity between 1977 and 1980, there would still potentially be sufficient capacity on a nationwide basis in 1980.

The estimated 7.7 million metric tons of environmentally adequate capacity that could potentially be utilized on a nationwide basis in 1984 would be sufficient to handle the estimated 5.2 million metric tons of hazardous industrial wastes shipped off-site, assuming 13 percent off-site shipment. Again there would potentially be sufficient capacity nationwide even if there was no growth in capacity between 1977 and 1984.

In the case of 25 percent off-site shipment, there would potentially be a nationwide shortfall of 2.6 million metric tons of environmentally adequate capacity for treating/disposing hazardous manufacturing wastes in 1984.* Without any growth in environmentally adequate capacity, this shortfall could be 4.9 million metric tons. Shortfall in process capacity would first occur in 1984 in the former

*The actual shortfall would be 2.3 million metric tons. However, with a utilization rate of 90 percent, 2.6 million metric tons of capacity would be required.

case and in 1981 in the latter case. Based upon an average utilizable facility capacity of 60,000 metric tons per year (Foster D. Snell, Inc., 1976), approximately 45 additional off-site facilities could be required to handle hazardous manufacturing wastes by 1984 in the former case and approximately 80 additional off-site facilities could be required in the latter case.

It should be noted that the estimated availability of necessary, off-site, process capacity is based only on the treatment/disposal of hazardous industrial wastes and on the nationwide availability of this capacity. As indicated in Section 7.1.1, an indeterminable quantity of other hazardous wastes would be generated and an unknown portion of such wastes would be treated/disposed off-site and could cause shortfalls in capacity. Furthermore, these estimates assume that the available capacity would be of the type that is specifically required (e.g., secure landfills, incinerators, surface impoundments). However, it is very likely that there could be national, regional, statewide, or localized shortfalls of specific types of capacity even in those cases where the total available capacity appears to be more than adequate. Furthermore, since not all of the available capacity would necessarily be sited where it is needed, there could be localized shortfalls of process capacity even if the total nationwide process capacity were sufficient. Localized shortfalls could also result from public opposition to siting new facilities or from public opposition which results in the closing of existing environmentally adequate facilities. Any shortfall in on-site capacity as discussed below, could create localized shortfalls in off-site capacity. It should also be noted that if any generators were to send potentially toxic wastes that would not be considered hazardous under the Section 3001 regulations to permitted facilities in order to obtain more secure treatment/disposal, there would be an increased potential for localized shortfalls in off-site capacity. The requirement that at the time of facility closure, wastes must be removed from permitted surface impoundments that do not meet Subtitle C landfill requirements and from some landfarms could create or exacerbate any shortfalls. A recent report by the U.S. General Accounting Office (1978) estimates that when Subtitle C is implemented, 50 to 60 additional sites could be required nationally for hazardous waste treatment, storage, and disposal.

On-site Capacity. Data are not available to estimate if there would be any potential shortfall in environmentally adequate, on-site, hazardous waste management process capacity under the Subtitle C regulations. Based upon the assumption stated above, about 28.7 million metric tons of hazardous industrial wastes would be treated/ disposed on-site in 1980 and between 28.8 and 33.6 million metric tons would be treated/disposed on-site in 1984*.

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*The remainder of the hazardous industrial wastes not treated or disposed on-site or off-site would be recycled or sent to resource recovery operations, both on-site and off-site.

This would represent no change in 1980. The change in 1984 would range between a decrease of 4.0 million metric tons and an increase of 0.8 million metric tons. As indicated in Section 7.1.2.4, the Subtitle C regulations would likely result in an indeterminable decrease in existing on-site process capacity and, as a result, could potentially cause shortfalls in on-site process capacity in both 1980 and 1984. The requirement that at the time of facility closure wastes must be removed from permitted surface impoundments that do not meet Subtitle C landfill standards could exacerbate any shortfalls, both on-site and off-site. Increased resource conservation and recovery and use of more effi-cient processes would lessen the potential for on-site shortfalls.

7.2.4.2 Physical Capacity. Few data are available to estimate the overall physical capacity of facilities to store, treat, or dispose hazardous wastes. EPA recognizes the need for data on physical capacity and will be conducting a series of inventories toward that end. Under the mandate of the Safe Drinking Water Act, an inventory of surface impoundments will be conducted. Under the mandate of RCRA, an inventory of open dumps, solid waste landfills, and sludge disposal sites will be conducted (Office of Solid Waste, 1977a).

Any increase in the use of on-site or off-site landfills would accelerate the rate at which the physical capacity of such landfills would be exhausted. Although the rate of exhaustion of such landfills cannot be determined, it is possible to estimate the change in the necessary on-site and off-site landfill acreage between 1980 and 1984. Assuming that the shift in on-site and off-site disposal would be apportioned equally over this period (e.g., 15 percent off-site treatment/disposal in 1980, 17.5 percent in 1981, 20 percent in 1982, ..., 25 percent in 1984), there could be a total decrease of 1.9 million metric tons in hazardous industrial wastes sent off-site during this period, assuming 13 percent shipment off-site in 1984, and there could be a total increase of 9.3 million metric tons in hazardous industrial wastes sent off-site, assuming 25 percent shipment off-site in 1984.

Based upon Table 5-7, about 80 percent of hazardous industrial wastes are disposed in landfills and surface impoundments. Since wastes treated in surface impoundments would be required to be disposed in landfills if the surface impoundments do not meet the Subtitle C landfill standards and since approximately 99.9 percent of hazardous wastes are placed in surface impoundments that are environmentally inadequate (see Table 5-7), it is assumed, for purposes of analysis, that up to 80 percent of hazardous industrial wastes would ultimately be disposed by landfilling. Thus, there could be up to a 1.5 million metric ton decrease in off-site landfilling in the case of 13 percent off-site shipment and up to a 7.5 million metric ton increase in off-site landfilling in the case of 25 percent off-site shipment.

Assuming an average waste density of 0.8 metric tons per cubic meter and a landfill depth of 10 feet, one to two acres would be required for every 5,000 cubic meters of waste disposal (personal communication, J. Schaum, EPA, 1978). Thus, up to 400 to 800 fewer acres could be committed to off-site landfilling of hazardous manufacturing wastes between 1980 and the end of 1984 in the case of 13 percent off-site shipment and up to 1900 to 3800 additional acres could be committed to off-site landfilling of hazardous manufacturing wastes between 1980 and the end of 1984 in the case of 25 percent off-site shipment. In the former case, after 1984 there could be 160 to 320 fewer acres required off-site annually for landfills compared to requirements without the regulations. In the latter case, after 1984 there could be an additional 1,800 to 1,600 acres required off-site annually for landfills compared to total requirements without the regulations. There could be commensurate changes in on-site land requirements in each instance.

For purposes of comparison, based upon an average, secure, commercial landfill size of 270 acres (U.S. Environmental Protection Agency, Office of Toxic Substances, 1977), these land requirements would be equivalent to siting 1 to 3 fewer off-site secure landfills by the end of 1984 in the case of 13 percent off-site shipment. In this case, the equivalent of approximately one fewer off-site landfill could have to be sited annually after 1984. The land requirements would be equivalent to siting 7 to 14 additional off-site secure landfills by the end of 1984 in the case of 25 percent off-site shipment. In this case, the equivalent of 3 to 6 additional off-site landfills could have to be sited annually after 1984.

7.2.5 Land Use Impacts. More total land, off-site plus on-site, would be required for environmentally adequate hazardous waste management under the Subtitle C regulations than for hazardous waste management under current practices. The additional land necessary for environmentally adequate management of hazardous waste would be required both for the construction of permitted facilities necessary to meet any additional capacity shortfalls that could occur under the Subtitle C regulations and for such conjunctive developments as construction of roads, power lines, and pipelines. However, as indicated in Section 7.2.4, in the case of 13 percent off-site shipment there would be fewer hazardous industrial wastes sent off-site by 1984 under the Subtitle C regulations than under current practices. Thus, while more total land would be required, there could be less off-site land use and more on-site land use for hazardous industrial waste in this case. In the case of 25 percent off-site shipment, there would be more hazardous industrial wastes sent off-site by 1984 under the Subtitle C regulations than under current practices. Thus, there could be more off-site land use and less on-site land use for hazardous industrial waste in this case. Estimates of potential changes in off-site land requirements for landfills (and commensurate changes in on-site land requirements) are presented in Section 7.2.4.

It should be noted that while shifts to on-site land use could reduce off-site land requirements in the short term, such shifts could also accelerate the exhaustion of the relatively limited on-site physical capacity and could result in increased pressure for off-site facilities in the long term. Increases both in resource conservation and recovery and in treatment practices resulting in volume reduction (e.g., incineration) that occur as a result of the Subtitle C regulations would have the potential for reducing land requirements, both on-site and off-site, in the long term.

Existing land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Some agricultural, grazing, forest, recreational, and other lands could be removed from their existing uses. The regulations would prohibit facility construction, and thus not affect existing land uses, on 100-year flood plains, on or near active fault zones, in wetlands, in critical habitat areas, or in recharge areas of sole source aquifers.

Following closure of the hazardous waste management facility and rehabilitation of the site according to the closure plans, the land would be available for new or, in some cases, previously existing uses. Sites at which hazardous wastes have not been removed would be precluded from residential and agricultural uses, and may be precluded from some recreational and grazing uses following closure. Any activity requiring excavation would be prohibited at sites where wastes are not removed. Further, since the regulations would require records to be kept of the location and types of all hazardous wastes remaining at the site, the potential for incidents such as occurred at Love Canal in Niagra Falls, New York would be reduced. (This incident is discussed in Section 7.1.6.)

To the extent that the regulations would prevent other lands from being contaminated by improper disposal, dumping, storage, or treatment under current practices and regulations, there would be a potential for offsetting land use benefits. Sections 7.1.4, 7.1.5 and 7.2.1 describe the potential for the generation of air, water, and land residuals which could affect existing land uses under current practices and regulations. These sections also discuss the potential for reducing these residuals under the baseline regulations.

In addition to land use changes brought about by facility siting, operation, and closure, the baseline regulations could have an impact on a few current land use practices associated with potentially hazardous wastes. For example, landspreading of sludges is specifically addressed in the regulations. The requirements that landfarms be operated so as not to allow waste migration, and be closed so that food chain crops could be grown on site would both minimize the areal extent of contamination and would allow continued productive use of the land after waste applications ceases. Another example would be the regulation of road oiling for dust control. This practice is not specifically addressed in the baseline regulations, although numerous incidents of environmental contamination have occurred as a result of road oiling. (Some of these incidents are described in other parts of this chapter and in Appendix J.) The baseline regulations would require generators of over 100 kilograms per month of waste automotive oils to comply with the regulations. Additionally, hydraulic and cutting oil wastes are listed as hazardous wastes, and other waste oils may be included under the various criteria. Therefore, any waste oils which are considered hazardous under the baseline regulations would have to be treated so as to be rendered nonhazardous before being used for road oiling. This procedure would reduce the environmental damage and resultant adverse impacts to land use that have occurred due to unregulated road oiling.

7.2.6 Water Use Impacts. The Subtitle C regulations would affect water use in two ways--through a reduction in groundwater and surface water contamination and through increased water demand by expanded and new hazardous waste facilities. It is estimated that almost one half of the population of the United States depends on groundwater as a source of drinking water, and that over one third of the nation is underlain by groundwater reservoirs capable of yielding at least 75,000 gpd to an individual well (Office of Solid Waste Management Programs, 1977). It is further estimated that industrial impoundments account for over 100 billion gallons of contaminant per year to groundwater and that residential, commercial, and institutional land disposal sites account for about 90 billion gallons of leachate to groundwater annually (Office of Solid Waste Management Programs, 1977). It is apparent that the potential dangers of uncontrolled disposal of hazardous wastes are a serious problem. With the implementation of the regulations regarding disposal and treatment of hazardous wastes, a significant reduction in groundwater leachate should occur, thereby decreasing the potential danger to private and public underground water supplies.

The potential for the degradation of both groundwater and surface water would be reduced under the regulations. To the extent that degradation of water quality would have resulted in a decreased supply of surface water or groundwater being available to some or all consumers in the water use area, there would be an additional supply of groundwater or surface water potentially available to such consumers and fewer restrictions on the productive use of such surface water and groundwater supplies.

Implementation of the baseline regulations would necessitate that some existing facilities currently accepting hazardous wastes be upgraded in order to make them environmentally adequate, and that new facilities be sited to minimize potential capacity shortfalls. New facilities would be additional consumers of water for purposes such as:

- Dust control;
- Soil compaction;
- Washing and cleaning of equipment and containers;

- Biological treatment;
- Spill control;
- Laboratory requirements;
- Fire control and other emergencies;
- Site rehabilitation;
- Wet scrubbers for air pollution control;
- Miscellaneous uses, including cooling water.

Such demands would affect the water budget of the localities in which the facilities were located to varying degrees depending upon such factors as the type of facility sited, its water requirement, and the potential water availability in the area. The additional water requirement would be somewhat offset by the amount of water (if any) that would have otherwise been used for the treatment/disposal of these additional wastes under current practices and regulations.

7.2.7 <u>Impacts to Resource Conservation and Recovery.</u> As discussed in Section 5.4.2, approximately 3 to 5 percent of hazardous industrial wastes have been subject to resource recovery in recent years with most efforts directed toward the recovery of solvents, oils, metals, and energy. The Subtitle C regulations contain few provisions directed specifically toward increasing the portion of hazardous wastes that would be subject to resource conservation and recovery efforts.

However, since one of the major impacts of the regulations would be to increase generator's costs and the costs associated with hazardous waste transport, storage, treatment, and disposal, there would be an incentive provided by the regulations for generators to modify processes so as to enable increased recycling of hazardous wastes as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to change the nature of the wastes produced (e.g., to produce wastes that are less hazardous). In addition, the Section 3004 regulations direct that where practical, disposal of hazardous wastes would have to be avoided and alternatives, such as resource recovery, reuse, or other methods of recycling, would have to be employed. Furthermore, since the regulations prohibit the placing of ignitable wastes in landfills, landfarms, surface impoundments, and basins, the potential for increased incineration of such wastes, with possible energy recovery, would be greatly enhanced.

As previously indicated, the potential for the implementation of process modifications or other changes to promote resource conservation and/or recovery would be extremely waste stream and process specific and would depend upon such factors as changes in the economics of disposal, treatment, and transport; the cost of raw materials and energy; the availability of markets for and sources of recyclable hazardous wastes; and the availability both of the necessary technology for specific resource conservation or recovery efforts and of environmentally adequate disposal methods and capacity. Chapter 5 presents some examples of the potential for the increased resource recovery from and recycling of hazardous wastes. Due to the complex interrelationships among the above factors, it is not possible to determine the specific changes that could occur with regard to resource conservation and recovery, nor the overall extent of any such changes.

7.2.8 Energy Use Impacts. Promulgation of the Subtitle C regulations could cause changes in energy use in the following areas: hazardous waste management facility construction, facility operation, hazardous waste transport, hazardous waste resource conservation and recovery, and energy production.

The facility modification and construction that would be necessary under the regulations would result in increased energy use (see Section 7.1.2). More energy would also be used for the construction of new facilities under the regulations than would have otherwise been needed due to requirements directed toward making these facilities more environmentally secure (e.g., requirements for site preparation, landfill liners, diversion structures, monitoring systems, pollution control equipment).

There would also be increased energy use resulting from required changes in storage, treatment, and disposal operations under the regulations. For example, requirements for application of daily cover, for higher incineration temperatures and longer retention times, for increased removal of potential air contaminants, for periodic monitoring and analysis, for removal of wastes from surface impoundments at facility closure, and for post-closure care would all potentially result in increased energy use. However, any increase in resource conservation occurring under the regulations would reduce the quantity of wastes that would have otherwise been stored, treated, or disposed and could thus off-set the increase in energy use. Previously discussed changes in resource recovery would also lead to other changes in energy use. While any increase in resource recovery would likely require the initial input of additional energy, energy savings could result from increased energy recovery; from further reductions in wastes requiring storage, treatment, or disposal; and from materials recovery and reuse. This could result in an overall energy savings from resource recovery operations.

The changes in energy use from the transport of hazardous wastes would depend upon such factors as shifts in the portion of wastes managed on-site and off-site and changes in transport distances. Table 7-15 presents estimates of the magnitude of the potential change in energy use that could occur annually by 1984 from changes in transport distances and shifts in off-site and on-site treatment/disposal. Changes in transport distances are estimated as discussed in Section 7.1.4.1; the change in energy use is estimated assuming that trucks average 7.5 miles per gallon of fuel. The estimated annual change in energy use ranges from a decrease equivalent to about 20,000 barrels of crude oil for an average 100-mile round-trip distance with 13 percent off-site treatment/disposal to an increase

TABLE 7-15

ESTIMATED CHANGE IN FUEL CONSUMPTION IN 1984 FROM TRANSPORT OF HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in fuel consumption (million gallons)	Crude oil equivalent* (1,000 barrels)
13 percent	100	-0.7	-20
	200	4	100
	500	18	460
	1,000	42	1,100
25 percent	100	4	90
	200	13	320
	500	37	920
	1,000	86	2,200

*Assumes 95 percent efficiency in producing diesel fuel from crude oil.

equivalent to about 2.2 million barrels of crude oil for an average 1,000-mile round-trip distance with 25 percent off-site treatment/ disposal.

The regulations could also potentially have an impact on energy production. The Subtitle C requirements and resultant costs could potentially result in the closure of or reduced production at some energy producing operations (e.g., oil and gas drilling). Most such operations would, however, be subject only to the 'special waste' requirements, not to the full set of Subtitle C regulations. The Subtitle C regulations could also potentially lead some facilities to change the fuels they use so as to reduce or eliminate the generation of hazardous wastes. Any changes in fuel utilization could affect current energy supply/demand relationships.

7.2.9 <u>Impacts to Special Interest Points.</u> Special interest points consist of natural, modified, or artificial features of the environment that are of special aesthetic, cultural, and recreational significance. Such features include archaeological and paleontological sites; cultural areas; historical sites; parks and recreational areas; scenic areas and other aesthetic resources; unique geological formations; wilderness areas; wild and scenic rivers; and wildlife refuges and other natural areas. The extent to which current hazardous waste management practices may have resulted in adverse impacts to such resources is not documented. However, the types of incidents previously discussed would have had the potential to cause adverse impacts, primarily through the release of air, water, and soil contaminants that could disturb or degrade such special interest points.

The Subtitle C regulations contain provisions which, while not applying specifically to the protection of special interest points, would provide indirect benefits to special interest points and to the human enjoyment of such features. For example, restrictions on the siting of hazardous waste management facilities in wetlands, permafrost areas, and critical habitats would reduce the potential for adverse impacts to such areas. Furthermore, provisions that would potentially reduce the release of air, water, and soil contaminants from such facilities would reduce the potential for these contaminants to infringe upon special interest points located in the vicinity of hazardous waste management facilities. Reductions in air, water, and soil contaminants would also increase, or at least maintain, the opportunity for human enjoyment of such special interest points. Requirements applicable to the closure of facilities such as landfills, landfarms, and surface impoundments would increase the potential for revegetation of such facilities and would reduce the potential for adverse aesthetic impacts.

To the extent that additional lands would be disturbed by facility construction and operation and by conjunctive developments, there would be an increased potential for infringement upon special interest points. Construction of additional hazardous waste management facilities would represent an intrusion on the existing aesthetic environment and could also result in the disturbance of archeological or historical sites. The clearing of trees or other vegetation could result in substantial alterations to the visual characteristics of the site. Noise, dust, emissions, and other disturbances associated with site preparation, facility construction and operation, and hazardous waste transport could adversely effect nearby special interest points and could discourage their use or enjoyment. The perception of these alterations would depend upon many variables, as discussed in Section 7.1.3. Proper planning, while not able to eliminate these alterations, could make them less discernible. The Subtitle C regulations do not contain specific provisions for planning the siting of hazardous waste management facilities or transportation routes with regards to special interest points. However, the Section 3005 permit application review procedure, including the opportunity for public hearings on the permit application, would provide a means for consideration of such factors. Other Federal laws, such as the Archeological and Historic Preservation Act of 1974, and state and local laws and ordinances would also serve to mitigate any potential impacts to special interest points.

7.3 Significant Uncertainties in the Impact Analysis

The impact analysis is subject to a number of significant uncertainties. Limited data are currently available with regard to both the generation and the management of hazardous wastes. Uncertainties exist as to the types and quantities of hazardous wastes generated by various sources, especially non-manufacturing sources. Uncertainties also exist as to the number, distribution, capacity, and adequacy of existing hazardous waste management facilities. Data are sparse on the generation and release of specific hazardous air, water, and soil contaminants by various storage, treatment, and disposal methods. Data and methodologies are not available, for the most part, for determining the movement, transformation, and ultimate fate of most contaminants released to the environment. Human and biological health effects which are a function of both the concentrations of such contaminants and the duration of exposure are, therefore, uncertain. Dose-response data are not yet established for determining health effects from many potentially hazardous contaminants. These limited data, coupled with the site, process, and waste specific nature of most impacts, necessitates a qualitative assessment. Estimates of the probable range of changes and worst-case analyses have both been used to bound the magnitude of potential impacts. The emphasis of the impact analysis has necessarily been placed on hazardous manufacturing wastes, though large volumes of some other hazardous wastes may also be generated.

Furthermore, uncertainties exist with regard to the adequacy of existing technologies and methods for controlling the release of environmental contaminants. The long-term effectiveness of landfill and surface impoundment liners in preventing the discharge of leachate and other water contaminants is uncertain. Over long periods of time even materials such as clay and polymeric membranes, which are usually considered inert, may react with leachate or waste components and may fail or become more porous. Considerable research is currently underway to determine the long-term capabilities of various liner materials. Also, while 99.99 percent destruction efficiencies have been demonstrated for the incineration of many hazardous wastes, such destruction efficiencies have not been demonstrated for most hazardous wastes. Furthermore, in spite of the impressive performances of the incinerators reported in the literature in destroying hazardous wastes, most studies were performed under extremely controlled conditions and only specific products of combustion were sampled in many cases. Problems could occur due to requirements for frequent maintenance and extensive operator education in order to ensure proper functioning. Maintenance could be an especially serious problem since many wastes burned in incinerators are either extremely caustic or produce caustic products when burned.

8.0 IMPACTS OF THE ALTERNATIVES

Five reasonable alternatives to the baseline regulations have been developed to bracket the overall objectives and the resultant impacts anticipated from the regulations to be ultimately promulgated under Subtitle C. Each of the five alternatives is assessed in this section to the extent that it elicits changes in impacts relative to those that would result from implementation of the baseline regulations. Impacts of the alternatives that would be substantially the same as those of the baseline regulations are not presented in order to avoid duplication.

8.1 Potential Changes in Impacts Resulting from the No Action Alternative

As previously discussed, the No Action Alternative is defined as meaning that no part of RCRA, including Subtitle C, is to be implemented and that hazardous waste management would continue as currently practiced, modified by any future state legislation developed without Federal guidance. However, since implementation of RCRA is mandated by an act of Congress, implementation of this alternative would not be feasible without an additional act of Congress repealing RCRA. The No Action Alternative, therefore, is not realistically considered a viable alternative at the present time. The following discussion briefly outlines some of the potential impacts which could occur in the unlikely event that this alternative were followed.

8.1.1 Primary Impacts. In the absence of a Federal hazardous waste control program under RCRA, the primary means of controlling hazardous waste management activities would be through programs developed by individual states and through various sections of other Federal laws, notably, the Safe Drinking Water Act, the Federal Water Pollution Control Act, and the Clean Air Act, as amended. Since there would be no established mechanism to encourage states to enact equivalent regulatory approaches and consistent means of control, it is probable that the states would continue to take different regulatory approaches and to exert very different levels of control. Such approaches would depend on the individual needs, the types and amounts of waste generated, and the political climate in each state. Approaches could range from essentially no control to regulations more restrictive than the baseline Subtitle C regulations. Furthermore, state programs would remain subject to pressures for sending most hazardous wastes to other states, for banning hazardous waste shipments from other states, and for the enactment of more stringent or less stringent regulations than neighboring states. Differences in definitions and in criteria for characterizing hazardous wastes would likely be a common occurrence. The present splintered and uncoordinated development of hazardous waste control programs would continue. This inconsistency of programs would result in the less effective control of hazardous wastes and would allow the continued occurrence of those types of incidents previously discussed.

A detailed discussion of existing state regulations for selected states that have promulgated hazardous waste programs is presented in Appendix A. Many of the states currently manage hazardous waste problems on a case-by-case basis. As of 1978, only 16 states have specified criteria or lists for identifying hazardous waste. Most states identify hazardous materials through broad or generalized definitions. Also, only 17 states have (or have proposed) permit system regulations specifically for the disposal of hazardous waste; 13 states have (or have proposed) standards or regulations for a manifest program; 18 states have (or have proposed) recordkeeping or reporting standards or regulations; 16 states have (or have proposed) formalized inspection standards or regulations for some types of hazardous waste facilities; and 13 states have (or have proposed) specific monitoring program standards or regulations with regard to hazardous waste. Many states do, however, have the enabling authority to control each of these activities; however, most of these states have been waiting for Federal action before proceeding with their own programs. Without such action, it is difficult to determine the outcome of pending waste management programs.

It is likely that on-site activities would continue to escape regulation under many states laws. Existing regulations often apply only to off-site facilities operated in a non-private capacity. Without a Federal requirement for on-site control, a large portion of waste managed on-site could continue to go unregulated. Regulation of hazardous wastes would likely continue to occur on a case-by-case basis and, as a result, many wastes could continue to escape any control. Intrastate movement of hazardous wastes would likely continue to be poorly controlled.

The present trend toward control of hazardous wastes is slowly but steadily increasing as more states extend the limits of their enabling authority to include hazardous waste management. It is not possible to determine whether this trend would continue to occur independent of the requirements and goals provided by Subtitle C. National awareness of the hazardous waste problem is increasing as more environmental problems occur due to the improper management of hazardous waste However, individual states desiring to initiate hazardous waste programs would not be able to use the Federal funding authorized under the regulations. Depending on the extent of the control needed, the financial requirements for effective program implementation could be a substantial constraint to some states.

The impacts to air and water quality and to public health that would occur as a result of this alternative would be a continuation of those existing effects previously discussed. In many cases, even strict control by a state could not protect that state from air or water pollution originating in neighboring states. Incidents such as those described in Chapter 7 would continue to occur, though state regulations could produce local reductions. Large amounts of poorly controlled or uncontrolled hazardous wastes could contaminate many water supplies, air sheds, and large areas of land in many scattered locations. Public health effects from these materials could be manifested in many ways. Of particular concern are the often insidious effects of long-term, low-level exposure to toxic materials; such effects often may not become apparent for many years.

8.1.2 Secondary Impacts. Current impacts to physiography and soils, ecological systems, social conditions, land use, water use, energy use, resource recovery, and special interest points would continue to occur, though they could be mitigated by the enactment of more stringent state regulations than those that currently exist. The implementation of strict state controls would not necessarily protect states from air and water contaminants originating in neighboring states with less stringent regulations and from the secondary impacts of such air and water contaminants. Incidents such as those described in Chapter 7 would continue to occur, particulary in those states that exert little control over hazardous wastes.

At present, most states do not have regulations or standards for hazardous waste disposal sites or for disposing wastes in such sites. As a result, even if a shortage of environmentally acceptable disposal sites actually exists, there could technically be no shortfall since few states have requirements to use such sites. As additional states develop strict disposal regulations, local shortfalls of environmental adequate treatment, storage, and disposal capacity could occur.

Variations in the degree of control states exert over hazardous wastes could also create a tendency for industries to relocate in those states with the least stringent requirements. Other industries might elect to ship their wastes to such states if treatment and disposal costs in their own state were to be considered too high. This could lead to increased incidents of environmental degradation and potential public health problems in such states. Any widespread implementation of import bans, if constitutional, could have severe effects on states whose soils, climate, and geologic conditions are generally unsuitable for secure waste disposal.

8.2 Potential Changes in Impacts Resulting from the Phasing of Generators Alternative

This section discusses the potential changes in impacts (relative to those of the baseline regulations) that would occur as a result of promulgation of the regulations contained in the Phasing of Generators Alternative. To avoid considerable duplication in the presentation, potential impacts discussed in Chapter 7 that would not be changed under this Alternative are not repeated. Only major changes in potential impacts are discussed.

8.2.1 Primary Impacts. The change in primary impacts that could occur under this alternative are discussed below.

8.2.1.1 Hazardous Waste to be Regulated. The objective of this alternative is to reduce the potential for overtaxing resources (e.g., manpower, capital, disposal sites) beyond their capacity for responding effectively to the baseline Subtitle C regulations. This would be accomplished by phasing in, over a five-year period from 1980 through 1984, the generators to be regulated (larger generators first, then smaller generators), such that approximately twenty percent of the total hazardous waste would be controlled during the first year with an additional twenty percent being controlled each subsequent year. This alternative would be implemented by changing the generator limit defined in the baseline regulations. Under this alternative, the generator limit would be quite large the first year, and would be reduced each succeeding year, such that by the fifth year it would be 100 kilograms per month. This procedure would exclude those hazardous wastes that do not meet the generator limit from compliance with the generator requirements, though certain disposal requirements would still apply. Again, emphasis is placed upon hazardous wastes generated by the manufacturing industries for the purpose of analysis.

To develop phasing limits, data on hazardous waste generation from the manufacturing industries have been analyzed to estimate quantities of hazardous waste generated by SIC Code and by EPA Region, as well as to estimate the number of generating firms. Appendix H describes the methodology used for estimating the total potentially hazardous waste generation in the manufacturing industries. Appendix I describes the computer program used to determine the amounts of wastes and number of industries which would be controlled in each year of the phasing alternative. As in the analysis of the baseline regulations, this alternative is based on the assumption that only about 35 percent of the estimated potentially hazardous waste generated in SIC Code 28 would be subject to regulation, due to the nature of the toxicity characteristic (see Section 7.1.1 for more detail).

Using these methods, the generator limit is determined for each year of the five-year program. Then, using summary data from Appendix K, the number of establishments and the EPA Region in which they are located is determined. Tables 8-1 through 8-4 show the distribution of the hazardous waste regulated in each year. Because of assumptions and data limitations discussed in Appendices H and I, Tables 8-1 through 8-4 do not present the specific quantities of wastes or number of firms that would be subject to regulation during each year of phasing, but only indicate the EPA Regions and SIC Codes in which the regulated wastes are contained.

In order to bring 20 percent of the manufacturing wastes that are hazardous under control in 1980, it is estimated that the generator limit would have to be set at 12,900 metric tons per year; all establishments generating hazardous waste quantities greater than approximately 1,075 metric tons per month would be regulated during the first year. This could limit control efforts to SIC Codes 26 (Paper and Allied Products), 28 (Chemicals and Allied Products), 29 (Petroleum and Coal Products), and 33 (Primary Metal Industries), as shown in Table 8-1. It is estimated that about 75 percent of the

TABLE 8-1

REGULATED HAZARDOUS MANUFACTURING WASTES DURING THE FIRST YEAR OF PHASING (1980)* BY REGION AND SIC CODE

SIC Code	EPA Region										Totals	
	I	II	III	IV	V	VI	VII	VIII	IX	X	Wastes (1000 metric tons)	Number of establishments affected†
26	X		X	X	X	X				X	157	c
28	X	X	X	X	X	X	X		X	X	5170	f
29			X		X	X			X		263	c
33		X	X	X	X	X	X	X	X		1310	d
Totals-												
1000 metric tons	156	964	1430	1570	1540	938	109	35	78	76	6890	
Number of establish- affected†	b	d	d	d	e	d	a	a	a	a		f

*Based on a generator limit of 1075 metric tons/month, chosen to include approximately 20 percent of the total estimated hazardous wastes (see Section 7.1.1). An "X" indicates that at least some hazardous wastes generated in the appropriate SIC Code would probably be subject to Subtitle C requirements in the corresponding region.

†The number of establishments subject to Subtitle C requirements are presented as ranges: a=1-5; b=6-10; c=11-25; d=26-50; e=51-100; f=101-250; g=251-1000; h=1001-2500; i=2501 or more.

TABLE 8-2

REGULATED HAZARDOUS MANUFACTURING WASTES DURING
THE SECOND YEAR OF PHASING (1981)* BY REGION AND SIC CODE

SIC Code	EPA Region										Totals	
	I	II	III	IV	V	VI	VII	VIII	IX	X	Wastes (1000 metric tons)	Number of establishments affected†
26	X	X	X	X	X	X	X		X	X	947	f
28	X	X	X	X	X	X	X	X	X	X	8790	g
29	X	X	X	X	X	X	X	X	X	X	619	e
31								X			8	a
32	X	X	X		X		X				104	d
33	X	X	X	X	X	X	X	X	X	X	2790	g
34	X	X			X	X	X	X			165	e
35	X	X	X	X	X	X	X	X	X		1440	f
Totals												
1000 metric tons	552	2090	2380	2640	4090	1670	532	117	549	246	14,900	
Number of establishments affected†	e	f	f	f	g	f	e	c	e	d		h

*Based on a generator limit of 303 metric tons/month, chosen to include approximately 40 percent of the total estimated hazardous wastes (see Section 7.1.1). An "X" indicates that at least some hazardous wastes generated in the appropriate SIC Code would probably be subject to Subtitle C requirements in the corresponding region.

†The number of establishments subject to Subtitle C requirements are presented as ranges: a=1-5; b=6-10; c=11-25; d=26-50; e=51-100; f=101-250; g=251-10001 g=1001-2500; i=2501 or more.

TABLE 8-3

REGULATED HAZARDOUS MANUFACTURING WASTES DURING THE
THIRD YEAR OF PHASING (1982)* BY REGION AND SIC CODE

SIC Code	EPA Region										Totals	
	I	II	III	IV	V	VI	VII	VIII	IX	X	Wastes (1000 metric tons)	Number of establishments affected†
25				X	X	X					9	e
26	X	X	X	X	X	X	X	X	X	X	2470	g
28	X	X	X	X	X	X	X	X	X	X	9960	h
29	X	X	X	X	X	X	X	X	X	X	898	f
30					X		X	X			9	a
31	X	X	X	X	X	X	X	X	X		360	f
32	X	X	X	X	X		X		X		360	f
33	X	X	X	X	X	X	X	X	X	X	3660	g
34	X	X	X	X	X	X	X	X	X		486	f
35	X	X	X	X	X	X	X	X	X	X	3000	g
37	X	X	X	X	X	X	X	X	X	X	803	f
39	X		X		X						6	b
Totals												
1000 metric tons	1150	2890	3140	3550	6380	2240	934	205	1120	419	22000	
Number of establishments affected†	g	g	g	g	h	g	f	d	g	e		i

*Based on a generator limit of 125 metric tons per month, chosen to include approximately 60 percent of the total estimated hazardous wastes (see Section 7.1.1). An "X" indicates that at least some hazardous wastes generated in the appropriate SIC Code would probably be subject to Subtitle C requirements in the corresponding region.

†The number of establishments subject to Subtitle C requirements are presented as ranges: a=1-5; b=6-10; c=11-25; d=26-50; e=51-100; f=101-250; g=251-1000; h=1001-2500; i=2501 or more.

TABLE 8-4

REGULATED HAZARDOUS MANUFACTURING WASTES DURING THE FOURTH YEAR OF PHASING (1983)* BY REGION AND SIC CODE

SIC Code	EPA Region										Totals	
	I	II	III	IV	V	VI	VII	VIII	IX	X	Wastes (1000 metric tons)	Number of establishments affected†
20		X	X		X		X	X			14	d
22			X	X							26	e
25	X	X	X	X	X	X	X				60	f
26	X	X	X	X	X	X	X	X	X	X	3,440	h
28	X	X	X	X	X	X	X	X	X	X	12,600	i
29	X	X	X	X	X	X	X	X	X	X	1,070	g
30	X	X	X	X	X	X	X	X	X		87	f
31	X	X	X	X	X	X	X	X	X		686	g
32	X	X	X	X	X	X	X	X	X	X	1,070	h
33	X	X	X	X	X	X	X	X	X	X	4,730	h
34	X	X	X	X	X	X	X	X	X	X	1,340	h
35	X	X	X	X	X	X	X	X	X	X	4,330	i
36	X	X	X	X	X	X	X	X	X		94	f
37	X	X	X	X	X	X	X	X	X	X	966	g
38	X	X	X		X	X		X	X	X	22	c
39	X	X	X	X	X	X	X	X	X		93	f
Totals 1000 metric tons	1740	3970	4080	4740	8830	2940	1430	330	1960	594	30,600	
Number of establishments affected†	h	h	h	h	i	h	g	f	h	g		i

*Based on a generator limit of 34 metric tons per month, chosen to include approximately 80 percent of the total estimated hazardous wastes (see Section 7.1.1). An "X" indicates that at least some hazardous wastes generated in the appropriate SIC Code would probably be subject to Subtitle C requirements in the corresponding region.

†The number of establishments subject to Subtitle C requirements are presented as ranges: a=1-5; b=6-10; c=11-25; d=26-50; e=51-100; f=101-250; g=251-1000; h=1001-2500; i=2501 or more.

controlled wastes would be from SIC Code 28. All EPA Regions would be involved to some extent; though, as indicated, Regions III, IV, and V could generate about 65 percent of the regulated wastes. Approximately 230 establishments could be regulated nationwide.

In order to bring 40 percent of the manufacturing wastes that are hazardous under control in 1981, it is estimated that the generator limit would have to be set at 3,630 metric tons per year; all establishments generating quantities of hazardous waste greater than approximately 303 metric tons per month would be regulated during the second year. This could extend control efforts to SIC Codes 31 (Leather and Leather Products), 32 (Stone, Clay, and Glass Products), 34 (Fabricated Metal Products), and 35 (Machinery, Except Electrical), as shown in Table 8-2. It is estimated that about 60 percent of the controlled wastes would originate in SIC Code 28. Control efforts would be more pronounced in EPA Regions III, IV and V, though their share would decrease to about 61 percent, with one-half of that being in Region V. Approximately 1,500 establishments could be regulated nationwide.

In order to bring 60 percent of the manufacturing wastes that are hazardous under control in 1982, it is estimated that the generator limit would have to be set at 1,500 metric tons per year (125 metric tons per month). Control efforts could be further expanded to industries in SIC Codes 25 (Furniture and Fixtures), 30 (Rubber and Miscellaneous Plastic Products), 37 (Transportation Equipment), and

39 (Miscellaneous Manufacturing Industries), as shown in Table 8-3. Wastes from SIC Code 28 would still predominate, contributing about 45 percent of the total. EPA Region V would contain about 29 percent of the wastes, while Regions II, III, IV, and VI would each contain between 10 and 16 percent. About 4,300 establishments could be regulated nationwide.

In order to bring 80 percent of the manufacturing wastes that are hazardous under control in 1983, it is estimated that the generator limit would have to be set at 410 metric tons per year (34 metric tons per month). This control effort could now expand to cover portions of the hazardous wastes generated by establishments in all SIC Codes except 23 (Apparel and Other Textile Products), 24 (Lumber and Wood Products), and 27 (Printing and Publishing), as shown in Table 8-4. Again, SIC Code 28 would predominate, though its share would be reduced to about 41 percent. Distribution among the EPA Regions would remain essentially the same as in 1982, though an additional 8.5 million metric tons would be controlled. Approximately 15,500 establishments could be regulated nationwide.

In the fifth and final year of phasing, all hazardous waste generators would be regulated except those producing 100 kilograms or less per month. Table I-1 presents the quantities of hazardous wastes from manufacturing industries that would be phased into the program in 1984, as well as the distribution of the regulated establishments. During this final year, industries in virtually every manufacturing SIC Code and each EPA Region would be involved in regulatory actions. Approximately 232,000 manufacturing establishments would be regulated.

The net effect of this alternative is that a total of about 74 million metric tons of hazardous industrial wastes could be excluded from regulation during the first four years following implementation of the Subtitle C regulations. These wastes would represent about 50 percent of the total hazardous industrial wastes that could be regulated under the baseline regulations during this period.

8.2.1.2 Changes to Existing Generation, Transport, Storage, Treatment, and Disposal Practices and Procedures. Since this alternative only reduces the number of generators who would be subject to the generator regulations during the first four years following their implementation, there would be few changes in the impacts previously discussed. Those changes that do occur would be limited to the first five years following implementation of the regulations. Longer-term impacts would not change.

Generators who continue to produce a quantity of hazardous waste exceeding the generator limit in all years would not be affected by this alternative. Generators who produce a quantity of hazardous waste that exceeds the generator limit of the baseline regulations, but that does not exceed the generator limit of this alternative, would be excluded from the generator regulations under this alternative. These excluded generators would not have to comply with the manifesting, reporting, recordkeeping, or containerization requirements discussed in Section 7.1.2.1. However, as in the case of the baseline regulations, these generators would still be required to treat/dispose their wastes in a responsible manner.

The major options available to these generators would be disposal in an approved sanitary landfill meeting RCRA Subtitle D requirements (this would not be allowed for these generators under the baseline regulations); treatment/disposal in a permitted off-site facility; or treatment/disposal in a permitted on-site facility (although the generating establishment would not be subject to the generator regulations, treatment/disposal of hazardous wastes on-site would still require permitting of the treatment/disposal facility, unless the facility was an approved landfill meeting Subtitle D criteria). It should be noted that without requirements for manifesting and reporting of these wastes, there would be a greater potential for generators not to comply with these disposal requirements and a lesser potential for determining whether generators complied. It is therefore likely that additional wastes would be treated/disposed in an environmentally unacceptable manner under this alternative.

There would be few changes in transport, storage, treatment, or disposal practices under this alternative. Transporters would still have to comply with all regulations for the transport of manifested wastes; however, there would be fewer such manifested shipments. Transport distances would likely decrease during the first four years since the excluded hazardous wastes could be sent to sanitary landfills which would likely be more abundant and situated closer than off-site permitted facilities. To the extent generators would send their wastes to Subtitle D landfills, there would potentially be a lesser number of treatment/disposal facilities, primarily on-site facilities, that would have to be modified during the first few years following implementation of the regulations. However, to the extent that generators reverted to on-site treatment/disposal when again subject to the generator regulations, their facilities would have to be modified as before. There would be no change in the requirements for facilities that store, treat, or dispose hazardous wastes.

It should be noted that this alternative would allow most generators a longer time to familiarize themselves with the implications of the regulations before being required to comply. They would have a better opportunity to develop plans for compliance and be less subject to making quick decisions. Also, there would be an opportunity to detect any unexpected problems that arise from the implementation of the regulations and to make any necessary modifications in the regulations before all generators were included.

8.2.1.3 Administrative Changes. A major benefit resulting from this alternative would be the gradual expansion of administrative requirements, rather than the abrupt imposition of such requirements. Administrative requirements, primarily paperwork, would be reduced during the first four years following implementation of the regulations. The reduction in these administrative requirements could also encourage additional states to apply for interim or full authorization.

The estimated change in the number of hazardous waste generators who could be required to comply with the generator requirements is shown in Tables 8-1 through 8-4. Based upon the assumptions discussed in Section 7.1.3.6, it is estimated that industrial generators could have to prepare a total of between 660,000 and 1.3 million manifests during the period from 1980 to the start of 1984. This represents about a 50 percent reduction in the number of manifests that would have to be prepared by industrial generators during this period under the baseline regulations. During the first year, the industrial generators could have to prepare 72,000 manifests, an 80 percent reduction.

During the first 6 years*, the aggregated generators, transporters, and owners/operators of hazardous waste management facilities could each have to keep a total of between 3.2 million and 5.2 million manifests in storage; this would represent over a 30 percent decrease in manifests in storage during this period. During the first year, 72,000 manifests could have to be stored, an 80 percent reduction.

During the first four years, it is estimated that industrial generators could have to prepare a total of about 22,000 annual

*Due to the requirement for three-year storage of manifests, the impact of this alternative on the number of manifests in storage would continue for the first six years.

reports; this would represent over a 97 percent decrease in such annual reports. During the first year, about 230 annual reports could have to be prepared, a 99.9 percent reduction.

It is estimated that transporters could have to file a total of between 280 and 400 spill reports during the first 4 years, a reduction of over 45 percent.

As previously discussed, there would be, at most, a small reduction in the number of permitted facilities during the first four years. As a result, there could be a small reduction in the number of most reports prepared by permittees. However, since the additional hazardous wastes that would not be subject to the generator requirements under this alternative and would have to be sent to approved sanitary landfills or to permitted facilities, there would likely be an increase in the number of unmanifested shipments received at permitted facilities. Consequently, permittees could have to prepare an increased number of reports on the receipt of unmanifested wastes. The increase in the length of the reporting interval for such reports under this alternative would serve to reduce the number of additional reports prepared.

8.2.1.4 Air and Water Impacts. To the extent that a total of 74 million metric tons of hazardous industrial wastes excluded from the generator regulations under this alternative were not to be managed in a manner equivalent to that required under the baseline regulations, there would be an increased potential for the release of air and water contaminants from these wastes. These air and water contaminants could be released as described in Sections 7.1.4.1 and 7.1.5, and could result in the types of incidents and impacts discussed in those sections. The release of air and water contaminants could continue for many years following the disposal of such wastes.

8.2.1.5 Public Health Impacts. Changes in public health effects would be directly related to changes in the release of air, water, and soil contaminants. To the extent that increased releases were to occur, there would be an increased potential for the types of public health impacts discussed in Section 7.1.6 to continue to occur. Chronic effects related to long-term, low-level exposure to such contaminants could continue to occur for many years following improper disposal of such wastes.

8.2.2 Secondary Impacts. To the extent that a total of 74 million metric tons of hazardous industrial wastes were not to be managed in a manner equivalent to that required under the baseline regulations, there would be an increased potential for additional soil contamination, as described in Section 7.2.1. Changes in impacts to the biological environment, to water use, to land use, and to special interest points would be directly related to these changes in the release of air, water, and soil contaminants. To the extent that increased releases were to occur, there would be an increased potential for the type of impacts discussed in Section 7.2 to continue to occur. These impacts, especially biological and water use impacts, could continue to occur for many years following improper disposal of such wastes.

There would be less potential for demographic changes during the first four years due to reduced economic demands on generators that would in turn reduce the potential for plant closings or relocation, due to reduced demands for new hazardous waste management facility capacity, and due to the reduced administrative requirements. However, demographic shifts that were just delayed during the first four years could start to occur following the fourth year. The longer transition period would, however, provide an increased opportunity for planning and instituting measures to mitigate the potential impacts of any population shifts. The longer transition period could also reduce the potential for some plant closings by providing generators with an increased opportunity to evaluate alternatives available to them.

With regard to hazardous waste management facility capacity, Section 7.2.4.1 indicates that under the baseline regulations there would potentially be sufficient capacity on a nationwide basis for managing hazardous industrial wastes during the first four years, with one exception. In the case of no growth of existing environmentally adequate capacity and 25 percent off-site shipment, there could be a capacity shortfall by 1981, the second year of regulation. Under this phasing alternative, the potential for such a capacity shortfall could be delayed until 1983, the fourth year of regulation. In addition, there would be a lesser potential for any shortfalls to occur in all the other cases examined in Section 7.2.4.1.

Furthermore, there would be increased time for planning the siting of any new facilities that could be required.

8.3 Potential Change in Impacts Resulting from the Enhanced Public Health and Environment Protection Alternative

This section discusses the potential changes in impacts (relative to those of the baseline regulations) that could occur from the promulgation of the regulations contained in the Enhanced Public Health and Environmental Protection Alternative. To avoid considerable duplication in the presentation, potential impacts that would not be changed under this alternative are not repeated. Only major changes in potential impacts are discussed.

8.3.1 Primary Impacts. The major changes to primary impacts that could occur as a result of implementation of this alternative are discussed in the following sections:

- Hazardous Wastes to be Regulated;
- Changes to Existing Generation, Transportation, Storage, Treatment, and Disposal Practices and Procedures;
- Administrative Changes;
- Air Impacts;
- Water Impacts;
- Public Health Impacts.

8.3.1.1 Hazardous Waste to Be Regulated. Under this alternative, two additional hazardous waste characteristics would be added to the Section 3001 regulations and the existing toxicity criteria would be expanded so as to bring additional potentially hazardous wastes under regulation. It is expected that the expanded toxicity characteristic would result in the regulation of most, if not all, of the potentially hazardous organic wastes that would be excluded from regulation under the baseline regulations, as discussed in Section 7.1.1. Additionally, this alternative would eliminate the 100 kilogram per month generator limit and the previously discussed exclusion for generators engaged solely in farming or retail trade. Thus, all generators of any amount of wastes considered hazardous under the Section 3001 regulations (except household wastes) would have to comply with all Subtitle C regulations.

Based upon the expanded toxicity characteristic and the procedures described in Chapters 6 and 7 and Appendix H, it is estimated that approximately 57 and 65 million metric tons of hazardous manufacturing wastes would be controlled under this alternative in 1980 and 1984, respectively. The expanded criteria could also result in the inclusion of potentially large volumes of non-manufacturing wastes, such as those described in Section 6.1.2. The portion of these wastes which would be identified as hazardous by the characteristics is unknown, but could be quite large.

There could thus be a minimum of 22 and 25 million metric tons of additional wastes declared hazardous and brought under regulatory control with this alternative in 1980 and 1984, respectively, as compared to the baseline regulations. This would represent about a 63 percent increase in the hazardous wastes controlled in both these years. The hazardous wastes controlled under this alternative would represent about 16 and 19 percent, respectively, of the total annual industrial solid waste stream currently estimated to be generated.

8.3.1.2 Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Additional changes to generation, transport, storage, treatment, and disposal practices would be likely to occur under this alternative due to the additional wastes being regulated; due to the enactment of more stringent environmental requirements; due to resultant increases in storage, treatment, and disposal costs; and due to the imposition of additional procedural and operational requirements.

Generation. Under this alternative, many additional generators would be required to comply with the generator regulations. The additional generators to be regulated include those previously excluded due to the generator limit of 100 kilograms per month, farmers and retailers who only generate hazardous wastes other than waste automotive oil, generators who only produce wastes that now meet the expanded toxicity characteristic or the new infectious or radioactive characteristics, and generators who only produce 'special wastes'. Section 8.3.1.3 presents estimates of the number of additional generators to be regulated. These generators would be required to change their existing practices and procedures (as indicated in Section 7.1.4.1) with regard to manifesting, reporting, recordkeeping, containerization, and labeling. Furthermore, these generators and those generators previously regulated would both be subject to shorter reporting intervals, as indicated in Table 4-2.

Due to further increases in costs to hazardous waste generators and costs associated with hazardous waste transport, storage, treatment, and disposal under this alternative, all regulated generators would potentially have an increased incentive to further modify their processes so as to reduce and/or change the types and amounts of hazardous wastes generated and to enable the increased recycling of hazardous wastes as process feedstocks.

Transport. Due to the additional wastes subject to the generator regulations, additional transporters would likely have to comply with the transporter regulations discussed in Section 7.1.2.2. As a result there would likely be fewer instances of midnight dumping and spills from the transport of these additional wastes, as compared to existing practices. However, any increases in the average distance over which hazardous wastes are transported under this alternative could lead to an increase in vehicular accidents. This would offset some of the potential for a reduction in spills.

The average distance over which hazardous wastes are transported would be likely to increase due to several factors. The more stringent treatment and disposal requirements under this alternative would likely further decrease both the amount of existing on-site and off-site treatment/disposal capacity that could be permitted and the number of sites acceptable for construction of new facilities. Any such decreases in available facilities and sites would potentially lead to increased transport distances. Reductions in permittable on-site treatment/disposal capacity could further result in additional wastes being sent off-site for treatment/disposal. Increases in treatment/disposal costs could also further increase the distance over which wastes could be economically transported for resource recovery purposes. However, increased on-site resource conservation and recovery, as described above, could tend to reduce the quantity of wastes sent off-site.

The elimination of the use of a delivery document in lieu of a manifest would further affect existing transportation practices. The use of specific delivery documents is now required under Interstate Commerce Commission (ICC) regulations for transporters engaged in interstate commerce and under DOT regulations for the interstate transport of hazardous materials; as previously indicated, some states have also applied the DOT regulations to intrastate shipments of hazardous materials. The requirement under this alternative that all hazardous waste transporters use manifests, not delivery documents, could result in those transporters now being required to use delivery documents to also carry a manifest.

Storage. Due to the additional generators and wastes regulated under this alternative, additional storage facilities would likely have to comply with the storage regulations discussed in Section 7.1.2.3. Some of these existing storage facilities would be required to be modified or to close. Existing practices at most of these storage facilities would also have to be changed as previously indicated. In addition, all regulated storage facilities would have to comply with the additional requirements contained in Table 4-2. As indicated in Section 7.1.2.3, data are not available to estimate the number of facilities that would be affected, nor the quantities of wastes that would be affected.

Treatment/Disposal. Due to the additional generators and wastes regulated under this alternative, additional treatment/ disposal facilities would have to comply with the treatment/disposal regulations discussed in Section 7.1.2.4. Types of facilities likely to come under regulation under this alternative include those facilities used exclusively for 'special wastes' and those facilities used solely by farmers. Some of these facilities would be closed because they could not comply with the regulations or could not be economically modified. Some previously regulated facilities that would be permitted under the baseline regulations could be closed under this alternative or could require additional modifications because of the more stringent requirements. To the extent that existing on-site facilities were closed, increased quantities of hazardous wastes could be sent off-site; however, increased on-site resource conservation and recovery applications could off-set such a change.

Existing practices would have to be changed at most of the additional facilities to be regulated under this alternative, as indicated in Section 7.1.2.4. In addition, these additional facilities as well as all previously regulated treatment/disposal facilities would now have to comply with the more stringent requirements contained in Table 4-2. Due to these more stringent requirements and due to the costs associated with them, there would also be a potential for increases in the treatment of wastes for such purposes as volume reduction, energy recovery, and resource recovery. The regulation that the permitting authority could require potentially recoverable wastes to be land disposed in a segregated manner could further increase resource recovery from such wastes.

8.3.1.3 Administrative Changes. Several changes in the administration of the hazardous waste management program would result from promulgation of the regulations within this alternative. These regulations would affect:

- State administration of the program;
- Overlapping Federal and state programs;
- Number of generators required to comply with the regulations;
- Number of transporters required to comply with the regulations;
- Number of storers, treaters, and disposers required to obtain permits;
- Paperwork requirements.

State Administration of the Program. It is likely that fewer states would apply for authorization under this alternative because expansion of both the quantity of hazardous wastes and the number of generators, transporters, storers, treaters, and disposers being regulated, plus the increases in reporting frequencies, would lead to increased administrative and manpower requirements for authorized states.

Overlapping Federal and State Programs. Since Subtitle C prohibits any state from enacting less stringent regulations than those in the Federal program, the potential for overlapping Federal and state programs would be reduced under this alternative. The more stringent standards and increased amount of hazardous waste controlled under this alternative would reduce the potential benefits to, and thus the likelihood of, a state enacting a more stringent, independent, hazardous waste program. It is not possible at this time to estimate the number of states, if any, that would wish to have their own independent programs in addition to the Federal program under this alternative.

Number of Generators Required to Comply with the Regulations. As indicated in Section 8.3.1.2, there would be an increase in the number of generators required to comply with the regulations. Under the baseline regulations, approximately 270,000 to 300,000 generators are identified as potentially having to comply with the regulations. The elimination of the generator limit could result in up to an additional 81,000 manufacturing generators being required to comply (see Section 7.1.3.3). The elimination of the generator limit and the transfer of liability contract could result in up to an additional 217,000 automotive service stations being required to comply. The elimination of the exclusion for farmers and retailers, coupled with the elimination of the generator limit and the transfer of liability contract, could result in up to 1.5 million farmers (Trask, 1977) and up to 42,000 dry cleaning facilities (Battelle Columbus Laboratories, 1978) being required to comply. An indeterminable number of other generators (e.g., 'special waste generators' and other retailers) could also be required to comply due to the expansion in the wastes identified as hazardous as well as to the elimination of the other provisions previously discussed. Thus, on the order of 2.2 million generators within these identified categories could be required to comply with the regulations under this alternative. This would represent about a 700 percent increase in the number of generators being regulated.

Number of Transporters Required to Comply with the Regulations. The increased amounts of regulated hazardous wastes that would potentially be transported off-site would likely result in an indeterminable increase in the number of transporters carrying hazardous wastes.

Number of Storers, Treaters, and Disposers Required to Obtain Permits. Since there are no permit exclusions under the baseline regulations for storage, treatment, or disposal facilities that handle only small quantities of hazardous wastes, all facilities storing, treating, or disposing hazardous wastes would be required to obtain a permit under the baseline regulations with the exception of those generators who store wastes for less than 90 days prior to off-site transport. With one exception the only additional permittees under this alternative would be those facilities that handle wastes that would not be classified as hazardous under the baseline regulations, but that would be classified as hazardous under this alternative. The exception is that the additional facilities that could be needed to satisfy the potential capacity shortfall under this alternative (see Section 8.3.2.4) would also require permits if they were to be constructed. Based upon Section 8.3.2.4, approximately 120 additional facilities could require permits by 1984. However, to the extent that additional capacity would be added to existing facilities there would be a lesser number of such additional permittees.

Paperwork Requirements. Based upon section 8.3.2.4, the industrial generators could have to prepare between 580,000 and 1.1 million manifests annually by 1984. The aggregated generators, transporters, and hazardous waste management facility owner/operators could each have to keep between 1.7 million and 3.4 million manifests in storage on an annual basis. This would represent over a 60 percent increase in both requirements as compared to the baseline regulations. This increase would even be greater for any transporters who would now have to keep both a delivery document and a manifest in storage. In addition, transporters would have to file a total of between 220 and 440 spill reports annually--approximately a 60 percent increase.

The additional 2.2 million identified generators would have to prepare about 8.8 million quarterly reports on an annual basis; this would be over a 2,800 percent increase in such annual reporting. As indicated in Section 7.1.3.6, most potential permittees would be on-site facilities and would not prepare additional quarterly reports based on the manifests. Hazardous waste management service industry facilities and Federal installations could, however, prepare about 1400 such reports--a 300 percent increase. The permittees identified in Section 7.1.3.5 could prepare up to 117,000 monitoring reports annually; this would not represent any change. Thus, there could be upwards of 8.9 million quarterly reports prepared annually by generator, storers, treaters, and disposers--over a 2,100 percent increase.

The identified generators and permittees would have to file over 2.2 million notifications under Section 3010--about a 700 percent increase. Furthermore, since potential permittees would have to renew permits every 5 years rather than being issued one permit good for the projected life of the facility as under the baseline regulations, there could be up to a six-fold increase (in the case of a 30-year facility site life) in the paperwork associated with obtaining permits. These potential permittees would also have to prepare approximately 29,000 Supplemental Environmental Analyses as part of the initial permit review procedure; these Supplemental Environmental Analyses would not be required under the baseline regulations.

8.3.1.4 Air Impacts.

Air Quality. The regulations under this alternative would have the potential to cause further changes, primarily reductions, in air emissions resulting from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations.

Generation. As previously discussed, the baseline regulations would not have a direct effect on potential air emissions resulting from activities and processes generating hazardous wastes. However, to the extent that the requirements under this alternative would cause further changes in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be a greater potential for generators to make process modifications designed to further increase hazardous waste recycling and to reduce the quantity and/or types of hazardous wastes generated; any such process modifications would likely lead to changes in air emissions released by processes generating hazardous wastes. Furthermore, to the extent that additional generators would be brought under control of the program through the expanded definition of hazardous wastes and the elimination of exclusions, the potential for such process modifications and resultant changes in air emissions would be increased.

Transport. As indicated in Section 7.1.4.1, there are three major ways air contaminants are released by the transport of hazardous wastes:

- Through fugitive emissions resulting from improperly covered, sealed, or containerized wastes;
- Through emissions resulting from spills or other accidental releases of hazardous wastes;
- Through emissions resulting from the operation of the transport vehicle.

As discussed below, this alternative would affect, to varying degrees, the potential for the release of air emissions from each of these sources.

To the extent that the additional 25 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) brought under the regulations annually by 1984 would otherwise have been improperly covered, sealed, containerized, or segregated during any transport, the potential for the release of fugitive emissions by such transport and from any resultant spills or explosions would be reduced as described in Section 7.1.4.1. The following example illustrates an incident that occurred from the transport of a hazardous waste that would not likely be regulated under the baseline regulations but which would likely be regulated under this alternative:

- In southern Louisiana, industrial wastes containing hexachlorobenzene (HCB), a relatively volatile material, were transported over a period of time to municipal landfills in uncovered trucks. High levels of HCB have since been reported in the blood plasma of individuals along the route of transport. In a sampling of 29 households along the truck route, the average plasma level of HCB was 3.6 ppb, with a high of 23 ppb. The average plasma level of HCB in a control group was 0.5 ppb with a high of 1.8 ppb (Farmer et al., 1976).

Both the total quantity of regulated hazardous wastes being transported and the average distance over which such wastes are transported could increase under this alternative, as previously indicated. Additional transport would result in increased vehicular emissions and in an increased potential for vehicular accidents which could further release air emissions. However, transport of hazardous wastes in accordance with the regulations discussed above would reduce the potential for spills and explosions from improper transport and from resultant vehicular accidents. This would off-set some of the potential for increased vehicular accidents to result from increased transport distances. The changes in both the vehicular emissions and emissions resulting from accidents would be dependent upon such factors as the increase in travel distances, the change in portion of hazardous wastes transported off-site, and the increase in the amount of regulated wastes being transported.

Using the methodology and assumptions described in Section 7.1.4.1, the potential change in vehicular air emissions from the transport of the hazardous industrial waste regulated under this alternative has been estimated for four possible transport distances for both 13 and 25 percent off-site shipment of hazardous wastes in 1984*. Table 8-5 shows the change in vehicular emissions relative to those of the baseline regulations (as presented in Table 7-8). For example, for a 100-mile round-trip distance with 13 percent

*In this estimate, it is assumed that under the baseline regulations there would be 15 percent off-site shipment for those hazardous wastes that would not be regulated under the baseline regulations, but which would be regulated under this alternative.

TABLE 8-5

ESTIMATED CHANGE IN VEHICULAR EMISSIONS IN 1984 FROM TRANSPORT OF ADDITIONAL HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in emissions (metric tons)				
		Carbon monoxide	Hydrocarbons	Nitrogen oxides	Particulates	Sulfur oxides
13 percent	100	-100	-15	-70	-5	-10
	200	550	90	400	25	50
	500	2,500	400	1,800	110	240
	1,000	5,700	910	4,200	260	560
25 percent	100	480	80	350	20	50
	200	1,700	280	1,300	80	170
	500	4,900	100	3,600	220	480
	1,000	11,600	1,900	8,500	530	1,100

off-site treatment/disposal, the decrease in each air emission under this alternative could be equal to about 60 percent of that which could occur under the baseline regulations. For a 1,000-mile round-trip distance with 25 percent off-site treatment/disposal, the increase in each air emission under this alternative could be equal to about 60 percent of that which could occur under the baseline regulations. In this latter case, the additional increase in each air emission would be less 0.04 percent of the total U.S. emissions of that air pollutant and less than 2 percent of the total U.S. area emissions of that pollutant from heavy-duty, diesel-powered vehicles.

Based upon the methodology and assumptions described in Section 7.1.4.1, there could be on the order of 220 to 440 transportation-related hazardous wastes spills annually by 1984. As previously discussed, it is not possible to estimate the number of spills that would have occurred if the additional 25 million metric tons of hazardous wastes were not regulated under this alternative.

Storage, Treatment, and Disposal. As discussed in Section 7.1.4.1, there are several major ways that air contaminants can be released by current hazardous waste storage, treatment, or disposal practices:

- Through fugitive emissions resulting from improper storage of hazardous wastes;
- Through fugitive emissions from ground-based treatment/disposal activities such as landfills, landfarms, and surface impoundments;

- Through emissions occurring as the result of storage becoming the ultimate form of disposal of hazardous wastes;
- Through emissions generated by spills, fires, explosions, and other accidents;
- Through the combustion of hazardous wastes by incineration or open burning;
- Through fugitive emissions from other treatment activities;
- Through fugitive emissions from facility construction or modification.

This alternative would affect the potential for the release of air emissions from each of these sources as discussed below.

The additional 25 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) estimated to be brought under control of the regulations annually by 1984 would now have to be stored, treated, or disposed in accordance with the Section 3004 regulations. Since, as previously discussed, most of these wastes would otherwise have been stored, treated, or disposed by methods that are not likely to be enviromentally acceptable under the Section 3004 regulations, the overall potential for the release of hazardous air emissions from the management of such additional wastes would be reduced as described in Section 7.1.4.1.

It should be noted, however, that there would likely be some shift in the types of methods used to store, treat, or dispose these additional wastes under this alternative compared to the unregulated methods that would have been used under the baseline regulations. Such shifts would change both the types and quantities of air emissions generated from the management of specific wastes. For example, a shift from landfilling to incineration of a particular waste would result in the increased release of combustion products and the reduced release of particulate matter and/or volatile gases. Such shifts could, to an indeterminable extent, either enhance or reduce the potential for reductions in specific air emissions under this alternative. Furthermore, the construction of new facilities could lead to increased releases of air emissions in the vicinity of the facility and along any transport routes. Closure of existing facilities could lead to reduced releases of air emissions in the vicinity of the facility and along transport routes. The net result could be both a localized and/or nationwide reduction in the releases of many air contaminants from hazardous waste management and a localized and/or nationwide increase in the total releases of other air contaminants. Thus while there would most likely be improvements in air quality due to this alternative, there could also be some localized degradation of air quality. All releases of air contaminants and any localized degradation of air quality would, however, have to be in compliance with all applicable requirements (e.g., Clean Air Act, OSHA standards, state standards, and Subtitle C standards).

The following two examples illustrate incidents that occurred from the disposal of hazardous wastes that would not likely be regulated under the baseline regulations but which would likely be regulated under this alternative:

- The hexachlorobenzene wastes, previously discussed under transportation, were disposed in landfill items in southern Louisiana; some of this relatively volatile waste was covered following disposal, some was not. Soil and plant samples taken near the landfill area showed a decreasing HCB content as distance from the landfill increased. The HCB levels in the plasma of landfill workers was reported to range from 2 to 345 ppb; the average level in a control was 0.5 ppb with a high of 1.8 ppb.

- Vinyl chloride monomer (VCM) is retained in sludge wastes produced during polyvinyl chloride (PVC) processing. Following disposal, the gaseous VCM escapes from the sludge if not removed before disposal. A study by Markle et al. (1976) indicated background air concentrations of about 0.1 to 0.3 ppm VCM exist at landfills where PVC sludge has been disposed for several years. Peak concentrations on the order of 1.0 ppm VCM were observed at normal breathing heights as long as 24 hours after the PVC sludge deposits were covered. Other air samples collected in the vicinity of a New Jersey landfill indicated that vinyl chloride was continuously emitted from the landfill; vinyl chloride levels as high as 0.4 ppm were found in a residential area one mile from the landfill (Office of Solid Waste, Hazardous Waste Management Division, 1978b.)

Additional requirements imposed by this alternative would further reduce the potential for the release of air contaminants from the management of both the additional 25 million metric tons of hazardous wastes controlled under this alternative and the 40 million metric tons also controlled under the baseline regulations. The major impact would result from changing the application of the Theshold Limit Values (TLV) from an air human health and environmental standard to a mandatory standard with which facilities must always be in compliance, and the imposition of the TLV's as a maximum concentration not to be exceeded at any time rather than as a time-weighted average not to be exceeded over an 8-hour day and 40-hour week. To the extent that non-point source emissions, such as those from landfills, landfarms, surface impoundments, and storage areas (see section 7.1.4.1 for specific examples), would exceed the TLV's under the baseline regulations there would be further reductions in the release of air contaminants under this alternative.

The reduction in the maximum vapor pressure (from 78 mm mercury at 25 C to 53 mm mercury at 25 C) of wastes that may be placed in storage tanks vented directly to the atmosphere or treated/disposed in landfills, landfarms, surface impoundments, or basins would further reduce the potential for the release of emissions from the management of these volatile wastes, as described in Section 7.1.4.1. Examples of wastes constituents which have a vapor pressure between 53 and 78 mm mercury at 25 C and which could be identified as hazardous under the expanded Section 3001 lists and characteristics include boron tribromide, 1,2-dichloropropane, methacrylonitrile, and thiophene.

The requirement that owners/operators of inactive storage, treatment, or disposal sites would have to comply with the Section 3004 regulations would reduce the potential for releases of air emissions from wastes remaining in such inactive sites.

To the extent that additional storage, treatment, or disposal facilities would have to be modified or would have to be constructed under this alternative (see Section 8.3.2.4), there would be an increase in fugitive dust and vehicular emissions from such construction activities. These emissions would be extremely site dependent as previously indicated.

Climate. Localized impacts to temperatures, humidities, and low-level wind patterns could occur in those areas in which additional facilities were to be constructed and operated. Any such effects would be expected to be extremely localized.

8.3.1.5 Water Quality Impacts. The regulations under this alternative would have the potential to further decrease adverse water quality impacts resulting from generation, storage, transport, treatment, and disposal of hazardous wastes as compared to the baseline regulations.

Many of the potential changes to groundwater and surface water impacts would occur in much the same manner as the potential changes discussed under air quality. To avoid redundant discussions, such changes are briefly summarized below rather than discussed in detail. Following this summary, additional major changes are described.

Any process modifications designed to further reduce the quantity and/or types of hazardous wastes generated or to increase recycling of such wastes would likely lead to changes in water effluents produced by such processes, thus changing the potential for groundwater and surface water contamination by such effluents. To the extent that additional generators were to be brought under the control of the program through the expanded definition of hazardous wastes and the elimination of generator exclusions, the potential for such process modifications would be increased.

Increases in the quantity of hazardous wastes being transported subject to the Subtitle C regulations would reduce the potential for midnight dumping and spills and for resultant impacts to groundwater and surface water. However, increases in the average distance over which wastes are transported would increase the potential for vehicular accidents and could off-set some of the potential for a reduction in spills. Increased transport distances would also result in increased vehicular emissions and in an increased potential for oil, grease, and the hydrocarbons and heavy metals contained in vehicular exhausts to be carried into waterways by run-off.

The major beneficial impacts to groundwater quality would result from the elimination of the 'special waste' standards for facilities dealing with large volume wastes (e.g., phosphate slimes); from the added requirement that inactive facilities must comply with the Section 3001 regulations; from the lower permeability required for soil liners for landfills and surface impoundments; and from the control of at least an additional 25 million metric tons of potentially hazardous wastes annually by 1984.

Under the baseline regulations there is a requirement that there be no discharge from a hazardous waste storage, treatment, or disposal facility to the groundwater, unless it can be demonstrated that such discharge does not endanger Underground Drinking Water Sources anywhere outside the facility's property. (Endangerment means degradation such that the water exceeds a National Interim Drinking Water Standard, or that it becomes necessary to treat the water more than would otherwise have been necessary for any present or future use.) This alternative would have the potential for further reducing discharges of hazardous wastes to groundwater (and thus degradation of groundwater) over and above those reductions which would occur under the baseline regulations. This would result both from further reductions in discharges from permitted facilities and from an increase in the amount of wastes subject to regulation. Section 7.1.5 describes the potential for reducing groundwater and surface water impacts by control of these additional wastes.

It should be noted, however, that there could be shifts in the type of methods used to treat/dispose the additional wastes regulated under this alternative compared to the unregulated methods used under the baseline regulations. As previously discussed, such shifts could result in localized changes in the release of specific water pollutants under this alternative compared to the proposed regulations.

A number of incidents cited in Appendix J involve wastes which might not be controlled under the baseline regulations, but which would be controlled under this alternative. For instance, the incident of groundwater contamination by arsenic, discussed in Section 7.1.5, would escape control under the baseline regulations due to the small quantities of waste involved (less than 100 kilograms per month) and due to the fact that the waste was generated by farmers. This alternative would eliminate both of those exclusions and would require such wastes to be manifested and sent to a permitted disposal facility.

8.3.1.6 Public Health Impacts. Under this alternative, the potential for providing public health benefits would be increased relative to that of the baseline regulations. Section 7.1.6 discusses public health under the baseline regulations.

In addition to the 40 million metric tons of potentially hazardous manufacturing waste which would be controlled under the proposed regulations, another 25 million metric tons would be brought under control annually by 1984. Most of this increase would be attributable to the additional toxic wastes that would now be considered hazardous under the Section 3001 regulations. Part of the increase would also be due to the inclusion of additional infectious wastes and radioactive wastes. Based upon current practices, a large portion of these wastes would have been transported, stored, treated, or disposal in a manner that would not be acceptable under this alternative. Due to the inclusion of these wastes, there would be less potential for the release of air, water, and soil contaminants and for fires, explosions, spills, and other accidents. As a result, there would be less of a potential for the occurrence of associated public health incidents. Furthermore, the more stringent standards for hazardous waste management under this alternative would reduce the potential for release of contaminants and for the occurrence of associated health problems from the management of those wastes already controlled under the baseline regulations (see Sections 8.3.1.4, 8.3.1.5, and 8.3.2.1).

Although the characteristics and lists under the baseline regulations identify many hazardous wastes, a number of other potentially hazardous wastes would not be regulated. In particular, many potentially toxic wastes which are suspected to be carcinogenic, mutagenic, or teratogenic substances are not specifically listed and could be excluded from regulation.

The following examples illustrate health incidents that occurred from the management of hazardous wastes that would not likely be regulated under the baseline regulations, but which would likely be regulated under this alternative:

- In southern Louisiana, industrial wastes containing hexachlorobenzene (HCB) were transported in uncovered trucks and left uncovered at landfills. In a sampling of residents from 29 households situated along the transport route, the average plasma level of HCB was 3.6 ppb, with a high of 23 ppb. The range for the landfill workers exposed to HCB was 2 to 345 ppb. In comparison, the average plasma HCB level in a control group was 0.5 ppb, with a high of 1.8 ppb (Farmer et al., 1976). HCB is considered to be a moderately toxic substance. In cases where persons were exposed to HCB through oral ingestion, over long periods, the health effects observed included cases of permanent focal alopecia, corneal opacity, atrophic hands, and hypertrichosis with dermal lesians. Recovery usually followed termination of exposure, but relapses were known to occur (Gosselin et al., 1977).

- As indicated in Section 8.3.1.4, vinyl chloride monomer (VCM) is retained in sludges produced during polyvinyl chloride (PVC) processing. Landfilling of such sludges has resulted in release of the VCM. In 1974 the deaths of four workers in the polyvinyl chloride processing industry were believed to be attributable to VCM exposure. Since that time, angiosarcoma of the liver, a rare and fatal tumor, has been identified in at least 15 workers in U.S. PVC facilities. In addition, other forms of cancer, certain nonmalignant liver diseases, and acroosteolysis, a unique occupational disease, have also been found in such workers (Office of Solid Waste, Hazardous Waste Management Division, 1978b).

- In 1972 in Perham, Minnesota, 11 out of 13 persons using a well that had been dug on a construction site exhibited symptoms of arsenic poisoning. Five of the employees became ill with gastrointestinal symptoms and others exhibited symptoms of nausea, vomiting, abdominal pain, and diarrhea. Two persons required hospitalization and treatment, including one victim who lost the use of his legs for about six months due to severe neuropathy. After analysis, it was discovered that the affected well contained arsenic concentrations of up to 21 ppm. The drinking water standard for arsenic is 0.05 ppm. Human deaths have been reported in South Africa due to water containing 12 ppm arsenic. The source of the contamination was traced back to the mid-1930's when about 50 pounds of excess grasshopper bait containing arsenic trioxide was buried by farmers in the area (see Section 8.3.1.5) (State of Minnesota, 1977).

Due to the small amount of wastes involved in this latter incident and the fact that the wastes were generated by farmers, this waste would not be controlled under the baseline regulations. It should be noted that nature and persistance of arsenic is a health hazard in even small quantities. Other wastes that could constitute a public health hazard in small quantities would also be brought under regulation by this alternative.

8.3.2 Secondary Impacts. The major changes in secondary impacts (relative to the baseline regulations) that could occur as a result of implementation of this alternative are discussed in the following sections. These changes would result primarily from the control annually by 1984 of an additional 25 million metric tons of potentially hazardous industrial wastes plus other hazardous wastes; the enactment of more stringent environmental requirements with regard to storage, treatment, and disposal of hazardous wastes; and further increases in hazardous waste storage, treatment, and disposal costs.

8.3.2.1 Physiography and Soil Impacts. The major change in impacts to physiography and soils under this alternative would result from bringing an additional 25 million metric tons of potentially hazardous manufacturing wastes under regulation annually by 1984; from the elimination of exclusions for other hazardous waste generators (e.g., farmers and retailers); and from the enactment of more stringent regulations for the storage, treatment, and disposal of 'special wastes' (e.g., utility wastes).

All such wastes would have to be stored, treated, and disposed in accordance with the Section 3004 regulations. To the extent that these wastes would otherwise have been stored, treated, or disposed by methods which would not be acceptable under the Section 3004 regulations, the potential for soil contamination would be reduced as described in Section 7.2.1.

Disposal of the large volumes of 'special wastes' that could be brought under control by this alternative could create a significant demand for low permeability clays. Such a demand could be especially significant in areas having a high density of such hazardous waste generators, such as west-central Florida which produces over 200 million metric tons of phosphate rock overburden and gypsum slimes from phosphoric acid production (see Section 6.1.2). Local clay supplies in such areas may not be sufficient to meet the demand. Even where sufficient clays are available, their extraction would result in severe alternation of local topography.

Increases in the quantity of hazardous wastes being transported subject to the Subtitle C regulations would reduce the potential for midnight dumping and spills and for resultant impacts to soils. However, increases in the average distance over which wastes are transported would increase the potential for vehicular accidents and could off-set some of the potential for a reduction in spills. Increased transport would also result in increased vehicular emissions and in an increased potential for oil, grease, and the hydrocarbons and heavy metals contained in such emissions to be carried onto soils by run-off.

An example of a soil contamination incident associated with improper transportation and disposal of a waste that would likely be regulated under this alternative, but not under the baseline regulations, occurred in Louisiana in 1972. This incident, which resulted in contamination of soil, area residents, vegetation, and beef cattle in a 200 square-mile area, is discussed in Section 8.3.1.4.

To the extent that additional storage, treatment, or disposal facilities would have to be constructed to handle the potential increase in the shortfall of capacity (See Section 8.3.2.4), there would be a potential for further impacts to soils and physiography. Additional land and soils could also be disturbed by conjunctive developments such as construction of roads, power lines, pipelines, and housing. However, all these additional land requirements would be offset to the extent that land would also be required for the storage, treatment, and disposal of these additional wastes under current practices. Potential impacts to soils and physiography from construction would be essentially the same as those described in Section 7.2.1.

8.3.2.2. Biological Impacts. Existing vegetation would be destroyed on the additional lands disturbed by construction and operation of hazardous waste management facilities and conjunctive developments. Present plant succession would cease on such lands. Following rehabilitation of the site after closure of the facility, the plant community on the disturbed areas would likely differ in species composition and diversity.

These construction and operational activities could also result in the direct destruction of animal habitat. Some of this destruction would be permanent; other areas would be impacted only temporarily and would, over a period of time, recover in value as a habitat. However, the habitat and, consequently, the wildlife species composition following such recovery might be different from that which existed prior to disturbance of the area. In addition, the direct destruction of some wildlife could also result from activities which excavate, bury, overturn, clear, or grade large areas of previously undisturbed terrestrial habitat. While direct mortality would be rare to big game and other animals which have the ability to flee, many small animals with limited ranges may be killed by construction and operation activities. Operations which cause additional dewatering of aquatic habitats would result in the death of fishes, aquatic invertebrates, and amphibians in certain life stages. Furthermore, any increase in transport distances would increase the potential for road kills and, possibly, spills that could disrupt aquatic ecosystems.

These potential adverse impacts from land disturbance would, however, be offset by several potentially beneficial effects of the regulations under this alternative. An additional 25 million metric tons per year of potentially hazardous industrial wastes (plus other hazardous wastes) would be brought under regulatory control annually by 1984. Based on current practices, a large portion of these wastes would have been stored, transported, treated, dumped, or disposed in a manner that would not be environmentally acceptable under this alternative and would have had the potential to create the types of impacts dicussed in Section 7.2.2. By bringing these additional wastes under control of the program, the potential for such impacts would be greatly reduced. It should be noted, however, that in bringing these wastes under regulation, there could be shifts in the methods used to treat/dispose the wastes as described in Section 8.3.1.4. The potential for beneficial impacts to the biological environment would be modified to the extent of any such shift.

The following example illustrates an incident that occurred from the disposal of a hazardous waste that might not be controlled under the baseline regulations but which would likely be controlled under this alternative:

- Waste oil containing dioxin was sprayed in horse arenas and on an adjacent road in Missouri for dust control. This resulted in the death of six dogs, 12 cats, at least 63 horses, and a large number of birds, rodents, and other animals, there were also 26 abortions and six birth abnormalities among horses from this incident (Office of Solid Waste Management Programs, 1975b).

For both the additional wastes to be regulated under this alternative and for those wastes that would already be regulated under the baseline regulations, the potential for water quality impacts, and subsequent adverse impacts to both aquatic ecosystems and wildlife using contaminated water supplies, would be further reduced by the requirements for the use of less permeable liners for landfills and surface impoundments. The potential for air quality impacts, and subsequent adverse biological impacts, would be further reduced as discussed in Section 8.3.1.4. Furthermore, the potential for soil contaminant, and subsequent adverse impacts to biological productivity, would be further decreased as discussed in Section 8.3.2.1.

The requirement for the preparation of a Supplementary Environmental Analysis (SEA) as part of the permit process would provide an additional means for mitigating or preventing adverse impacts to the biological environment. The SEA would require that the permit applicant analyze the impact of and methods proposed to comply with the following federal statutes and regulations: the Endangered Species Act, the Fish and Wildlife Coordination Act, and the Coastal Zone Management Act.

8.3.2.3 Social Impacts.

Demographic Impacts. Additional industrial plant closings or relocations due to the increased costs under this alternative could lead to additional populations shifts as described in Section 7.2.3.1. In addition, there would be an increased need for construction workers due to the increased facility modification and construction under this alternative; there would be an increase in the number of personnel required for hazardous wastes management activities due to the additional operational requirements and the increase in wastes being regulated; and there would be an increase in the number of personnel required to administer and enforce the regulations due to the increase in both the quantity of hazardous wastes and the number of generators, disposers, and permittees being regulated. Additional population shifts could occur in response to these increased personnel requirements as discussed in Section 7.2.3.1. Any such shifts would be expected to be small on a national scale; however, there could be localized instances of a relatively large influx of workers, particularly for hazardous waste management facilities located near very small towns, or there could be localized instances of a relatively large outflux of workers, especially in a case where a plant being closed constituted the primary source of employment in an area.

Based upon a minimum requirement of 500 workers to handle (store, treat, or dispose) a million metric tons of waste per year, it is estimated that at least 32,500 such workers could be required nationally by 1984; this would represent over a 60 percent increase in this requirement compared to the baseline regulations. Approximately 4,200 to 8,100 of these workers could be required at off-site facilities; about 24,400 to 28,300 of these workers could be required at on-site facilities. This would represent over a 60 percent increase at both types of facilities. To the extent that personnel would still be required to manage these additional wastes even if not regulated, there would be fewer new workers required nationally.

Social Conditions. The increased public health benefits to be derived from this alternative would provide increased social benefits as discussed in Section 7.2.3.2. Reductions in chronic and acute health effects would also reduce the social and economic costs associated with such effects, e.g., increased mortality, birth defects, lowered productivity, lost wages.

The increased potential for population shifts under this alternative would increase the impacts associated with such shifts. As discussed in Section 7.2.3.2, any large, rapid, population influx could cause inflation, strains on the existing infrastructure, social tensions, changes in daily living patterns, and increased physical and mental disorders. Any large, rapid, population outflux could cause problems in maintaining the existing infrastructure, deflation, additional unemployment, social stress, changes in daily living patterns, and increased mental and physical health problems.

Public opposition to the siting and construction of hazardous waste management facilities could be further exacerbated by the increased requirements for such facilities under this alternative. However, this opposition could be mitigated by the more stringent environmental requirements under this alternative and by the requirements for the preparation of a Supplementary Environmental Analysis as part of the permit review process and for permits to be renewed every 5 years rather than not at all.

Increases in the necessary construction of hazardous waste management facilities and in the off-site transport of hazardous wastes could cause several adverse social effects. Aesthetic impacts would occur from the construction of new facilities. Noise levels would increase both in the vicinity of new facilities and along access routes to such facilities. Any increased transport of hazardous wastes would also increase the potential for vehicular accidents. Based upon the methodology and assumptions discussed in Section 7.2.3.2, it is estimated that there could be about 170 additional vehicular accidents annually in 1984 in the case of 13 percent off-site shipment and about 540 additional vehicular accidents annually in the case of 25 percent off-site shipment. This would represent about a 63 percent increase in vehicular accidents in both cases compared to the baseline regulations. The requirement for the preparation of a Supplementary Environmental Analysis as part of the permit process would provide an additional means under this alternative for mitigating the above types of adverse impacts. The Supplementary Environmental Analysis would require that the permit applicant describe such factors as proposed access routes; the promixity of the proposed site to populations centers; and the methods to be used to minimize noise, dust, and odors associated with the construction and operation of the proposed facility.

The requirement that inactive sites be required to comply with the Section 3004 requirements would cause adverse social and economic impacts. People who own property that contains an inactive hazardous waste disposal site could be required to comply with the Section 3004 regulations even if they brought the property after all disposal activities had ceased at the site and were unaware of such former activities. The need to comply with the Subtitle C regulations in such cases would undoubtedly be tested in the courts.

8.3.2.4 Hazardous Waste Management Facility Capacity.

Process Capacity. Based upon the methodology and assumptions described in Section 7.2.4.1, it is estimated that about 8.6 million metric tons of hazardous industrial wastes could be shipped off-site for treatment/disposal in 1980 and that between 8.5 and 16.3 million metric tons could be shipped off-site in 1984. This would represent an increase of approximately 3.3 million metric tons of regulated industrial wastes required to be sent to permitted off-site facilities in 1980 and an increase of between 3.3 and 6.3 million metric tons of regulated industrial wastes required to be sent to permitted off-site facilities in 1984.

Based upon the estimate 6.2 million metric tons of environmentally adequate off-site capacity that could be utilized on a nationwide basis in 1980, there could potentially be a nationwide shortfall of 2.7 million metric tons of off-site capacity for hazardous industrial wastes in 1980.* Without any growth in environmentally

*All estimates of shortfall are based upon a 90 percent utilization rate for the additional capacity required. The indicated shortfall is thus the difference between the quantity of wastes requiring treatment disposal and the utilizable capacity, all divided by 0.9.

adequate off-site capacity between 1977 and 1980, this nationwide shortfall could be 4.2 million metric tons. It is estimated in Section 7.2.4.1 that under the baseline regulations there could be sufficient off-site capacity on a nationwide basis for hazardous industrial wastes. Based upon a utilizable facility capacity of 60,000 metric tons per year, approximately 45 additional permitted off-site facilities could be required for hazardous industrial wastes in 1980 in the former case and approximately 70 additional permitted off-site facilities could be required in the latter case.

Based upon the estimated 7.7 million metric tons of environmentally adequate off-site capacity that could be utilized on a nationwide basis in 1984, in the case of 13 percent off-site shipment there could potentially be a shortfall of 0.9 million metric tons of environmental adequate off-site capacity for hazardous industrial wastes in 1984. Without any growth in environmentally adequate off-site capacity between 1977 and 1984, this shortfall could be 3.2 million metric tons. It is estimated in Section 7.2.4.1 that there could be sufficient off-site capacity on a nationwide basis for the treatment disposal of hazardous industrial wastes under the baseline regulations in both instances. Since less off-site capacity would be required in 1984 than in 1980 in the case of 13 percent off-site shipment, no additional permitted off-site facilities would be required for hazardous industrial wastes in 1984.

In the case of 25 percent off-site shipment, there could potentially be a nationwide shortfall of 9.6 million metric tons of environmentally adequate off-site capacity for hazardous industrial wastes in 1984. Without any growth in environmentally adequate off-site capacity between 1977 and 1984, this shortfall could be 11.9 million metric tons. It is estimated in Section 7.2.4.1 that under the baseline regulations there could be a nationwide shortfall of 2.6 million metric tons in the former case and a nationwide shortfall of 4.9 million metric tons in the latter case. Approximately 160 additional permitted off-site facilities could be required to handle hazardous industrial wastes in 1984 in the former case and approximately 200 additional permitted off-site facilities in the latter case. Based upon the estimated shortfall under the baseline regulations, only 115 of the necessary permitted facilities would be attributable to this alternative in the former case and only 120 would be attributable to this alternative in the latter case.

Data are not available to estimate potential shortfalls in environmentally adequate on-site process capacity. Industrial generators could send 46.7 million metric tons of hazardous wastes to permitted on-site treatment/disposal facilities in 1980 and between 46.8 and 54.6 million metric tons of hazardous wastes to permitted on-site facilities in 1984.* This would represent an increase of

*The remainder of the hazardous waste not sent on-site or off-site would be recycled or sent to resource recovery operations, both on-site and off-site (see Table 5-10).

approximately 18.0 million metric tons of regulated industrial wastes required to be sent to permitted on-site facilities in 1980 and an increase of between 18.0 and 21.0 million metric tons of regulated industrial wastes required to be sent to permitted on-site facilities in 1984. It should noted that more stringent treatment/disposal requirements under this alternative would likely result in a decrease in the existing on-site capacity. Any such decrease would further increase any potential for a shortfall in on-site capacity.

Section 7.2.4.1 discusses other factors that could either lead to shortfalls or that could exacerbate the size of the estimated potential shortfall in both on-site and off-site process capacity, especially on a localized basis. In addition to those factors, the potentially large quantity of 'special wastes' that could be hazardous would significantly exacerbate any shortfall. Also, the more stingent requirement under this alternative could reduce the number of sites at which facilities could be located.

Physical Capacity. Based upon the methodology and assumptions discussed in Section 7.2.4.2, relative to the baseline regulations there could be a further decrease of approximately 1.3 million metric tons in the total hazardous industrial wastes sent off-site during the period from 1980 through 1984, assuming 13 percent shipment off-site in 1984, and there could be a further increase of 6.1 million metric tons in the total hazardous industrial wastes sent off-site during this period, assuming 25 percent shipment off-site in 1984.*

Up to 250 to 500 fewer acres could thus be committed to off-site landfilling of hazardous industrial wastes during this period in the case of 13 percent off-site shipment and up to 1,200 to 2,400 additional acres could be committed to off-site landfilling of hazardous industrial wastes during this period in the case of 25 percent off-site shipment. In the former case, after 1984 there could be 100 to 200 fewer acres required off-site annually compared to total requirements under the baseline regulations. In the latter case, after 1984 there could be 500 to 1,000 additional acres required off-site annually compared to the total requirements under the baseline regulations. In all instances there could be commensurate change in on-site land requirements.

For purposes of comparison, based upon an average, secure, commercial landfill size of 270 acres (U.S. Environmental Protection Agency, Office of Toxic Substances, 1977), these land requirements would be equivalent to siting one to two fewer off-site secure landfills by the end of 1984 in the case of 13 percent off-site shipment. In this case, the equivalent of less than one fewer off-site secure landfill could have to be sited annually after 1984 for hazardous

*In this estimate, it is assumed that under the baseline regulations there would be 15 percent off-site shipment for those hazardous wastes that would not be regulated under the baseline regulations but which would be regulated under this alternative.

industrial wastes. The land requirements would be equivalent to siting five to nine additional off-site secure landfills by the end of 1984 in the case of 25 percent off-site shipment. In this case, the equivalent of two to four additional off-site landfills could have to be sited annually after 1984.

8.3.2.5 Land Use Impacts. More total land, off-site plus on-site, would be required for environmentally adequate hazardous waste management under this alternative than under the baseline regulations. This additional land necessary for environmentally adequate management of hazardous waste would be required both for the construction of the permitted facilities needed for the storage, treatment, and disposal of the additional hazardous wastes regulated under this alternative and for such conjunctive developments as construction of roads, power lines, and pipelines. However, as indicated in Section 8.3.2.4, in the case of 13 percent off-site shipment there would be fewer regulated hazardous industrial wastes sent off-site by 1984 under this alternative than there would be total hazardous wastes sent off-site under the baseline regulations.* Thus, while more total land would be required under this alternative, in the case of 13 percent off-site shipment there could be less off-site land use and more on-site land use for hazardous industrial wastes. In the

*The total hazardous wastes consist of those wastes regulated under the baseline regulations plus the additional wastes that would not be regulated under the baseline regulations but which would be regulated under this alternative.

case of 25 percent off-site shipment, there would be more regulated industrial wastes sent off-site by 1984 under this alternative than there would be total hazardous wastes sent off-site under the baseline regulations. Thus, there could be more off-site land use and less on-site land use for hazardous industrial wastes in this case. Estimates of potential changes in off-site land requirements for landfills (and commensurate changes in on-site land requirements) are presented in Section 8.3.2.4.

In should be noted that while shifts to on-site land use could reduce off-site land requirements in the short term, such shifts could also accelerate the exhaustion of the relatively limited on-site physical capacity and could result in increased pressures for off-site facilities in the long term. However, additional increases in resource conservation and recovery and in treatment practices leading to volume reduction (e.g., incineration) under this alternative would also provide a greater potential for reducing total land requirements, both on-site and off-site, in the long term.

Existing land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Some agricultural, grazing, forest, recreational, and other lands could be removed from their existing uses. Following closure of the hazardous waste management facility and any rehabilitation of the site according to the closure and post-closure care plans, the land would be available for new or, in some cases, previously existing uses. Sites at which hazardous wastes have been disposed would be precluded following post-closure care from certain future uses (such as residential, recreational and grazing uses, and any activities requiring excavation). To the extent that the regulations under this alternative would prevent other lands from being contaminated by improper dumping, treatment, or disposal of the hazardous wastes not regulated under the baseline regulations, there would be off-setting land use benefits. Section 7.2.5 describes the types of land use benefits that could occur.

8.3.2.6 Water Use Impacts. As previously discussed, the potential for the degradation of groundwater and surface water would be further reduced under this alternative. To the extent that degradation of water quality would have resulted in a decreased supply of surface water or groundwater being available to some or all consumers in the water use area, there would be an additional supply of groundwater or surface water potentially available to such consumers and fewer restrictions on the productive use of such surface water and groundwater supplies.

The additional on-site and off-site permitted hazardous waste management facilities that could be required would be additional consumers of the available water supply. This water could be required for such purposes as dust control, soil compaction, biological treatment, wet scrubbers for incinerators, and site rehabilitation. This additional water requirement would be reduced to the extent that water would otherwise have been consumed in the management of the additional wastes now regulated under this alternative.

8.3.2.7 Resource Conservation and Recovery. The major changes in resource conservation and recovery would result from bringing an additional 25 million metric tons of hazardous manufacturing wastes under the Subtitle C regulations annually by 1984 and from further increases in costs to hazardous waste generators and costs associated with hazardous waste transportation, storage, treatment, and disposal due to the more stringent requirements under this alternative. As discussed in Section 7.2.7, these changes would provide increased incentives for generators to modify processes so as to enable increased recycling of hazardous waste as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to change the nature of wastes produced. In addition the requirement that the permitting authority could require that wastes which could be recoverable in the foreseeable future would have to be land disposed in a segregated manner would increase the potential for future resource recovery from such wastes. Chapter 5 presents examples of the potential for increased resource recovery from and recycling of hazardous wastes.

8.3.2.8 Energy Use. Energy use would be impacted under this alternative by changes in facility construction, facility operation, hazardous waste transport, and resource conservation and recovery. The additional facility modification and construction that would be necessary under this alternative would result in increased energy use. The requirement for decreased permeability of landfill and surface impoundment liners and for reduced non-point source air emissions from these facilities would increase the energy use required for construction of such facilities.

There would also be increased energy use associated with required changes in facility operation and closure. Management of the additional 25 million metric tons of hazardous industrial wastes regulated annually by this alternative would require increased energy use as discussed in Section 7.2.8. The additional 20-year period over which post-closure care could be required would increase the energy use associated with such care. Additional energy could also be required for control equipment used to insure that the non-point source air emission standard was not violated.

Previously discussed changes in resource recovery would lead to other changes in energy use. While any increase in resource recovery would likely require the initial input of additional energy, there could be a net savings in energy from recovery operations as discussed in Section 7.2.8.

The changes in energy use from the additional transport of hazardous wastes would depend upon such factors as shifts in the portion of wastes managed on-site and off-site and changes in transport distances. Based upon the methodology and assumptions described in Section 7.2.8, Table 8-6 contains estimates of the magnitude of the

TABLE 8-6

ESTIMATED CHANGE IN FUEL CONSUMPTION IN 1984 FROM TRANSPORT OF ADDITIONAL HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in fuel consumption (million gallons)	Crude oil equivalent * (1,000 barrels)
13 percent	100	-0.5	-10
	200	3	60
	500	11	290
	1,000	26	660
25 percent	100	2	60
	200	8	200
	500	23	580
	1,000	54	1,400

*Assumes 95 percent efficiency in producing diesel fuel from crude oil.

potential change in energy use (compared to that under the baseline regulations) that could occur annually from changes in transport distances and shifts in off-site and on-site treatment disposal. The estimated change in energy use under this alternative ranges from an annual decrease equivalent to approximately 10,000 barrels of crude oil for a 100 mile round-trip distance with 13 percent off-site treatment/disposal to an annual increase equivalent to approximately 1.4 million barrels of crude oil for a 1,000-mile round-trip distance with 25 percent off-site treatment/disposal.

There could also be further reductions in energy production due to the increased costs associated with the management of wastes from such activities and due to the elimination of the special regulations for 'special wastes'; many 'special wastes' are generated by energy production activities. There could also be increased changes in fuels used by facilities, so as to reduce hazardous waste generation. This could result in increased changes in energy supply/demand relationships.

8.3.2.9 Impacts to Special Interest Points. To the extent that unregulated treatment/disposal of the additional wastes brought under control by this alternative would have disturbed, destroyed, or intruded upon special interest points, there would be a commensurate reduction in such adverse effects as discussed in Section 7.2.9. However, the additional lands, especially off-site lands, that would be disturbed by the increased requirements for facility construction and associated conjunctive developments under this alternative would increase the potential for the disturbance and/or destruction of such special interest points as sites of aesthetic, archaeological, historical, paleontogical, or recreational value.

The requirement for the preparation of a Supplementary Environmental Analysis as part of the permit process would provide an additional means for mitigating such adverse impacts. The SEA would require the permit applicant to analyze the impact of and methods proposed to comply within the following Federal statutes and published regulations, if applicable: The Endangered Species Act; The National Historic Preservation Act; The Historic Sites, Buildings, and Antiquities Act; The Fish and Wildlife Coordination Act; and The Coastal Zone Management Act.

8.4 Potential Change in Impacts Resulting from the Lesser Degree of Public Health and Environmental Protection Alternative

This section discusses the potential changes in impacts (relative to those of the baseline regulations) that could occur as a result of promulgation of the regulations contained in the Lesser Degree of Public Health and Environmental Protection Alternative. To avoid considerable duplication in the presentation, potential impacts that would not be changed under this alternative are not repeated. Only major changes in potential impacts are discussed.

8.4.1 Primary Impacts. The major changes to primary impacts that could occur as a result of implementation of this alternative are discussed in the following sections:

- Hazardous Wastes to be Regulated;
- Changes to Generation, Transportation, Storage, Treatment, and Disposal Practices and Procedures;
- Administrative Changes;
- Air Impacts;
- Water Impacts;
- Public Health Impacts.

8.4.1.1 Hazardous Waste to be Regulated. Under this alternative, the toxicity characteristic and wastes whose listing is based solely on toxicity or Administrator's judgment (AD) would be removed from the Section 3001 regulations identifying hazardous wastes, and 'special wastes' (e.g., utility wastes and oil drilling muds and brines) would be specifically excluded from regulation. Additionally, this alternative would increase the generator limit from 100 kilograms per month to 1,000 kilograms per month. EPA staff estimates are that eliminating the toxicity criteria and the wastes whose listing is based upon toxicity would result in the exclusion of about 40 percent of those manufacturing wastes that would be regulated under the baseline regulations. Further, the 'special wastes' and some portion of the other large volume wastes discussed in Section 6.1.2 (e.g., utility fly ash and toxic dredge materials) which may have been identified as hazardous under the baseline regulations, would be excluded, either directly (e.g., fly ash) or through elimination of the toxicity criteria (e.g., dredge materials).

Based upon the procedures described in Chapter 6 and 7 and Appendices H and I, it is estimated that approximately 20 and 24 million metric tons of hazardous manufacturing wastes could be controlled under this alternative in 1980 and 1984, respectively. These estimates include an adjustment for wastes that would not be regulated due to the change in the generator limit. Table 8-7 shows the estimated quantity of hazardous manufacturing wastes and the number of generating establishments that could be excluded from regulation based upon a generator limit of 1,000 kilograms per month (due to the reduction in wastes considered hazardous under this alternative, some of these generators would also be excluded even without the increase in the generator limit). In addition, an unknown portion of the potentially hazardous non-manufacturing wastes discussed in Section 7.1.1 would also be excluded from regulation.

There could thus be a decrease of at least 14 and 16 million metric tons in potentially hazardous wastes brought under regulatory control in 1980 and 1984, respectively, as compared to the baseline regulations. This would represent approximately a 40 percent decrease in regulated hazardous industrial wastes in both years. The hazardous wastes controlled under this alternative would represent about 6 and 7 percent, respectively, of the total annual industrial solid waste stream (hazardous and non-hazardous) currently estimated to be generated.

TABLE 8-7

ESTIMATED QUANTITY OF HAZARDOUS MANUFACTURING WASTES AND NUMBER OF ESTABLISHMENTS EXCLUDED FROM REGULATION AT A GENERATOR LIMIT OF 1,000 KILOGRAMS PER MONTH

EPA Region	Number of manufacturing establishments excluded	Percent of total manufacturing establishments excluded	Hazardous manufacturing wastes excluded (1000 metric tons/year)	Percent of total hazardous manufacturing wastes excluded
I	13,300	57	28	1
II	34,200	65	68	1
III	16,100	57	32	<1
IV	28,300	62	50	<1
V	35,500	52	70	<1
VI	14,800	61	29	<1
VII	8,300	58	17	<1
VIII	4,400	68	10	2
IX	23,900	63	50	2
X	8,000	70	17	2
National total	186,500	60	371	<1

8.4.1.2 Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Fewer changes to generation, transport, storage, treatment, and disposal practices would be likely to occur under this alternative due to the lesser amount of wastes being regulated; due to the enactment of less stringent environmental requirements; due to resultant reductions in storage, treatment, and disposal costs; and due to the imposition of fewer procedural and operational requirements.

Generation. Under this alternative, fewer generators would be required to comply with the generator regulations. Those generators specifically excluded from regulation under this alternative include: those who generate between 100 and 1,000 kilogram per month of any identified hazardous wastes; those who store hazardous wastes on-site for 90 days to 1 year prior to off-site disposal; those who generate only 'special wastes'; and those who generate only wastes identified as toxic under the baseline characteristics and listings. Section 8.4.1.3 presents estimates of the number of generators to be excluded from regulation. These generators would not be required to change their existing practices and procedures (as indicated in Section 7.1.4.1) with regard to manifesting, reporting, recordkeeping, containerization, and labeling. In addition, those generators who would still be regulated under this alternative would be subject to reduced manifesting and reporting requirements, as indicated in Table 4-3.

Furthermore, due to likely reductions under this alternative both in costs to hazardous waste generators and costs associated with hazardous waste transport, storage, treatment, and disposal relative to those of the baseline regulations and in the number of regulated generators, there would be a lesser incentive for generators to modify their processes so as to reduce and/or change the types and amounts of hazardous wastes generated by the process and to enable the increased recycling of hazardous wastes as process feedstocks.

Transport. Due to the lesser quantity of wastes subject to the generator regulations, fewer transporters would likely have to comply with the transporter regulations discussed in Section 7.1.2.2. There would likely be increased instances of midnight dumping and of spills from any transport of those additional wastes excluded from regulation. Elimination of the requirement that generators report on hazardous wastes not received at the designated facility would further increase the potential for midnight dumping. Any decreases in the average distance over which hazardous wastes are transported under this alternative could lead to a decrease in vehicular accidents. This would off-set some of the potential for an increase in spills.

The average distance over which hazardous wastes are transported would be likely to decrease due to several factors. The less stringent treatment and disposal requirements under this alternative would likely increase both, the amount of existing on-site and off-site treatment/disposal capacity that could be permitted and the number of sites acceptable for construction of new facilities. Any such increases in available facilities and sites would potentially lead to reduced transport distances. Furthermore, increases in permittable on-site treatment/disposal capacity could result in fewer wastes being sent off-site for treatment/disposal. Decreases in treatment/disposal costs could also reduce the distance over which wastes could be economically transported for resource recovery purposes. Elimination of the requirement that consolidated wastes not requiring a manifest must be delivered to a permitted facility would likely decrease the average distance such wastes would be transported. However, any reduction in on-site resource conservation and recovery, as described above, could tend to increase the quantity of wastes being sent off-site.

The replacement of the baseline Section 3002 manifest requirements with a new manifest requirement that all shipments (interstate and intrastate) must be accompanied by shipping paper/bill of lading which designates delivery to a permitted storage, treatment, or disposal facility and which meets the requirements of the DOT Hazardous Materials Regulations would further reduce changes to existing transport practices. The use of such delivery documents is now required under Interstate Commerce Commission (ICC) regulations for transporters engaged in interstate commerce and under DOT regulations for the interstate transport of hazardous materials; as previously indicated, some states have also applied the DOT regulations to intrastate shipments of hazardous materials. Thus, except for the requirements that the shipping paper/bill of lading must designate delivery to a permitted facility, those transporters now required to prepare shipping papers/bills of lading would not have to modify their existing practices. However, those transporters who make intrastate shipments or who do not transport hazardous wastes that are also identified as DOT hazardous materials would still have to modify their practices. Similarly, the reduction in required recordkeeping times would not likely affect those transporters currently required to prepare shipping papers/ bills of lading since, as indicated in Appendix E, most such transporters keep such records for at least 3 years due to various existing requirements.

The elimination of the emergency spill requirements for notification and clean up would also not affect transporters carrying interstate and some intrastate shipments of hazardous wastes that are also identified as DOT hazardous materials. Such transporters are currently required to report and clean up such spills. Also, any spill by any transporter that could threaten navigable waters or which are into or upon navigable waters, adjoining shorelines, or contiguous zones, or which may affect applicable natural resources would still have to be reported and cleaned up under Section 311 of the Federal Water Pollution Control Act.

Storage. Due to the lesser number of generators and reduced quantities of wastes regulated under this alternative, it is likely that fewer storage facilities would have to comply with the storage regulations discussed in Section 7.1.2.3. In addition, the increase in the permit exclusion from 90 days to one year for generators who store wastes on-site prior to off-site disposal would further reduce the number of generators subject to the storage regulations.

As a result, fewer storage facilities could be required to be modified or to be closed. Existing storages practices would not have to be changed at facilities excluded from regulation under this alternative. In addition, those storage facilities that would still be regulated under this alternative would be subject to reduced construction, operational, and closure requirements as indicated in Table 4-3 and would have to make fewer changes to existing practices.

Treatment/Disposal. Due to the lesser number of generators and reduced quantities of wastes regulated under this alternative, it is likely that fewer treatment/disposal facilities would have to comply with the treatment/disposal regulations discussed in Section 7.1.2.4. As a result, fewer facilities would be closed because they could not comply with the regulations or could not be economically modified. In addition, regulated facilities would be subject to the less stringent requirements contained in Table 4-3. As a result, fewer regulated facilities would be required to be modified; for those facilities requiring modification, the changes would also likely be less extensive. Regulated facilities would also have to make fewer changes in their existing operation and closure practices.

Due to these less stringent requirements and the reduced costs associated with them, and due to fewer wastes and generators being regulated, there would also be a lesser potential for treatment of wastes for such purposes as volume reduction, energy recovery, and resource recovery. Furthermore, to the extent that fewer existing on-site facilities were closed and fewer wastes and generators were regulated, there would be a potential for fewer wastes to be sent off-site for treatment/disposal. However, reductions in on-site resource conservation and recovery practices, as described above, could tend to off-set any change in wastes being sent off-site.

8.4.1.3 Administrative Changes. Several changes in the administration of the hazardous waste management program would result from promulgation of the regulations under this alternative. These regulations would affect:

- State administration of the program;
- Overlapping Federal and state programs;
- Number of generators required to comply with the regulations;
- Number of transporters required to comply with the regulations;
- Number of storers, treaters, and disposers required to obtain permits;
- Paperwork requirements.

<u>State Administration of the Program.</u> Several factors would increase the potential for states to apply for full, partial, or

interim authorization under this alternative. Elimination of all restrictions on granting of interim authorization, except the Memorandum of Understanding, would make every state eligible to be granted interim authorization. The elimination of restrictions on granting full or partial authorization to states with more stringent standards would also enable additional states, including the six with importation bans identified in Section 7.1.1.3, to qualify for full or partial authorization. In addition, reductions in the quantities and types of wastes considered hazardous and the raising of the generator limit would decrease the number of potential generators, transporters, storers, treaters, and disposers that the state would have to regulate. This, plus the reductions in reporting requirements, would lead to further reductions for administrative and manpower requirements for authorized states and could increase the willingness of states to apply for authorization.

However, the elimination of the toxicity characteristic could off-set any potential for increased state authorization. If enough states felt that the regulations were inadequate without the inclusion of toxic wastes, there could be an overall reduction in authorized states under this alternative.

<u>Overlapping Federal and State Programs.</u> Since Subtitle C prohibits any state from enacting less stringent regulations than those in the Federal program, the potential for overlapping Federal and state programs would be increased under this alternative. The

less stringent standards and reduced amount of hazardous waste controlled under this alternative would increase the potential benefits to, and thus the likelihood of, a state enacting a more stringent, independent, hazardous waste program. It is not possible at this time to estimate the number of states, if any, that would wish to have independent programs in addition to the Federal program under this alternative.

Number of Generators Required to Comply With the Regulations. As indicated in Section 8.4.1.2, there would be a decrease in the number of generators required to comply with the regulations. Under the baseline regulation, 270,000 to 300,000 generators are identified as potentially having to comply with the regulations (see Section 7.1.3.3).

The increase in the generator limit could result in approximately 105,000 additional manufacturing generators being excluded from compliance with the regulations (see Tables 7-2 and 8-7). The total number of manufacturing generators excluded would represent about 60 percent of all manufacturing generators; however, they are estimated to generate less than 1 percent of the total hazardous manufacturing wastes. Some additional manufacturing generators could also be excluded by the elimination of the toxicity characteristic and listings, however data are not sufficient to estimate the number of additional exclusions. EPA staff estimates are that most, if not all, of the 50,000 automotive service stations and 5,800 research facilities that could be potential generators under the baseline regulations could be excluded by the increased generator limit under this alternative. An indeterminable number of other generators could also be excluded. Thus, on the order of 110,000 to 140,000 generators within the categories identified could be required to comply with the regulations under this alternative. This would represent almost a 60 percent reduction in the number of generators being regulated.

Number of Transporters Required to Comply with the Regulations. The reduced of regulated hazardous wastes that would potentially be transported off-site would likely result in a decrease in the number of transporters carrying hazardous wastes. However, since the number of such transporters under the baseline regulations is not known, it is not possible to estimate the decrease that could occur under this alternative.

Number of Storers, Treaters, and Disposers Required to Obtain Permits. Since there are no permit exclusions under the baseline regulations for storage, treatment, or disposal facilities that handle only small quantities of hazardous wastes, all facilities storing, treating, or disposing hazardous wastes would be required to obtain a permit under the baseline regulation, with the exception of those generators who store wastes for less than 90 days prior to off-site transport. Thus, with one exception, the only facilities that would be excluded from the requirements to obtain a permit under this alternative would be those facilities that handle only wastes that would be classified as hazardous under the baseline regulations, but that would not be classified as hazardous under this alternative. The exception is that generators who store hazardous wastes between 91 days and one year would also be excluded under this alternative. Data are not available to estimate the reduction in potential permittees under this alternative.

Paperwork Requirements. Based upon the estimated number of off-site shipments (see Section 8.4.2.4), the industrial generators could have to prepare between 200,000 and 420,000 shipping papers/bills of lading annually by 1984. This would represent about a 40 percent decrease in the number prepared under the baseline regulations. The aggregated generators, transporters, and hazardous waste management facility owner/operators could each have to keep a minimum of between 200,000 and 420,000 shipping papers/bills of lading in storage on an annual basis. This would represent about an 80 percent decrease in recordkeeping requirements as compared to the baseline regulations. This decrease in both the number of new manifests prepared and stored under this alternative would be even greater to the extent that generators and transporters were able to use and store shipping papers/bills of lading that would also have to be prepared and stored under other existing regulations (see Section 8.4.1.2).

The 110,000 to 140,000 identified generators would have to prepare 110,000 to 140,000 reports on an annual basis; this would represent nearly a 60 percent decrease in such annual reporting. As indicated in Section 7.1.3.6, most potential permittees would be on-site facilities and would not have to prepare additional annual reports based on the manifests. Transporters would not have to prepare any spill reports under this alternative as compared to between 140 and 270 under the baseline regulations; however, some transporters would have to prepare spill reports to satisfy requirements under other existing laws (see Section 8.4.1.2). The reduction in the number of permittees is not determinable, but is expected to be small as previously indicated. Due to the relatively small number of off-site permittees (see Table 7-7) and due to the potentially small decrease in such permittees, any reduction in the number of annual reports based upon manifested wastes to be prepared by such permittees should also be small. There could, however, be a large decrease in the number of monitoring reports prepared by permittees under this alternative. Permittees would have to prepare such reports annually rather than quarterly. There could be up to 117,000 such monitoring reports under the baseline regulations. Using the number of potential permittees from the baseline regulations as an estimate of the upper limit of the number under this alternative, there could be up to 29,000 monitoring reports prepared annually under this alternative -- a reduction of at least 75 percent. Overall there could be a total of 139,000 to 169,000 generator and permittee reports prepared annually under this alternative -- a reduction of about 60 percent.

There would also be a slight decrease in the number of permit applications prepared. The identified generators and permittees could have to file on the order of between 110,000 and 140,000 notifications under Section 3010--a reduction of nearly 60 percent. The likely reduction in the number of regulated transportees would also reduce the number of transporters who would be required to file notifications under Section 3010.

8.4.1.4 Air Impacts.

Air Quality. The regulations under this alternative would have the potential to cause fewer changes in air emissions resulting from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations.

Generation. As previously discussed, the baseline regulations would not have a direct effect on potential air emissions resulting from activities and processes generating hazardous wastes. However, to the extent that the requirements under this alternative would cause less changes in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be less of a potential for generators to make process modifications designed to increase hazardous waste recycling and to reduce the quantity and/or types of hazardous wastes generated; any such reductions in process modifications under this alternative would likely lead to fewer changes in air emissions released by processes generating hazardous waste. Furthermore, with fewer generators being brought under control of the program, the potential for such process modifications and resultant changes in air emissions would be further decreased.

Transport. As indicated in Section 7.1.4.1, there are three major ways air contaminants are released by the transport of hazardous wastes:

- Through fugitive emissions resulting from improperly covered, sealed, or containerized wastes;
- Through emissions resulting from spills or other accidental releases of hazardous wastes;
- Through emissions resulting from the operation of the transport vehicle.

As discussed below, this alternative would affect, to varying degrees, the potential for the release of air emisions from each of these sources.

By 1984, approximately 16 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) would be removed annually from regulations under this alternative as compared to the baseline regulations. As a result, transport of these wastes would not have to be in accordance with the Section 3002 containerization requirements or the Section 3003 transport requirements unless the wastes were also identified as hazardous materials under the DOT Hazardous Materials Transport Act.* Thus, to the extent that these wastes would be containerized or transported using methods not

*In such a case, for all interstate transport and some intrastate transport, these wastes would be subject to essentially the same containerization and transport requirements as under the baseline regulations.

acceptable under the baseline regulations, the potential for the release of fugitive emissions by such transport and from any resultant spills or explosions would be increased under this alternative. Section 7.1.4.1 discusses the potential for the release of air emissions from unregulated transport practices. Furthermore, the elimination, except as previously noted, of the requirement that transporters need to report and clean up spills would further increase the potential for air contaminants to be released from such spills under this alternative. The elimination of spill response information from the manifest could further increase the time for spill clean up and thus increase the potential for the release of air contaminants.

Both the total quantity of regulated hazardous wastes being transported and the average distance over which such wastes are transported could decrease under this alternative, as previously indicated. Any such reductions would lead to the release of fewer vehicular emissions and to a reduced potential for vehicular accidents to occur and to release air emissions. However, less transport of hazardous waste in accordance with the regulations would increase the potential for spills and explosions from improper transport and from resultant vehicular accidents. This would off-set some of the potential for fewer vehicular accidents to result from reduced transport distances. The changes in both the vehicular emissions and emissions resulting from accidents would be dependent upon such factors as the decrease in travel distances, the change in portion of hazardous wastes transported off-site, and the decrease in the amount of regulated wastes being transported.

Using the methodology and assumptions described in Section 7.1.4.1, the potential change in vehicular air emissions resulting from the reduced transport of regulated hazardous industrial waste has been estimated for four possible transport distances for both 13 and 25 percent off-site shipment of hazardous wastes in 1984. Table 8-8 shows the change in vehicular emissions relative to those of the baseline regulations (see Table 7-8). For example, for a 100-mile round-trip distance with 13 percent off-site treatment/disposal, there could be an increase in each vehicular air emission equal to about 40 percent of that which could occur under the baseline regulations. For a 1,000-mile round-trip distance with 25 percent off-site treatment/disposal, there could be a decrease in each air emission equal to about 40 percent of that which could occur under the baseline regulations. In the former case, the increase in each air emission would be less than one one-thousandth of a percent of the total U.S. emission of that air pollutant and less than 0.007 percent of the total U.S. area emission of that pollutant from heavy-duty, diesel-powered vehicles. In the latter case, the decrease in each air emission would be less than 0.03 percent of the total U.S. emission of that air pollutant and approximately 1 percent of the total U.S. area emission of that pollutant from heavy-duty, diesel-powered vehicles.

TABLE 8-8

ESTIMATED CHANGE IN VEHICULAR EMISSIONS IN 1984 FROM TRANSPORT OF LESS HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in emissions (metric tons)				
		Carbon monoxide	Hydrocarbons	Nitrogen oxides	Particulates	Sulfur oxides
13 percent	100	+60	+10	+45	+3	+6
	200	-350	-55	-250	-15	-35
	500	-1,600	-250	-1,200	-70	-150
	1,000	-3,600	-580	-2,700	-170	-360
25 percent	100	-310	-50	-230	-15	-30
	200	-1,100	-180	-800	-50	-110
	500	-3,200	-510	-2,300	-140	-310
	1,000	-7,400	-1,200	-5,400	-340	-730

Based upon the methodology and assumptions described in Section 7.1.4.1, there could be on the order of 80 to 180 transportation-related hazardous wastes spills annually by 1984 from the transport of the regulated wastes. As previously discussed, it is not possible to estimate the change in the number of spills that would occur from the removal of 16 million metric tons of hazardous waste from regulation by 1984.

Storage, Treatment, and Disposal. As discussed in Section 7.1.4.1, there are several major ways that air contaminants can be released by current hazardous waste storage, treatment, or disposal practices:

- Through fugitive emissions resulting from improper storage of hazardous wastes;
- Through fugitive emissions from ground-based treatment/disposal activities such as landfills, landfarms, and surface impoundments;
- Through emissions occurring as the result of storage becoming the ultimate form of disposal of hazardous wastes;
- Through emissions generated by spills, fires, explosions, and other accidents;
- Through the combustion of hazardous wastes by incineration or open burning;
- Through fugitive emissions from other treatment activities;
- Through fugitive emissions from facility construction or modification.

This alternative would affect the potential for the release of air contaminants from each of these sources as discussed below.

To the extent that fewer storage, treatment, or disposal facilities would have to be modified or would have to be constructed under this alternative (see Section 8.4.2.4), there would be a decrease in fugitive dust and vehicular emissions from such construction activities. Such emissions would be extremely site dependent.

By 1984, approximately 16 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) would be removed annually from regulation under this alternative as compared to the baseline regulations. These hazardous wastes would not have to be stored, treated, or disposed in accordance with the Section 3004 regulations. Since it is likely that most of these wastes would not be managed by methods that are environmentally acceptable under the Section 3004 regulations, the overall potential for the release of air contaminants from the management of such wastes would be increased under this alternative relative to the baseline regulations. Section 7.1.4.1 discusses the potential for the release of air contaminants from unregulated treatment, storage, and disposal practices.

With regard to the estimated 24 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) that would still be regulated annually under this alternative in 1984, the less stringent requirements under this alternative would have the potential for increasing the release of air contaminants from the management of these wastes as compared to their management under the baseline regulations. For example, many of the incineration requirements under the baseline regulations apply only to the incineration of pesticide wastes or to wastes that are hazardous due to toxicity. The proposed regulations require that such wastes be incinerated at 1,000 C with greater than 2 seconds retention time and greater than 2 percent excess oxygen and that the incineration achieve 99.99 percent destruction of the principal toxic components of the wastes. Elimination of the toxicity characteristic under this alternative would remove the incineration of almost all regulated wastes from compliance with the above requirement.

Only pesticide wastes that are hazardous due to a characteristic other than toxicity would still have to be incinerated under the above operating conditions. The incineration would, however, have to achieve a 99.9 percent destruction efficiency of the principal components of the pesticide waste rather than a 99.99 percent destruction efficiency; thus, there could be up to a 900 percent increase in the release of the principal components from the incineration of such pesticide wastes (however, as indicated in Appendix M, incineration under the conditions specified above can result in better than 99.99 percent destruction of the principal components of many pesticides). Incineration of other wastes regulated under this alternative that would have been identified as toxic under the baseline regulations (e.g., slop oil emission solids from petroleum refining -- see Table D-7) would also be removed from complying with the incineration requirements noted above. Thus, under this alternative there would be a much greater potential for incineration of these wastes to release hazardous air contaminants.

Furthermore, the incineration of all regulated wastes would be subject to less stringent requirements for combustion efficiencies and for halogen removal under this alternative. Required combustion efficiencies would be reduced from 99.9 percent to 99 percent; required halogen removal efficiencies would be reduced from 99 percent to 90 percent. Thus, there could be up to a 900 percent increase in the release of halogens and carbon monoxide under this alternative. In addition, the reduced combustion efficiencies could also result in the less complete destruction both of other combustion products and of hazardous waste constituents with a resultant increase in their release to the atmosphere. Thus, incineration under this alternative would likely lead to locally higher ambient air concentrations of many of the hazardous air contaminants generated by the incineration. However, all emissions and resultant changes in air quality would have to be in compliance with all applicable requirements (e.g., Clean Air Act standards and state standards).

Other changes that would potentially increase the release of air contaminants from wastes regulated under this alternative include the removal of the prohibition against placing volatile wastes in landfills, landfarms, surface impoundments, or storage tanks vented directly to the atmosphere (see Section 7.1.4.1 for examples of volatile hazardous wastes). To the extent that regulated volatile wastes would be stored, treated, or disposed by such methods under this alternative, there would be an increased release of air contaminants as described in Section 7.1.4.1. The application of the Threshold Limit Values (TLV's) as a time-weighted average for a 24-hour day rather than as a time-weighted average for an 8-hour day and a 40-hour week would allow increased emissions from such non-point sources as landfills, landfarms, surface impoundments, and storage areas. The reduction in the minimum distance that active portions of facilities must be located from the facility boundary, coupled with the above changes, would likely lead to increased ambient air concentrations of hazardous emissions beyond the facility boundary. Increases in the time interval for completing required training would also increase the potential for personnel to improperly manage hazardous wastes so as to cause fires, explosions, or other accidents that could release air contaminants.

It should be noted, however, that there would likely be some shift in the types of methods used to store, treat, or dispose both the regulated wastes and the wastes excluded from regulation under this alternative compared to the methods that would have been used to manage these wastes under the baseline regulations. For example, the elimination of restrictions on the management of volatile wastes could reduce the incineration of such wastes and increase their landfilling, relative to the baseline regulations. Such shifts would change both the types and quantities of air emissions produced by the management of specific wastes. For example, a shift from incineration to landfilling of a particular waste would potentially result in a decrease in the release of combustion products and an increase in the release of particulate matter and/or gases contained in the waste. Such shifts could either enhance or reduce the potential for this alternative to cause increases in the release of specific air emissions in any given locality. All emissions and any localized degradation of air quality would have to be in compliance with all applicable requirements (e.g., Clean Air Act standards, OSHA standards, state standards).

Climate. Fewer hazardous waste management facilities would potentially have to be constructed under this alternative than under the baseline regulations. Thus, there would be fewer localized impacts to temperatures, humidities, and low-level wind patterns from such construction.

8.4.1.5 Water Quality Impacts. While the regulations under this alternative would reduce the potential for adverse impacts to water quality resulting from generation, storage, transport, treatment and disposal of hazardous wastes, the potential reduction in impacts would be significantly less than the potential reduction which would result from implementation of the baseline regulations.

Many of the potential changes to groundwater and surface water impacts under this alternative would occur in much the same manner as the potential changes discussed under air quality. To avoid redundant discussions, such changes are briefly summarized below rather than discussed in detail. Following this summary, additional major changes are described.

Since generators would be less likely to make process modifications designed to increase recycling or to reduce the quantity and/or types of hazardous wastes generated, this would lead to fewer changes in water effluents produced by such processes and thus to fewer changes in groundwater and surface water contamination by such effluents. With fewer generators being brought under the control of the program, the potential for such process modifications would be further decreased. Furthermore, to the extent that this alternative would bring less storage by generators under the Section 3004 regulations,* the potential for groundwater and surface water contamination by spills and runoff from storage of these additional wastes would be increased.

Decreases in the quantity of hazardous wastes being transported subject to the Subtitle C regulations would increase the potential both for midnight dumping and spills and resultant impacts to groundwater and surface water quality. However, decreases in the

*Generators who store hazardous wastes for less than 1 year prior to off-site shipment would not be required to obtain a permit under this alternative; under the baseline regulations, this permit exclusion would be limited to 90 days storage.

average distance over which wastes are transported would decrease the potential for vehicular accidents and could at least partially offset the potential for an increase in spills. The elimination, except as previously noted, of the requirement that transporters need to report and clean up spills and that manifests need to contain spill information would further increase the potential for water quality impacts to result from such spills under this alternative. Decreased transport distances would also result in decreased vehicular emissions and in a decreased potential for oil, grease, and the hydrocarbons and heavy metals contained in vehicular exhausts to be carried into waterways by run-off.

One major change in water quality impacts would result from the removal of 16 million metric tons of hazardous industrial wastes (plus other hazardous wastes) from regulation annually by 1984 under this alternative as compared to the baseline regulations. These potentially hazardous wastes would not have to be treated/disposed in accordance with the Section 3004 regulations, though they could be subject to applicable regulations under Subtitle D of RCRA and other State and Federal legislation (e.g., the Clean Water Act and the Safe Drinking Water Act). Based on current practices, most of these wastes would not be stored, treated, or disposed by methods which are environmentally acceptable under the Section 3004 regulations. Thus, the overall potential for groundwater and surface water degradation would be increased. Section 7.1.5 describes the potential for surface water and groundwater impacts from the treatment/disposal of such wastes under current practices and requirements. Many of the incidents reported in that section involve toxic wastes which would not be regulated under this alternative. These include all incidents exclusively involving pesticides or heavy metals (e.g., the Moscow Mills, Missouri endrin incident, and the groundwater contamination incident involving chromium and cadmium from an aircraft plant in South Farmindale, Long Island). Similar types of incidents would also not be prevented by the regulations under this alternative.

Additional impacts to water quality could also result from the enactment of less stringent regulations for the treatment/disposal of the 24 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) that would still be under control of the program annually. This alternative decreases the required minimum distance between the active portions of facilities and water supplies; allows the use of more permeable soil liners for surface impoundments and landfills; limits groundwater monitoring requirements to facilities which have the potential to discharge to underground drinking water sources; eliminates quarterly groundwater monitoring while retaining the requirement for annual monitoring; and decreases the time requirement for post close-out care. To the extent that more permeable liners would allow more rapid movement of leachates and that less frequent monitoring would delay detection of liner failure, there would be an increased potential for degradation and contamination of groundwater and of surface waters recharged by the groundwater. Similarly, the other changes would also increase the potential for undetected groundwater and surface water degradation.

It should be noted, however, that there could be shifts in the type of methods used to treat/dispose regulated wastes and wastes removed from regulation under this alternative, compared to methods used under the baseline regulations. As previously discussed, such shifts could result in localized changes in the release of specific water pollutants under this alternative, compared to the baseline regulations.

8.4.1.6 Public Health Impacts. This alternative would have the potential to reduce the public health benefits that would be derived from the baseline regulations. The impacts to public health under the baseline regulations are discussed in Section 7.1.6.

Approximately 16 million metric tons of potentially hazardous industrial wastes would be removed from regulation annually by 1984 under this alternative as compared to the baseline regulations. This decrease would primarily be attributable to the large quantity of toxic substances that would be excluded from regulation. Based upon current practices, a large portion of these wastes would potentially be stored, transported, treated, and disposed in a manner that was not environmentally acceptable under the regulations. Also through the imposition of less stringent standards, there would be a greater potential for the regulated wastes to release air, water, and soil contaminants that could cause adverse public health impacts (see

Sections 8.4.1.4, 8.4.1.5, and 8.4.2.1). The removal of all toxic wastes from regulation would result in many wastes that are known or suspected to be carcinogenic, mutagenic, or teratogenic being excluded from regulation. Of particular concern is the possibility for the occurrence of additional disasters similiar to that of Love Canal in Niagara, New Falls, New York (see Section 7.1.6). In that incident, an undeterminable quantity of toxic chemicals had been improperly disposed, homes had been built adjacent to the disposal site, and numerous public health problems resulted.

An example of wastes containing potentially toxic substances, such as cadmium or chromium compounds, that might not be regulated under this alternative, but that could be controlled under the baseline regulations is as follows:

- An aircraft plant in Nassau County, New York generated and disposed large quantities of electroplating wastes containing chromium, cadmium, and other metals during World War II. An estimated 200,000 to 300,000 gallons per day of these wasteswere discharged into unlined disposal pits throughout the 1940's. Groundwater contamination by chromium was first noted in 1942 by the Nassau County Department of Health. Subsequent studies indicated that a hugh plume of contaminated groundwater had been formed, extending from the surface of the water table to depths of 50 to 70 feet below the surface. In 1962, test wells revealed concentrations of hexavalent chromium up to 14 ppm, and concentrations of cadmium up to 3.7 ppm. The contaminated plume cannot be removed or detoxified without massive efforts and will take many more years of natural attentuation and dilution before it becomes usuable again. Meanwhile, it is still slowly moving, threatening a nearby creek and other wells in the area (Tinlin, 1976; State of Minnesota, 1977).

For purposes of comparison with regard to this incident, the National Interim Primary Drinking Water Standard for chromium is .01

ppm and .05 ppm for cadmium, respectively. While the harmful effects of this incident are believed to be limited to groundwater contamination, it is important to note that the incident which began in the 1940's continued for over two decades. Although hexavalent chromium has been found to be toxic to some aquatic species, information on its chronic effects to humans is limited almost entirely to data on occupational health effects. Lung cancer, ulceration, and perforation of the nasal septum, and other respiratory complications and skin effects have been observed (U.S. Environmental Protection Agency, 1976a). In 1941, it was reported that a group of 29 school children experienced violent nausea after eating popsicles containing 13 to 15 ppm of cadmium (U.S. Environmental Protection Agency, 1976a).

8.4.2 <u>Secondary Impacts.</u> The major changes in secondary impacts that could occur as a result of implementation of this alternative would result primarily from the removal of approximately 16 million metric tons of hazardous industrial wastes (plus other hazardous wastes) from regulation annually by 1984; the enactment of less stringent environmental requirements with regard to storage, treatment, and disposal of hazardous wastes; and potentially lower increases in storage, treatment, and disposal costs as a result of these less stringent regulations.

8.4.2.1 Physiography and Soils Impacts. The major change in impacts to physiography and soils would result from the elimination of 16 million metric tons per year of hazardous industrial wastes (plus other hazardous wastes) from regulation. To the extent that these wastes would be stored, transported, treated, or disposed by methods which are not environmentally acceptable under the baseline regulations, the potential for adverse impacts to soils would be increased. Section 7.2.1 describes the types of impacts to soils that could occur from such methods. The potential for adverse impacts to soils would be further increased by allowing longer storage of wastes by generators without requiring a permit.

Reductions in the quantity of hazardous wastes being transported subject to the Subtitle C regulations would increase the potential both for midnight dumping and spills and for resultant impacts to soils. However, decreases in the average distance over which wastes are transported would decrease the potential for vehicular accidents and could off-set the potential for an increase in spills. Reduced transport would also result in decreased vehicular emissions and in a decreased potential for oil, grease, and the hydrocarbons and heavy metals contained in such emissions to be carried onto soils by run-off.

To the extent that fewer storage, treatment, or disposal facilities would have to be constructed under this alternative due to a potential reduction in the off-site process capacity shortfall (see Section 8.4.2.4), there would be a lesser potential for physical impacts to soils and physiography. Allowing the use of more permeable soil liners would allow more disposal sites to use natural, in-place soils, and would therefore reduce the demand for, and impacts of off-site excavation of clays. Less land and soil would also be disturbed by facility construction and by conjunctive developments such as construction of roads, power lines, pipelines, and housing. However, these reduced land requirements would be off-set to the extent that land would still be required for the storage, treatment, and disposal of the wastes excluded from regulation under this alternative. Potential impacts to soils and physiography from construction would be essentially the same as those described in Section 7.2.1.

8.4.2.2 Biological Impacts. Land requirements for facility construction and operation and for conjunctive developments would be reduced under this alternative. As a result, the potential for adverse impacts to flora, fauna, and ecological systems from land disturbance would also be reduced. In addition, the reduction in the transport of hazardous wastes could lead to a reduction in road kills.

These potential benefits to the biological environment would, however, be off-set by several other changes that could occur under this alternative. Approximately 16 million metric tons of potentially hazardous industrial wastes (plus other hazardous wastes) would be removed annually from regulation. Based upon current practices, a large portion of these wastes would potentially be stored, transported, treated, or disposed in a manner that was not environmentally acceptable under the baseline regulations. To the extent that these wastes were to be handled in such a manner, the potential for adverse impacts to the biological environment would be increased. Section 7.2.2 describes the types of impacts that could occur from practices not regulated under Subtitle C.

It should be noted, however, that in removing these wastes from regulation, there could be shifts in the methods used to treat/dispose these wastes. This could result in localized changes in the quantity of specific air, land, and water residuals generated by the treatment/disposal of these wastes as described in Section 8.3.1.4. The potential for increased adverse biological impacts from these residuals would be modified to the extent of any such shifts.

For those hazardous wastes that would still be controlled under this alternative, the potential for water quality impacts, and subsequent adverse impacts to aquatic ecosystems and to wildlife using contaminated water supplies, would be increased by the use of more permeable liners and by other changes discussed in Section 8.4.1.5. The potential for air quality impacts, and subsequent adverse ecological impacts, would be increased as discussed in Section 8.4.1.4. Furthermore, the potential for impacts to soils, and subsequent adverse impacts to biological productivity, would be increased as discussed in Section 8.4.2.1.

8.4.2.3 Social Impacts.

Demographic Impacts. Fewer industrial plant closings or relocations due to lesser increases in costs under this alternative could lead to fewer population shifts as described in Section 7.2.3.1. In addition, there would be a decrease in the number of construction workers required due to the lesser amount of facility modification and construction necessary under this alternative; there would be a reduction in the number of personnel required for hazardous waste management activities due to both the less stringent operational requirements and the decrease in wastes being regulated; and there would be a decrease in the number of personnel required to administer and enforce the regulations due to reductions in both the quantity of hazardous wastes and the number of generators, disposers, and permittees being regulated. Fewer population shifts could also occur in response to these reduced personnel requirements as discussed in Section 7.2.3.1. Any such shifts would be expected to be small on a national scale; however, there could still be localized instances of relatively large influxes of workers, particularly for hazardous waste management facilities located near very small towns, or of relatively large outfluxes of workers, especially in the case where a plant being closed constituted the primary source of employment in an area. Based upon a minimum requirement of 500 workers to handle (store, treat, or dispose) a million metric tons of waste per year, it is estimated that at least 12,000 such workers could be required nationally by 1984; this would represent about a 40 percent decrease in this requirement compared to the baseline regulations. About 1,500 to 3,000 of these workers could be required at off-site facilities; about 9,000 to 10,500 of these workers could be required at on-site facilities. This would represent about a 40 percent decrease at both types of facilities. To the extent that pesonnel would still be required to manage the wastes excluded from regulation under this alternative, there would be a lesser reduction in the number of workers required nationally.

Social Conditions. The lesser public health benefits to be derived from this alternative relative to the baseline regulations would provide fewer social benefits as discussed in Section 7.2.3.2. Fewer reductions in chronic and acute health effects would also result in an increase in the social and economic costs associated with such effects, e.g., increased mortality, birth defects, lowered productivity, lost wages.

A reduction in population shifts would decrease the potential for impacts associated with such shifts. However, as discussed in Section 7.2.3.2, any large, rapid, population influx could still cause inflation, strains on the existing infrastructure, social tensions, changes in daily living patterns, and increased physical and mental disorders. Any large rapid, outflux could still cause problems in maintaining existing infrastructures, deflation, additional unemployment, social stress, changes in daily living patterns, and increased mental and physical health problems.

Public opposition to the siting and construction of hazardous waste management facilities could be reduced by the need for fewer facilities under this alternative. However, any opposition that occurs could be exacerbated by the less stringent environmental requirements for such facilities under this alternative.

Decreases in the construction of hazardous waste management facilities and in the off-site transport of hazardous wastes could result in several beneficial social effects. Reductions in facility construction would eliminate the potential for noise impacts, aesthetic impacts, land use impacts, water use impacts, and pressures on existing infrastructures that could be associated with the facility. Any decrease in the transport of hazardous wastes would decrease the potential for vehicular accidents. Based upon the methodology and assumptions discussed in Section 7.2.3.2, it is estimated that there could be approximately 110 fewer vehicular accidents annually in 1984 in the case of 13 percent off-site shipment and about 340 fewer vehicular accidents in the case of 25 percent off-site shipment. This would represent about a 40 percent decrease in vehicular accidents compared to the baseline regulations.

8.4.2.4 Hazardous Waste Management Facility Capacity.

Process Capacity. Based upon the methodology and assumptions described in Section 7.2.4.1, it is estimated that approximately 3.0 million metric tons of regulated hazardous industrial wastes could be shipped off-site for treatment/disposal in 1980 and that between 3.1 and 6.0 million metric tons could be shipped off-site in 1984. This would represent a decrease of 2.3 million metric tons of regulated industrial wastes required to be sent to permitted off-site facilities in 1980 and a decrease of between 2.2 and 4.0 million metric tons of regulated industrial wastes required to be sent to permitted off-site facilities in 1984.

Based upon the estimated 6.2 million metric tons of environmentally adequate off-site capacity that could be utilized on a nationwide basis in 1980, there would potentially be sufficient capacity on a nationwide basis to handle the estimated 3.0 million metric tons of regulated hazardous industrial wastes shipped off-site. Even if there was no growth in environmentally adequate off-site capacity between 1977 and 1980, there would still potentially be sufficient capacity on a nationwide basis in 1980. Under the baseline regulations there would also potentially be sufficient off-site capacity available on a nationwide basis in 1980.

The estimated 7.7 million metric tons of environmentally adequate off-site capacity that could be utilized in 1984 would be sufficient on a nationwide basis to handle the estimated 3.1 million metric tons of regulated hazardous industrial wastes shipped off-site in the case of 13 percent off-site shipment. Again there would potentially be sufficient off-site capacity on a nationwide basis even if there was no growth in capacity between 1977 and 1984. Under the regulations there would also potentially be sufficient off-site capacity available on a nationwide basis in 1984.

In the case of 25 percent off-site shipment, sufficient off-site capacity would also potentially be available on a nationwide basis for hazardous industrial wastes in 1984. However, without any growth in environmentally adequate off-site capacity between 1977 and 1984, there could potentially be a nationwide shortfall of almost 0.5 million metric tons in 1984.* In this latter case, 1984 could be the first year of shortfall. Based upon a utilizable facility capacity of 60,000 metric tons per year, approximately eight additional off-site facilities could be required to handle hazardous industrial waste in 1984 in this latter case. It is estimated that under the baseline regulations that there could be a nationwide shortfall of 2.6 million metric tons of capacity in 1984 in the former case and of 4.9 million metric tons in the latter case. Thus, approximately 45 fewer permitted off-site facilities could be required for hazardous industrial waste under this alternative in the former case and 72 fewer permitted off-site facilities could be required in the latter case, as compared to the baseline regulation.

*The actual shortfall would be 0.4 million metric tons; however, with a utilization rate of 0.9, approximately 0.5 million metric tons of capacity would be required.

Data are not available to estimate the potential for shortfalls in environmentally adequate on-site process capacity. Industrial generators could treat/dispose approximately 16.4 million metric tons of regulated hazardous industrial wastes on-site in 1980 and between 17.3 and 20.2 million metric tons of regulated hazardous industrial wastes on-site in 1984.* This would represent a decrease of approximately 12.3 million metric tons of regulated industrial wastes required to be sent to permitted on-site facilities in 1980 and a decrease of between 11.5 and 13.4 million metric tons of regulated wastes required to be sent to permitted on-site facilities in 1984. It should be noted that less stringent treatment/disposal requirements under this alternative would likely result in an increase in the existing on-site capacity. Any such increase would further decrease any potential for a shortfall in necessary on-site capacity.

Section 7.2.4.1 discusses other factors that could either lead to shortfalls or that could exacerbate the size of the estimated potential shortfall in both on-site and off-site process capacity, especially on a localized basis. Furthermore, the wastes removed from regulation would still have to be treated/disposed, both on-site and off-site. While such wastes could be treated/disposed in non-permitted facilities, their management could increase the potential for an overall shortfall in available capacity; however, any

*The remainder of the waste not sent on-site or off-site would be recycled or sent to resource recovery operations, both on-site and off-site.

resultant shortfall would be less than that under the baseline regulations. The less stringent requirement under this alternative would also increase the number of sites at which facilities could be located.

Physical Capacity. Based upon the methodology and assumptions discussed in Section 7.2.4.2, relative to the baseline regulations there could be an increase of approximately 0.6 million metric tons in the total hazardous industrial wastes sent off-site during the period from 1980 through 1984, assuming 13 percent shipment off-site in 1984, and there could be a decrease of 4.3 million metric tons in the total hazardous industrial wastes sent off-site during this period, assuming 25 percent shipment off-site in 1984.*

Up to 120 to 240 additional acres could thus be committed to off-site landfilling of hazardous industrial wastes during this period in the case of 13 percent off-site shipment and up to 860 to 1,700 fewer acres could be committed to off-site landfilling of hazardous industrial wastes during this period in the case of 25 percent off-site shipment. In the former case, after 1984 there could be 65 to 130 additional acres required off-site annually compared to total requirements under the baseline regulations. In the latter case, after 1984 there could be 320 to 640 fewer acres required off-site annually compared to the total requirements under the

*In this estimate, it is assumed that under this alternative there would be 15 percent off-site shipment for those hazardous wastes that would be regulated under the baseline regulations but which would not be regulated under this alternative.

baseline regulations. In all instances there could be commensurate changes in on-site land requirements.

For purposes of comparison, based upon an average, secure commecial landfill size of 270 acres (U.S. Environmental Protection Agency, Office of Toxic Substances, 1977), these land requirements would be equivalent to siting about one additional off-site secure landfill by the end of 1984 in the case of 13 percent off-site shipment. In this case, the equivalent of less than one additional off-site secure landfill could have to be sited annually after 1984 for hazardous industrial waste. The land requirements would be equivalent to siting three to six fewer off-site secure landfills by the end of 1984 in the case of 25 percent off-site shipment. In this case, the equivalent of one to two fewer off-site landfills could have to be sited annually after 1984.

8.4.2.5 Land Use Impacts. Less total land, off-site plus on-site, would be required for the construction of any storage, treatment, and disposal facilities needed under this alternative and for such conjunctive developments as construction of roads, power lines, and pipelines. Less additional land would be required since fewer wastes would have to be sent to permitted facilities; the wastes removed from regulation could use existing facilities or other facilities that were not adequate under the baseline regulations. However, as indicated in Section 8.4.2.4, in the case of 13 percent off-site shipment there would be more total hazardous industrial wastes (those regulated plus those removed from regulation) sent off-site than there would be in the similar case under the baseline regulations. Thus, while less total land would be required, there could be more off-site land use and less on-site land use for hazardous industrial wastes in this case. In the case of 25 percent off-site shipment, there would be less total hazardous industrial wastes sent off-site than there would be in the similar case under the baseline regulations and, thus, there could be less off-site land use and more on-site land use for hazardous industrial wastes. Estimates of potential change in off-site land requirements for landfills (and commensurate changes in on-site land requirements) are presented in Section 8.4.2.4. Existing land uses would not change on lands excluded from hazardous waste management under this alternative; however, there could be localized changes in land use from any additional shifts to off-site management from on-site management or to on-site management from off-site management as discussed above.

It should be noted that while shifts to on-site land use could reduce off-site land requirements in the short term, such shifts could also accelerate the exhaustion of the relatively limited on-site physical capacity and could result in increased pressures for off-site facilities in the long term. Furthermore, the reduced potential under this alternative for increases, both in resource conservation and recovery and in treatment practices leading to volume reduction (e.g., incineration), would also provide a lesser potential for reducing total land requirements, both on-site and off-site, in the long term.

To the extent that the regulations under this alternative would result in additional lands being contaminated by improper storage, treatment, or disposal of hazardous wastes, there would be off-setting adverse impacts to existing land uses. Section 7.2.5 describes the types of impacts that could occur.

8.4.2.6 Water Use Impacts. The potential for the degradation of groundwater and surface water quality would be increased under this alternative as previously discussed. Increased degradation of water quality would result in a decreased supply of surface water or groundwater being available to some or all consumers in the water use area and increased restrictions on the productive use of the water.

Since fewer hazardous waste management facilities could be required, less water would be required under this alternative for operation of such facilities. This reduced water requirement would, however, be off-set to the extent that water would still be consumed in the management of the wastes removed from regulation.

8.4.2.7 Resource Conservation and Recovery. The major changes in resource conservation and recovery would result from excluding 16 million metric tons of hazardous manufacturing wastes from control under the Subtitle C regulations annually by 1984 and from the relatively lower costs to hazardous waste generators and costs associated with hazardous waste transportation, storage, treatment, and disposal due to the less stringent requirements under this alternative. As discussed in Section 7.2.7, these changes would provide less incentive for generators to modify processes so as to enable increased recycling of hazardous wastes as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes, or to change the nature of wastes produced. Chapter 5 presents examples of the potential for increased resource recovery from and recycling of hazardous wastes.

8.4.2.8 Energy Use. Energy use would be impacted under this alternative by changes in facility construction, facility operation, hazardous waste transport, and resource conservation and recovery. The lesser amount of facility modification and construction that would be necessary would result in a decrease in energy use. Less stringent requirements for soil liner permeabilities and for non-point source air emission releases would further decrease the energy use associated with facility construction.

There would also be less energy use associated with changes in facility operation and closure under this alternative. Removal of 16 million metric tons of hazardous industrial wastes (plus other hazardous wastes) from regulation annually by 1984 would reduce energy use as discussed in Section 7.2.8. The reduction in the post close-out period from 20 years to 10 years would decrease the energy use associated with post close-out care. Less energy would also be required due to less stringent requirements for such activities as incineration and leachate and groundwater monitoring.

Previously discussed changes in resource recovery would lead to other changes in energy use. While any reduction in resource recovery would result in less energy being initially required for such activities, there would be a lesser potential for net energy savingsfrom resource recovery activities.

The changes in energy use resulting from a reduction in the transport of hazardous wastes would depend upon such factors as shifts in the portion of wastes managed on-site and off-site and changes in transport distances. Based upon the methodology and assumptions described in Section 7.2.8, Table 8-9 presents estimates of the magnitude of the potential change in energy use (compared to that under the baseline regulations) that could occur annually from changes in transport distances and shifts in off-site and on-site treatment disposal. The estimated change in energy use under this alternative ranges from a decrease equivalent to approximately 870,000 barrels of crude oil for a 1,000-mile round-trip distance with 25 percent off-site treatment/disposal to an increase equivalent to approximately 7,000 barrels of crude oil for a 100-mile round-trip distance with 13 percent off-site treatment/disposal.

TABLE 8-9

ESTIMATED CHANGE IN FUEL CONSUMPTION IN 1984 FROM TRANSPORT OF LESS HAZARDOUS INDUSTRIAL WASTES UNDER SUBTITLE C REGULATIONS

Wastes transported off-site	Average round-trip distance (miles)	Change in fuel consumption (million gallons)	Crude oil equivalent * (1,000 barrels)
13 percent	100	+0.3	+7
	200	-2	-40
	500	-7	-180
	1,000	-17	-420
25 percent	100	-2	-40
	200	-5	-130
	500	-15	-370
	1,000	-35	-870

*Assumes 95 percent efficiency in producing diesel fuel from crude oil.

There could also be fewer reductions in energy production due to the reduced costs associated with management of wastes from such activities and due to the exclusion of 'special wastes' from regulation; many special wastes are generated by energy production activities. There could also be fewer changes in fuels used by facilities. This could result in reduced impacts to energy supply/demand relationships.

8.4.2.9 Impacts to Special Interest Points. To the extent that treatment/disposal of the wastes removed from regulation under this alternative would disturb, destroy, or intrude upon special interest points, there would be less of a reduction in adverse effects to such special interest points as discussed in Section 7.2.9. However, to the extent that fewer lands, especially off-site lands, would be disturbed for facility construction and operation and for conjunctive developments under this alternative, there would be a lesser potential for the disturbance and/or destruction of sites of aesthetic, archaeological, historical, paleontological, or recreational value.

8.5 Potential Changes in Impacts Resulting from the Phase I Alternative

This section discusses the potential changes in impacts (relative to those of the baseline regulations) that could occur from the promulgation of the regulations contained in the Phase I Alternative. To avoid considerable duplication in the presentation, potential impacts that would not be changed under this alternative are not repeated. Only major changes in potential impacts are discussed.

One of the major changes under this alternative is the addition of Interim Status Standards (see Table 4-4). The Interim Status Standards represent the minimum requirements with which an existing treatment, storage, or disposal facility must comply until administrative disposition of the facility's permit application is made. The Interim Status Standards would apply to all activities affecting any hazardous waste handled at such a facility after the effective date of the regulations. Under the baseline regulations existing facilities would not be required to modify their present practices until after being issued a permit.

8.5.1 Primary Impacts. The major changes to primary impacts that could occur as a result of implementation of this alternative are discussed in the following sections:

- Hazardous Wastes to be Regulated;
- Changes to Existing Generation, Transporation, Storage, Treatment, and Disposal Practices and Procedures;
- Administrative Changes;
- Air Impacts;
- Water Impacts;
- Public Health Impacts.

8.5.1.1 Hazardous Waste to be Regulated. Under this alternative several modifications would affect the quantity of waste that is subject to Subtitle C requirements, as compared to the baseline regulations. These modifications relate to the following:

- Generator limit;

- Corrosivity characteristic;
- Toxicity characteristic;
- Listed wastes;
- Wastes that are re-used;
- 'Special wastes';
- Farm wastes;
- Retail wastes.

Each of the above would affect the quantity of waste subject to the Subtitle C regulations in different ways. General effects are discussed first. Specific changes with regard to the regulation of manufacturing wastes, 'special wastes', and non-manufacturing wastes are then summarized. Changes are quantified to the extent that data permit; however, most of this discussion is necessarily qualitative. EPA staff estimates are that the net effect of all the above modifications would likely be a slight decrease in the quantity of waste regulated under this alternative, as compared to the baseline regulations.

General Changes. The first five modifications listed above would affect wastes generated by all sources (i.e., manufacturing wastes, 'special wastes', and non-manufacturing wastes) and are discussed in this section. Each of these modifications, except for changes in listed wastes, would act to reduce the quantity of waste subject to regulation. The last three modifications listed above would relate only to the wastes specified and are discussed in subsequent sections. It should be noted that the overall effects of the individual modifications would be somewhat duplicative in that some of the same wastes would likely be excluded from regulation by more than one modification.

Under the baseline regulations, the generator limit would be 100 kilograms per month. Under this alternative, the generator limit would be raised to 1,000 kilograms per month during the first 2 to 5 years following implementation of the regulations. At the end of this period, the generator limit would again be set at 100 kilograms per month. During this initial period, almost all hazardous wastes from each source generating a total of between 100 and 1,000 kilograms of hazardous waste per month would be excluded from regulation. Based on Sections 7.1.1 and 8.4.1.1, the net effect of this change is estimated to be a slight reduction in the quantity of waste being regulated. There would, however, be two categories of wastes which would not be subject to this new generator limit. The first category consists of those listed waste for which a separate, lower exclusion limit is specified.* The second category consists of those wastes which result from discarding any quantity of specified commercial chemical products and manufacturing chemical intermediates,† from discarding over 10 kilograms of containers and liners used for these chemical products and intermediates, and from discarding over 100

*There are no such exclusion limits specified at this time, however.

†See Section 4.5.

kilograms of spill clean-up residues from these products and intermediates. Except for the spill clean-up residues, the portion of hazardous waste that is generated from these products and intermediates at a rate in excess of the limits indicated above, but at a rate of less than 100 kilograms per month, would constitute an additional quantity of waste not previously controlled under the baseline regulations. The control of these two additional categories of wastes would off-set some of the reduction in regulated waste that results from raising the generator limit under this alternative.

Modifications to the characteristics for corrosivity and toxicity would also reduce, by an indeterminable amount, the quantity of waste regulated under this alternative, as compared to the baseline regulations. The pH limits for identifying an aqueous waste as a corrosive waste would be narrowed. Wastes with a pH between 2 and 3, or between 12 and 12.5, would not be regulated as a corrosive waste under this alternative. The concentrations of contaminants in the extract used to identify a waste as toxic waste would also be raised.* Wastes whose extract contains a concentration of any specified contaminant that is between 10 and 100 times its EPA Primary

*Under this alternative, wastes meeting the toxicity characteristic are defined as Type I toxic wastes to distinguish them from other wastes that are listed as toxic based on criteria other than this toxicity characteristic (see Table 4-4). To be consistent with other portions of the EIS, the Type I toxic waste is referred to as toxic waste in this section, and the other listed toxic wastes are referred to as general toxic wastes.

Drinking Water Standard would not be regulated as a toxic waste under this alternative.

Changes in the quantity of wastes to be regulated would also result from modifications to the criteria for listing hazardous waste and modifications to the lists themselves. The criterion of Administrator's Judgment for listing wastes would be eliminated and replaced by a set of specific criteria for listing waste. Little or no change in the quantity of waste regulated is expected from this change since it is essentially a formalization of the decision process implicitly used under the baseline regulations.

The lists of hazardous wastes from specific and non-specific sources and the list of infectious waste would all be modified under this alternative. Wastes would be both added to and deleted from the lists. Many of the additional wastes listed would be included based upon the criteria of general toxicity (as opposed to the toxicity characteristic) and, thus, would not have been controlled under the baseline regulations. To the extent that any other wastes that are added to the lists would previously have been hazardous under the baseline characteristics, there would be essentially no change in the quantity of such wastes being regulated. Similarly, to the extent that any wastes deleted from the lists would still be hazardous under the characteristics of this alternative, there would also be essentially no change in the quantity of such wastes being regulated. The net effect of these changes in listed wastes is estimated to be an increase in the quantity of such wastes being regulated under this alternative, as compared to the baseline regulations.

With regard to waste materials that are both re-used and whose re-use constitutes disposal (e.g., wastes incinerated for energy recovery or re-used in road construction or as a soil conditioner), there would be a significant reduction in the quantity of such wastes regulated under this alternative. Under the baseline regulations, specified waste oils and any other hazardous waste whose re-use constitutes disposal would be subject to the regulations. Under this alternative, only specified waste materials* that are used, re-used, or stored for use or re-use would be subject to the regulations. Waste materials that are not specified would be excluded from regulation if used, re-used, or stored for use or re-use. Waste oil used for purposes other than material recovery or energy recovery is the only waste specified for regulation under this alternative.† Examples of wastes which, if identified as hazardous, would be excluded from regulation by this change include waste oils and solvents incinerated for energy recovery; coal ash used for road construction, as a soil conditioner, and as a de-icing agent on roads; cement kiln dust used for soil conditioning and road construction;

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*Waste materials include by-products as well as wastes.

†It is anticipated that additional materials would be specified; any such additional listing would off-set some of the reduction in waste being regulated as a result of this modification.

and iron and steel slags used for road construction, for landfilling, and as railroad ballast.

Specific Changes.

Manufacturing Waste. Under the baseline regulations, it is estimated that approximately 35 and 40 million metric tons of manufacturing waste could be subject to the Subtitle C regulations in 1980 and 1984, respectively. Except for the change in listed wastes, each modification discussed above would tend to reduce the quantity of manufacturing waste that is subject to regulation under this alternative. While the specific impact of most of these modifications is not quantifiable, it is estimated that there would likely be a net reduction in the quantity of manufacturing waste being controlled, as compared to the baseline regulations.

The change in the generator limit could result in a small (i.e., less than 0.1%) decrease in the quantity of manufacturing waste regulated during the first 2 to 5 years. Based upon Tables 7-2 and 8-7, this change could result in approximately 340,000 metric tons of manufacturing wastes being excluded from regulation during each of the first 2 to 5 years. There would be a total reduction of between 0.7 and 1.7 million metric tons of manufacturing waste being regulated during this period as a result of this change. However, some of this reduction would be off-set by the increased control of specified commercial chemical products and manufacturing chemical intermediates.

Modification of the characteristics for corrosivity and toxicity would also reduce, by an indeterminable amount, the quantity of manufacturing wastes being regulated. For example, some lime treated sludges would be excluded by the change in the corrosivity characteristic.

There would also be a significant reduction in the regulation of those hazardous waste materials that are re-used in a manner constituting disposal. For example, approximately 30 million metric tons of iron and steel slags were re-used in such a manner in 1976 (U.S. Environmental Protection Agency, 1979). Data are not available to estimate the portion of such slags or any other re-used waste materials (e.g., oils and solvents) that could be considered hazardous under the regulations and that could, thus, be excluded from regulation under this alternative.

Modifications to the listed wastes are estimated to result in a net increase in manufacturing wastes that would be subject to the regulations. For example, pesticide production wastes, PCB's and PCB items, and additional organic chemical wastes would be added to the hazardous waste lists. Cooling tower sludges, non-stabilized sewage treatment sludges, and copper production slags would be deleted.

Special Waste. The baseline regulations specify six, large volume, 'special wastes' that, if identified as hazardous, would be subject to a limited subset of the regulations. Under this alternative, all hazardous 'special wastes', except for uranium mining and phosphate rock mining, beneficiation, and processing wastes, would now be subject to the full set of Subtitle C regulations.* The uranium mining and phosphate mining, beneficiation, and processing wastes would still be subject to a limited subset of the regulations, though modified from the baseline regulations (see Table 4-4).

Changes in the generator limit and corrosivity and toxicity characteristics and in the control of waste materials that are re-used would reduce, by an indeterminable amount, the total quantity of all 'special wastes' that are subject to regulation under this alternative. For example, approximately 13 million metric tons of coal ash were re-used in 1977 (The Utility Solid Waste Activities Group and The Edison Electric Institute, 1979). Data are not available to estimate the portion of any coal ash or other re-used waste materials that could be considered hazardous under the regulations and that could thus be excluded from regulation under this alternative. An exclusion added for in-situ mining wastes would further reduce the quantity of 'special waste' being regulated. Changes in listed wastes would not effect the quantity of 'special wastes' being regulated.

The net effect would be an increase in 'special wastes' being subject to the full set of regulations, but a decrease in the total quantity of 'special wastes' being subject to any regulation.

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*It should be noted that several bills are presently pending in Congress to exempt, at least temporarily, most 'special wastes' from any regulation under Subtitle C.

Non-Manufacturing Waste. The net effect of this alternative is estimated to be a reduction in the quantity of non-manufacturing wastes being regulated, as compared to the baseline regulations.

The changes in the generator limit and the corrosivity and toxicity characteristics and in the control of waste materials that are re-used would reduce the quantity of non-manufacturing wastes subject to regulation by an indeterminable amount.* The change in listed wastes would also reduce the quantity of non-manufacturing wastes regulated. The list of infectious wastes would be more specific, resulting in fewer wastes from hospitals, veterinary hospitals, and medical and research laboratories being identified as hazardous. Cooling tower sludges would also be deleted from the lists while PCB's and PCB items would be added. Leachate from hazardous waste disposal facilities would also be added to the list; however, it is anticipated that most of this leachate would previously have been identified as hazardous under the baseline regulations.

Other changes would result in less waste from commercial establishments being subject to regulation. Under the baseline regulations waste automotive oil is the only waste from commercial establishments that would be subject to control. The waste automotive oil

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*A recent study (TRW, 1979) estimates that changing the generator limit from 100 kilograms per month to 1,000 kilograms per month could exclude about 15 percent of non-manufacturing wastes from regulation. However, much of this non-manufacturing waste is generated by commercial establishments and, as such, would already have been excluded under the baseline regulations.

from commercial establishments would be excluded from regulation under this alternative. However, control of waste chemical commercial products generated by commercial establishments would off-set some of this reduction in the control of commercial waste.

Under the baseline regulations, persons engaged principally in farming would be subject to the regulations only with regard to the generation of waste automotive oil. Under this alternative, such persons would be regulated with regard to all hazardous waste generated, except waste pesticides.* Consequently, there would be an increase in the quantity of farm wastes regulated when the generator limit is lowered to 100 kilograms per month. However, during the initial 2 to 5 year period when the generator limit is raised to 1,000 kilograms per month, there likely would be a net reduction in farm wastes regulated, as compared to the baseline regulations.

8.5.1.2 Changes to Generation, Transport, Storage, Treatment, and Disposal Practices. Changes to generation, transport, storage, treatment, and disposal practices would likely occur under this alternative due to the changes in wastes being regulated; due to implementation of the Interim Status Standards; due to revisions in procedural and operational requirements; and due to resultant changes in the cost of hazardous waste generation and in storage, treatment, and disposal costs.

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*Waste pesticide would be excluded from regulation provided it is generated by the farmer's own use and is managed as specified in Table 4-4.

In general, there would be some significant differences between those changes related to the management of hazardous 'special wastes' and those changes related to the management of all other hazardous wastes. These differences would be the result of the requirement that most hazardous 'special wastes' comply with the full set of Subtitle C standards under this alternative, rather than the limited set of standards specified under the baseline regulations. All other hazardous wastes are already required to comply with the full set of regulations. As a result, the changes related to 'special wastes' and the changes related to all other hazardous wastes are discussed separately throughout this section.

Generation. There would be changes in those generators that are required to comply with the generator regulations. A number of generators would be excluded from regulation under this alternative. These generators include those who, during the first 2 to 5 years, generate between 100 and 1,000 kilograms per month of almost any identified hazardous waste; those who generate only wastes deleted from the baseline hazardous waste lists; those who generate only wastes no longer identified as hazardous under the revised corrosivity and toxicity characteristics; those who general only wastes that are re-used in a manner constituting disposal; and those commercial sources generating only waste automotive oil. A number of additional generators would also be required to comply with the generator regulations. These generators include those who generate only wastes added to the baseline hazardous waste lists; those who only import hazardous wastes into the jurisdiction of the U.S.; those who generate only wastes from the specified commercial chemical products; and those farmers who only generate hazardous waste other than automotive oil or pesticides. Section 8.5.1.3 presents estimates of changes in the number of generators to be regulated.

Those generators excluded from regulation under this alternative would no longer be required to modify their existing practices and procedures, as indicated in Section 7.1.4.1, with regard to manifesting, reporting, recordkeeping, containerization, and labeling. Those additional generators brought under regulatory control would, on the other hand, be required to modify their existing practices and procedures. Furthermore, all generators regulated under this alternative would be subject to reduced manifest requirements and increased reporting, recordkeeping, and waste accumulation requirements, as indicated in Table 4-4. For example, generators who do not receive a signed copy of the manifest from the designated permitted facility within 35 days after acceptance by the initial transporter would have to contact the transporter and/or designated facility to determine the status of the movement.

Furthermore, with the exception of those generators of hazardous 'special wastes,' there would be less of an incentive for generators to modify their processes or activities so as to reduce and/or change the types and amounts of hazardous wastes generated and to enable the increased recycling of hazardous wastes as process feedstocks. This would be the result of reductions under this alternative in costs to such hazardous waste generators*; reductions in costs associated with transportation, storage, treatment, and disposal of these wastes*; reductions in the number of generators being regulated; and reductions in the quantity of wastes being regulated. Most generators of hazardous 'special wastes' would, however, have increased costs for storing, treating, and disposing their wastes since the wastes would be subject to the full set of regulations instead of a limited portion. This could provide an increased incentive for some of these generators to further modify their processes or operations so as to reduce and/or change the types and amounts of hazardous waste generated.

Transport. Changes in transport practices and procedures are discussed first with regard to hazardous wastes other than 'special wastes.' Changes related to the transport of hazardous 'special wastes' are then addressed.

Due to expected reductions in the quantity of hazardous wastes, other than 'special wastes', subject to the generator regulations, fewer transporters would likely have to comply with the transporter regulations discussed in Section 7.1.2.2. There would likely be increased instances of midnight dumping and spills from transport of those wastes excluded from regulation. The requirement that

*See the Economic Impact Analysis for Subtitle C, Resource Conservation and Recovery Act of 1976.

transporters deliver the waste movement only to facilities designated by the generator, along with the shorter interval for the reporting of manifests not received from the designated facility would, however, reduce the potential for any midnight dumping of regulated wastes. Any decreases in the average distances over which these regulated wastes are transported under this alternative could lead to a decrease in vehicular accidents and in resultant spills. This would off-set some of the increased potential for spills indicated above. Elimination of the prohibition on transporters accepting containers that are leaking or that appear damaged could slightly increase the potential for spills; however, since the transporter would be responsible for the waste during transport, it would not be in the transporters interest to accept such containers.

The average distance over which hazardous wastes (other than 'special wastes') are transported would likely decrease due to several factors. The requirements under this alternative would, to a small extent, reduce the likelihood of on-site and off-site treatment/disposal facility closure. However, the Interim Status Standards could result in those facility closings that do occur taking place sooner under this alternative than under the baseline regulations. Any increase in available facility capacity would potentially lead to reduced transport distances. Furthermore, increases in permittable on-site treatment/disposal capacity could result in fewer wastes being sent off-site. Decreases in treatment/disposal costs could also reduce the distance over which wastes could be economically transported for resource recovery purposes. However, any reductions in on-site resource conservation and recovery, as described above, could tend to increase the quantity of waste being sent off-site.

The replacement of the baseline requirements for spill notification and reporting with requirements specified under Department of Transportation regulations (49 CFR 171) and Coast Guard regulations (33 CFR 153) would further reduce changes to some existing transport practices. Interstate and some intrastate shipments of those hazardous wastes that are also identified as DOT hazardous materials are currently subject to these DOT regulations. Consequently, existing spill notification and reporting practices would not have to be modified in the case of spills of such wastes. Also, water (bulk shipment) transporters are currently subject to the Coast Guard Regulations for any spill that could threaten navigable waters; any spill that is into or upon navigable waters, adjoining shorelines, or contiguous zones; or any spill that may affect applicable natural resources. Thus, these transporters would not have to modify their existing spill notification procedures in the event of such spills. The reporting requirement added under the baseline regulations for spills by these transporters would also be eliminated under this alternative.

Other changes would impose additional administrative requirements on transporters. Those transporters who ship hazardous waste out of the U.S. would be subject to additional reporting and recordkeeping requirements. Water (non-bulk shipment) transporters would have to obtain signatures for intramodal transfers of hazardous waste. All transporters would be required to obtain signatures immediately upon delivery of the waste to the designated facility, instead of within 5 days as allowed under the baseline regulations.

With regard to hazardous 'special wastes,' there would be a lesser quantity of such waste subject to regulation under this alternative. However, there could be a net increase in the quantity of hazardous special wastes being sent off-site and, thus, in the number of transporters of 'special wastes' who would be required to comply with the transporter regulations previously discussed. Currently, 'special wastes' are typically managed at on-site facilities. Imposition of the full set of Subtitle C regulations could result in the closing of some of these on-site facilities; this could lead to increased off-site shipments of hazardous 'special wastes.' Increased off-site shipments could potentially result in increased spills of such wastes and increased vehicular accidents.

Transport practices for those hazardous 'special wastes' already shipped off-site under the baseline regulations would be modified in a manner similar to that discussed above for hazardous wastes other than 'special wastes.'

Storage. Changes in storage practices and procedures are discussed first with regard to hazardous wastes other than 'special wastes.' Changes related to the storage of hazardous 'special wastes' are then addressed.

Due to anticipated reductions in both the number of generators and the quantity of hazardous wastes (other than 'special wastes') regulated under this alternative, it is likely that fewer storage facilities handling such wastes would have to comply with the storage regulations discussed in Section 7.1.2.3. As a result, fewer of these facilities could be required to be modified or closed. Those closings or modifications that do occur could, however, take place sooner under this alternative due to the requirements of the Interim Status Standards. Facilities excluded from regulation under this alternative would not have to change existing storage practices. However, for those facilities still regulated, compliance with the Interim Status Standards could necessitate earlier implementation of required changes to existing practices. Regulated facilities would also have to comply with the modified requirements contained in Table 4-4.

With regard to hazardous 'special waste,' there would be a lesser quantity of such wastes subject to regulation under this alternative. Thus, fewer facilities storing these wastes would have to comply with the storage requirements. However, for those facilities still regulated, compliance with the full set of storage requirements would likely lead to additional changes in existing practices, similar to those discussed in Section 7.1.2.3, and to additional modifications and closings. These facilities would also have to implement some required changes sooner, in accordance with the Interim Status Standards.

Treatment/Disposal. Changes in treatment/disposal practices are discussed first with regard to hazardous wastes other than 'special wastes.' Changes related to the treatment/disposal of hazardous 'special wastes' are then addressed.

Due to anticipated reductions in both the number of generators and quantity of hazardous waste (other than 'special wastes') regulated under this alternative, it is likely that fewer treatment/disposal facilities would have to comply with the treatment/disposal regulations discussed in Section 7.1.2.4. As a result, fewer facilities would be closed because they could not comply with the regulations or could not be economically modified. Those closings or modifications that do occur could take place sooner, however, due to the requirements of the Interim Status Standards. To the extent that fewer on-site facilities were closed and fewer wastes and generators were regulated, there would be a potential for fewer wastes to be sent off-site for treatment/disposal. However, reductions in on-site resource conservation and recovery practices, as described above, could tend to off-set any such change in wastes being sent off-site.

Facilities excluded from regulations would not have to change existing treatment/disposal practices. However, for those facilities still regulated, compliance with the Interim Status Standards could necessitate the earlier implementation of some changes to existing practices. In addition, regulated facilities would now also have to comply with the other modified requirements contained in Table 4-4. Some of these requirements would be more stringent than those of the baseline regulations. For example, the period for post-closure care would be increased from a period not to exceed 20 years to a period of at least 30 years in most cases. Other requirements would be less stringent. For example, all Human Health and Environmental Standards and all requirements to comply with such standards would be eliminated. And still other requirements would be essentially equivalent to baseline requirements in their effect, but would be more flexible in their application. For example, the requirement that the active portion of a facility must be surrounded by a fence or barrier would be replaced by several options for insuring equivalent site security.

With regard to hazardous 'special wastes,' there would be a lesser quantity of such waste subject to regulation under this alternative. Thus, fewer facilities treating/ disposing these wastes would have to comply with the treatment/disposal regulations. However, for those facilities still regulated, compliance with the full set of treatment/disposal requirements would likely lead to additional changes in existing practices, similar to those discussed in Section 7.1.2.4, and to additional facility modifications and closings. These facilities would also have to implement some of these changes sooner, in accordance with the Interim Status Standards. To the extent that existing on-site facilities were closed, increased quantities of hazardous special wastes could be sent off-site. The regulated facilities would also have to comply with the modified requirements contained in Table 4-4.

8.5.1.3 Administrative Changes. Several changes in the administration of the hazardous waste management program would result from promulgation of the regulations within this alternative. These regulations would affect:

- State administration of the program;
- Overlapping Federal and state programs;
- Number of generators required to comply with the regulations;
- Number of transporters required to comply with the regulations;
- Number of storers, treaters, and disposers required to obtain permits;
- Paperwork requirements.

State Administration of the Program. It is likely that there would be little change in the number of states applying for interim and full authorization under this alternative. Reductions in both the quantity of wastes being regulated and the number of generators, storers, treaters, and disposers being regulated would lead to some reduced administrative and manpower requirements for authorized states and could increase the willingness of a few states to apply for authorization. The revisions contained in Table 4-4 are based, in part, upon public comments received on the proposed Subtitle C requlations and as such could also increase the willingness of some states to apply for authorization. However, those revisions include less stingent requirements, more stingent requirements, and equivalent but more flexible requirements than those of the baseline regulations. While these changes could make some states more willing to apply for authorization, they could make some other states less willing to apply.

Partial authorization would be eliminated. As a result, some states that might have applied for partial authorization could attempt to become eligible to qualify for full authorization. However, others could decide not to apply for either interim or full authorization.

<u>Overlapping Federal and State Programs.</u> The elimination of partial authorization could increase the potential for a few states to enact one or more components of an independent, hazardous waste program. However, the revised regulations under this alternative would not be expected to significantly impact the number of states desiring to enact their own independent programs. It is not possible at this time to estimate the nuber of states, if any, that would wish to have independent programs or program components in addition to the Federal program under this alternative.

<u>Number of Generators Required to Comply With the Regulations.</u> As indicated in Section 8.5.1.2, there would likely be a net reduction in the total number of generators required to comply with the regulations.

The increase in the generator limit could result in approximately 105,000 additional manufacturing generators being excluded from compliance with the regulations during the first 2 to 5 years (see Tables 7-2 and 8-7). The total number of manufacturing generators excluded during this period would represent about 60 percent of all manufacturing generators; however, they are estimated to generate less than 1 percent of the total hazardous manufactuing wastes. On balance, some additional manufacturing generators could also be excluded by the other changes discussed in Section 8.5.1.1, however data are not sufficient to estimate the number of any such additional exclusions.

Commercial facilities generating waste automotive oil would be excluded from regulation under this alternative. As a result, approximately 50,000 automotive service stations, plus those persons assuming liability for waste automotive oil generators, could be excluded from regulation (see Section 7.1.3.3). About 5,800 research faciliteies could be excluded during the first 2 to 5 years due to the revision in the generator limits (see Section 8.4.1.3). An indeterminable number of other non-manufacturing generators would also be affected. For example, additional numbers of farmers, hazardous waste importers, and facilities generating wastes from commercial chemical products would be required to comply with the regulations. Other non-manufacturing generators would be excluded by changes in the corrosivity and toxicity characteristics and in the listed wastes. In addition, an indeterminable number of 'special waste' generators would be excluded by the changes discussed in Section 8.5.1.1.

Under the baseline regulations, approximately 270,000 to 300,000 generators are identified as potentially having to comply with the regulations (see Section 7.1.3.3). Based upon the additional exclusions discussed above, during the first 2 to 5 years, on the order of 110,000 to 140,000 identified generators could be required to comply with the regulations under this alternative. This would represent nearly a 60 percent reduction in identifiable generators. At the end of this 2 to 5 year period, on the order of 220,000 to 250,000 identified generators could be required to comply. This would represent over a 15 percent reduction. As discussed above, there would also be an indeterminable reduction in the number of other generators who would be required to comply with the regulations.

Number of Transporters Required to Comply with the Regulations. The reduction in the amounts of regulated hazardous wastes (other than 'special wastes') that would potentially be transported off-site would likely result in an indeterminable decrease in the number of transporters carrying these hazardous wastes. The increased amounts of regulated 'special wastes' that could potentially be transported off-site would likely result in an increase in the number of transporters carrying these wastes.

Number of Storers, Treaters, and Disposers Required to Obtain Permits. Since there are no permit exclusions under the baseline regulations for storage, treatment, or disposal facilities that handle only small quantities of hazardous wastes, all facilities storing treating, or disposing hazardous wastes would be required to obtain a permit under the baseline regulations with the exception of generators who accumulate wastes on-site for less than 90 days prior to off-site transport. Thus, the only facilities that would be entirely excluded from the requirements to obtain a permit under this alternative would be those facilities that handle only those wastes that would be classified as hazardous under the baseline regulations, but that would not be classified as hazardous under this alternative. In addition, facilities receiving wastes only from generators producing between 100 and 1,000 kilograms per month of hazardous wastes would be excluded from the requirement to obtain a permit during the first 2 to 5 years of the program. The only additional facilities that would be required to obtain a permit under this alternative would be those facilities that handle wastes that would not be classified as hazardous under the baseline regulations, but that would be classified as hazardous under this alternative. On balance, the number of facilities requiring permits is expected to be slightly reduced, as compared to the baseline regulations. However, facilities managing 'special wastes' would now have to comply with the full set of treatment, storage, and disposal regulations.

Paperwork Requirements. The information required on manifests would be reduced under this alternative as indicated in Table 4-4. Based upon the expected change in off-site shipments of hazardous waste, generators of hazardous 'special wastes' could have to prepare additional manifests under this alternative. The aggregated generators, transporters, and hazardous waste management facility owners/operators handling these wastes would also have to keep the additional manifests in storage for 3 years. There would, however, likely be a net reduction in the number of manifests that would be prepared by generators of other hazardous wastes. The aggregated generators, transporter, and hazardous waste management facility owners/operators handling these latter wastes would also have to keep fewer manifests in storage. The total number of manifests prepared and stored would be less during the first 2 to 5 years than in the following years.

The generators previously identified would have to prepare 110,000 to 140,000 reports on an annual basis during the first 2 to 5 years and 220,000 to 250,000 reports on annual basis therafter; this would represent nearly a 60 percent decrease in annual reporting during the first period and over a 15 percent decrease thereafter.

Generators would also be subject to additional recordkeeping and reporting requirements under this alternative. Copies of annual reports, exception reports, test results, waste analyses, and other required records (see Table 4-4) would have to be retained for at least 3 years. Following the first 2 to 5 year period, over 660,000 to 750,000 of each of these records could be kept in storage on an annual basis. For international shipments, generators would have to comply with the additional rporting requirements in Table 4-4 (e.g., notifying the Regional Administrator two weeks before the initial shipment to any foreign country in each year). However, these generators would have to report on international shipments annually, rather quartherly as under the baseline regulations. Generators who designate hazardous waste for off-site management at a facility which the generator owns and which is located in the same state in which waste generation occurs would also be required to prepare annual reports and exception reports and to retain copies of manifests under this alternative, but not under the baseline regulations.

The generators previously identified would initially have to file on the order of 110,000 to 140,000 notifications under Section 3010. This would represent nearly a 60 percent decrease in the number of such notifications. At the end of the first 2 to 5 year period, approximately 110,000 additional generators would have to file such notifications. Overall, there would be about a 15 percent reduction in the number of notifications filed by generators.

Transporters would have to prepare fewer spill reports under this alternative since only those hazardous waste spills meeting the requirements of 49 CFR 171 would have to be reported. Reportable spills include those which result in a person being killed or receiving injuries requiring hospitalization and those resulting in a continuing danger to life, health, or the environment at the scene of the incident.

Under this alternative, owners/operators of facilities treating, storing, or disposing hazardous waste would be subject to revised reporting and recordkeeping requirements in the period after being issued a permit and to additional reporting and recordkeeping requirements in the period before being issued a permit. Changes related to reporting and recordkeeping by permitted facilities are discussed first.

The total number of facilities requiring permits is not expected to be significantly less under this alternative than under the baseline regulations.* Any reduction in the number of annual reports prepared by permittees would thus be relatively small under this alternative. There could, however, be a large reduction in the number of monitoring reports prepared by permittees. After completing one year of monitoring, permittees would have to submit all subsequent monitoring reports annually rather than quarterly; furthermore, these monitoring reports would be submitted as part of the annual report rather than as additional reports. Under the baseline regulations there could be up to 117,000 such monitoring reports prepared annually. Using the number of potential permittees from the baseline regulations as an estimate of the upper limit of the number of permittees under this alternative, there could be up to 29,000 monitoring reports prepared annually under this alternative once all facilities have completed one year of monitoring. This would represent a reduction of at least 75 percent in such reports.

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*However, for reasons discussed above, slightler fewer facilities would be sujbect to the treatment, storage, and disposal regulations under this alternative during the first 2 to 5 years than in the following years. The total amount of reporting and recordkeeping would thus be slightly less on an annual basis during these first 2 to 5 years than in the following years.

Permittees would also be subject to revised recordkeeping requirements under this alternative. Groundwater monitoring data would have to be retained until closure of the facility rather than for 3 years; in the case of disposal facilities, the monitoring data would have to be kept throughout the entire post-closure period. Inspection records would have to be retained for 3 years rather than until facility closure. Training records for current employees would have to be kept until closure of the facility rather than for 3 years. For former employees these records would have to be kept for three years from the time of the employee's departure.

These facility owners/operators would also be subject to other administrative requirements. For example, waste analysis, inspection, and post-closure plans would have to be prepared and submitted with Part B of the permit applications. Outlines of programs for both groundwater damage assessment and for groundwater corrective action would also have to be prepared and submitted with the permit application. Owners/operators of facilities receiving waste from off-site would have to notify generators in writing that they have the appropriate permit for and will accept delivery of the waste the generator is shipping. Facility owners/operators would also have to notify the Regional Administrator at least two weeks before the expected date of arrival of hazardous waste shipments from foreign sources.

Due to the expected reduction in the number of permittees, there would be a slight decrease in the total number of notifications required to be filed by facility owners/operators under Section 3010 and in the number of permit applications prepared under this alternative. However, any reductions in permit applications would be off-set by the requirement that permits be reviewed at least once every 5 years rather than being issued for the projected life of the facility. Consolidation of requirements for obtaining NPDES permits under the Clean Water Act, UIC permits under the Safe Drinking Water Act, Section 404 permits under the Clean Water Act, and facility permits under RCRA would reduce the overall administrative requirements associated with such permits.

Facility owners/operators would also be subject to additional reporting and recordkeeping requirements in the period before being issued a permit. During this period, the owners/operators of existing facilities would be subject to the Interim Status reporting and recordkeeping requirements indicated in Table 4-4. These Interim Status requirements would essentially be identical to the reporting and recordkeeping requirements applicable to permittees. Under the baseline regulations, facility owners/operators would not be subject to reporting or recordkeeping requirements until after being issued a permit.

8.5.1.4 Air Impacts.

Air Quality. The regulations under this alternative would have the potential to cause changes affecting the release of air contaminants resulting from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations.

Generation. As previously discussed, the baseline regulations would not have a direct effect on air emissions resulting from activities and processes generating hazardous wastes. However, for generators of hazardous wastes other than 'special wastes,' to the extent that the requirements under this alternative would cause lesser changes in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be less of a potential for these generators to make process modifications designed to increase hazardous waste recycling and to reduce the quantity and/or types of hazardous wastes generated; any such reductions in process modifications under this alternative would likely lead to fewer changes in air emissions released by processes generating hazardous waste. For generators of 'special wastes,' to the extent that the requirements under this alternative would cause further increases in the economics of storage, treatment, or disposal relative to those of the baseline regulations, there would be a greater potential for generators of these wastes to make process or operational modifications designed to reduce the quantity and/or types of hazardous wastes generated; any such modifications could lead to increased changes in air emissions released by processes generating hazardous wastes. To the extent that fewer generators would be brought under control of the program in both instances, the overall potential for any such process modifications and resultant changes in the release of air emissions would be accordingly reduced.

Transport. As indicated in Section 7.1.4.1, there are three major ways air contaminants are released by the transport of hazardous wastes:

- Through fugitive emissions resulting from improperly covered, sealed, or containerized wastes;
- Through emissions resulting from spills or other accidental releases of hazardous wastes;
- Through emissions resulting from the operation of the transport vehicle.

As discussed below, this alternative would affect, to varying degrees, the potential for the release of air emissions from each of these sources.

Less waste would likely be regulated under this alternative than under the baseline regulations. As a result, transport of the wastes removed from regulation would not have to be carried out in accordance with the Section 3002 containerization requirements or the Section 3003 transport requirements unless the wastes were also identified as hazardous materials under the DOT Hazardous Materials Transport Act.* Thus, to the extent that these wastes would be containerized or transported using methods not acceptable under the baseline regulations, the potential for the release of fugitive emissions by such transport and from any resultant spills or explosions would be

*In such a case, for all interstate transport and some intrastate transport, the wastes would be subject to many of the same containerization and transport requirements as under the baseline regulations.

increased under this alternative. Section 7.1.4.1 discusses the potential for the release of air emissions from unregulated transport practices.

For those hazardous wastes other than 'special wastes,' both the total quantity of regulated wastes being transported and the average distance over which such wastes are transported could decrease under this alternative, as previously indicated. Any such reductions would lead to the release of fewer vehicular emissions and to a reduced potential for vehicular accidents to occur and to release air emissions. However, the elimination of spill response information from manifests could increase the time for spill clean-up and thus increase the potential for the release of air contaminants from such spills. Elimination of the prohibition on transporters accepting containers that are leaking or that appear damaged could also increase the potential for spills or for the release of fugitive emissions from the transport of regulated wastes; however, acceptance of such containers would not be in the transporter's interest under the Subtitle C regulations.

For hazardous 'special wastes' there could be an increase in the quantity of regulated wastes being transported off-site under this alternative. This would increase the potential for the transport of such wastes to release fugitive emissions, to release vehicular emissions, and to result in vehicular accidents causing spills. Particulate matter would likely be the major air contaminant released by such spills. Any increased transport of 'special wastes' would, however, have to be in compliance with all Subtitle C generator and transporter requirements.

For all wastes, the changes in fugitive emissions, vehicular emissions, and emissions resulting from accidents and spills would be dependent upon such factors as the change in travel distances, the change in portion of hazardous wastes transported off-site, and the change in the amount of regulated wastes being transported.

Storage, Treatment, and Disposal. As discussed in Section 7.1.4.1, there are several major ways that air contaminants can be released by current hazardous waste storage, treatment, or disposal practices:

- Through fugitive emissions resulting from improper storage of hazardous wastes;
- Through fugitive emissions from ground-based treatment/disposal activities such as landfills, landfarms, and surface impoundments;
- Through emissions occurring as the result of storage becoming the ultimate form of disposal of hazardous wastes;
- Through emissions generated by spills, fires, explosions, and other accidents;
- Through the combustion of hazardous wastes by incineration or open burning;
- Through fugitive emissions from other treatment activities;
- Through fugitive emissions from facility construction or modification

This alternative would affect the potential for the release of air contaminants from each of these sources in various ways as discussed below.

To the extent that additional storage, treatment, or disposal facilities for hazardous 'special wastes' would have to be modified or constructed under this alternative, there would be an increase in fugitive dust and vehicular emissions from such construction activities. To the extent that fewer facilities for other hazardous wastes would have to be modified or constructed under this alternative (see Section 8.5.2.4), there would be a decrease in fugitive dust and vehicular emissions from such construction activities. Such emissions would be extremely site dependent.

Less waste would likely be regulated under this alternative than under the baseline regulations. As a result, those hazardous wastes excluded from regulation would not have to be stored, treated, or disposed in accordance with the Section 3004 regulations. Since it is likely that most of these wastes would not be managed by methods that are environmentally acceptable under the Section 3004 regulations, the overall potential for the release of air contaminants from the management of such wastes would be increased under this alternative relative to the baseline regulations. Wastes that are incinerated for energy recovery (e.g., waste solvents and oil) represent one type of waste that would be excluded from regulation under this alternative. Section 7.1.4.1 discusses the potential for the release of air contaminants from unregulated treatment, storage, and disposal practices.

With regard to the hazardous waste that would still be regulated under this alternative, the requirements under this alternative would have to potential for affecting the release of air contaminants from the management of these wastes in various ways. For example, most of the 'special wastes' would now have to be stored, treated, or disposed in accordance with the full set of Section 3004 requirements rather than a limited portion of these requirements. Most of the requirements applicable to these wastes under this baseline regulations relate to general facility practices, such as reporting and recordkeeping, visual inspections, post-closure care, and waste analyses, rather than to specific treatment, storage, or disposal practices. As such, they would have little effect on the release of air contaminants from such wastes. By subjecting these wastes to the full set of Section 3004 requirements, the overall potential for the release of air contaminants from the management of these wastes would be reduced in a manner similar to that described in Section 7.1.4.1 (with modifications as discussed below).

The Interim Status Standards would further reduce the potential for the release of air emissions from the management of all wastes regulated under this alternative. Existing facilities would not be required to modify their current practices until after being issued a permit under the baseline regulations. Thus, in the period before being issued a permit, it is likely that regulated wastes would continue to be managed by methods that would not be environmentally acceptable under the Interim Status Standards. Under this alternative, existing facilities would have to manage wastes in accordance with the Interim Status Standards until they were issued a permit. Provisions of the Interim Status Standards that should reduce the potential for the release of air emissions during this period are discussed below.

The Interim Status standards would require that facility owners/operators inspect facilities for equipment malfunctions and deterioration, operator errors, and spills which may be causing or which may lead to the release of hazardous constituents to the air; the Interim Status Standards would also require owners/operators to make necessary repairs or take necessary remedial action. The facilities would have to be maintained and operated so that the possibility of a discharge, fire, or explosion which could threaten the environment or human health outside the facility is minimized. Ignitable or reactive wastes would have to be separated and protected from sources of ignition or reaction. Contingency plans would have to be developed to minimize human health and environmental damage in the event of an unplanned sudden or non-sudden discharge of hazardous waste. During an emergency, the facility's emergency coordinator would have to take all reasonable measures to ensure that fires and explosions do not occur, re-occur, or spread and would have to monitor for leaks, pressure buildups, gas generation, or ruptures if the facility stops operations.

In addition, ignitable, reactive, and/or incompatible wastes would be prohibited from being placed in tanks, surface impoundments, land treatment facilities, or landfills unless the waste both would not generate heat, fumes, fires, or explosive reactions and would be rendered non-ignitable or non-reactive by such activities. Ignitable and/or reactive wastes could not be placed in waste piles unless the above two conditions were met. Incompatible wastes would be prohibited from being placed in the same container or pile, and containers or piles holding incompatible wastes would have to be separated from incompatible wastes in other piles, containers, or impoundments. Furthermore, all wastes placed in piles would have to be covered or otherwise managed so as to prevent wind dispersal.

Incinerators would have to be brought to steady state (normal) conditions of operation before hazardous wastes were added so as to insure adequate destruction of the waste and to minimize the release of air contaminants. Wastes would have to be analyzed to establish steady state operating conditions and to determine the types of pollutants that might be emitted. The stack plume and existing instruments which relate to combustion and emission control would have to be monitored periodically to insure that the incinerator was operating properly. The complete incinerator and associated equipment would have to be inspected at least daily for leaks, spills, and fugitive emissions. Open burning would be prohibited for all wastes except explosive wastes.

Following the Interim Status period, other changes under this alternative would further affect the potential for the release of air emissions. With regard to equipment malfunctions or deterioration, a requirement would be added for making repairs or taking other remedial action on a timely basis so as to ensure that environmental or human health hazards do not occur. A requirement would also be added for contingency plans to include provisions for controlling spills. To the extent that such provisions reduce the number of spills or the time for spill clean-up, the potential for the release of air emissions would be reduced.

The air human health and environmental standards would be eliminated under this alternative. This would reduce the potential for decreases in the release of air contaminants from non-point sources (e.g., surface impoundments, landfills, storage areas) at permitted facilities, as compared to the baseline regulations. The air human health and environmental standard would have required that non-point sources of air emissions not contribute any listed air contaminant (see Appendix B, Subpart D, Annex 2) to the atmosphere, at the surface of the non-point source, in concentrations exceeding the listed Threshold Limit Value (TLV) for that contaminant, nor contribute two or more listed air contaminants in a manner which causes the sum of the individual concentrations divided by the individual TLV's to exceed unity. Examples of air contaminants to which the air human health standards would apply and which have been identified in the reported incidents cited in Section 7.1.4.1 include acetone, asbestos, benzene, carbon monoxide, carbon tetrachloride, methane, and methylene chloride. As discussed in Section 7.1.4.1, the air human health and environmental standard would apply only after the standard was violated; it would not be a means to initially prevent the release of air contaminants. Thus, under this alternative, air emissions from regulated wastes would be increased to the extent that releases from non-point sources would exceed the limits indicated above.

It should be noted that there would likely be some shift in the types of methods used to store, treat, or dispose both regulated wastes and the wastes excluded from regulation under this alternative compared to the methods that would have been used to manage these wastes under the baseline regulations. For example, the elimination of air human health and environmental standards could reduce the incineration of some wastes and increase their landfilling or treatment in surface impoundments, relative to the baseline regulations. Such shifts would change both the types and quantities of air emissions produced by the management of specific wastes. For example, a shift from incineration to landfilling of a particular waste would potentially result in a decrease in the release of combustion products and an increase in the release of particulate matter and/or gases contained in the waste. Such shifts could either enhance or reduce the potential for this alternative to cause the indicated increased or decreases in the release of specific air emissions in any given locality. Furthermore, the construction of new facilities could lead to increased releases of air emissions in the vicinity of the facility and along any transport routes. Closure of existing facilities could lead to reduced releases of air emissions. All emissions and any localized degradation of air quality would have to be in compliance with all applicable requirements (e.g., Clean Air Act standards, OSHA standards, state standards).

Climate. To the extent that additional hazardous waste management facilities would have to be constructed and operated for hazardous 'special wastes' under this alternative, there could be increased localized impacts to temperatures, humidities, and low-level wind patterns from such construction. To the extent that fewer hazardous waste management facilities would have to be constructed for other hazardous wastes, there could be fewer localized impacts to temperatures, humidities, and low-level wind patterns. Any such effects would be expected to be extremely localized.

8.5.1.5 Water Quality Impacts. The regulations under this alternative would have the potential to cause changes affecting the release of water contaminants from the generation, transport, storage, treatment, and disposal of hazardous wastes, as compared to the baseline regulations. As discussed below, this would lead to instances of both incresed and reduced localized improvements in water quality, as compared to the baseline regulations.

Many of the potential changes to groundwater and surface water impacts would occur in much the same manner as the potential changes discussed under air quality. To avoid redundant discussions, such changes are summarized below rather than discussed in detail. Other major changes are described in more detail.

As indicated, generators of hazardous 'special wastes' would be more likely to make process modifications designed to reduce the quantity and/or types of hazardous wastes generated and to increase recycling of such wastes. This would likely lead to increased changes in any water effluents being produced by such processes and thus to increased changes in any resultant groundwater and surface water contamination. Generators of other hazardous wastes would be less likely to make such process modifications. This would lead to fewer changes in any water effluents produced by such processes and thus to fewer changes in any resultant groundwater and surface water contamination. To the extent that fewer generators would be brought under control of the program in both instances, the overall potential for any such process modifications and resultant changes in the release of water contaminants would be accordingly reduced.

For hazardous wastes other than 'special wastes', both the total quantity of waste being transported subject to the Subtitle C regulations and the average distance over which the wastes are transported could decrease under this alternative. A decrease in the quantity of such waste transported subject to the regulations would increase the potential both for midnight dumping and spills and for resultant impacts to groundwater and surface water quality. Other changes discussed under air quality, such as the elimination of spill response information from the manifest, could further increase both the potential for spills to occur and the time for clean-up of such spills, thus increasing the potential for water quality degradation. However, any decrease in the average distance over which these wastes are transported would decrease the potential for vehicular accidents and for resultant spills. Reduced transport distances would also result in decreased vehicular emissions and in a decreased potential for oil, grease, and the hydrocarbons and heavy metals contained in vehicular exhausts to be carried into waterways by run-off.

For hazardous 'special wastes', there could be an increase in the quantity of regulated wastes being transported off-site. This would increase the potential both for vehicular accidents to occur and to cause spills and for oil, grease, and the hydrocarbons and heavy metals contained in vehicular exhausts to be released and carried into waterways. Other changes discussed above could further increase the potential for water quality impacts. Any increased transport of 'special wastes' would, however, have to be in compliance with all Subtitle C generator and transporter requirements.

The hazardous wastes excluded from regulation under this alternative would not have to be stored, treated, or disposed in accordance with the Section 3004 regulations, though they could be subject to applicable regulations under Subtitle D of RCRA and other

State and Federal legislation (e.g., the Clean Water Act and the Safe Drinking Water Act). Wastes with a pH between 2 and 3 or between 12 and 12.5 and wastes whose extract contains any specified water contaminant in a concentration between 10 and 100 times its EPA Primary Drinking Water Standards would be among those excluded. Based on current practices, many of the wastes excluded from regulation would not be stored, treated, or disposed by methods which are environmentally acceptable under the Section 3004 regulations. Thus, the potential for groundwater and surface water degradation from management of these wastes would be increased relative to the baseline regulations. Section 7.1.5 describes the potential for surface water and groundwater impacts from the treatment/disposal of such wastes under current practices and requirements.

With regard to the hazardous waste that would still be regulated, the requirements under this alternative would have the potential for affecting the release of water contaminants from the management of these wastes in various ways. Some of the requirements would result in an increase in the potential for the release of such contaminants relative to the baseline regulations while others would result in a decrease. Changes that could potentially have significant affects on the release of contaminants are discussed below.

To the extent that additional storage, treatment, or disposal facilities for hazardous 'special wastes' would have to be modified or constructed, there would be an increase in fugitive dust, vehicular emissions, and runoff from such construction activities. To the extent that fewer facilities for other hazardous wastes would have to be modified or constructed, there would be a decrease in fugitive dust, vehicular emissions, and runoff. Such emissions would be extremely site dependent.

Much hazardous 'special wastes' would now have to be stored, treated, or disposed in accordance with the full set of Section 3004 requirements rather than just a limited portion of these requirements. By subjecting these wastes to the full set of Section 3004 requirements, the overall potential for the release of water contaminants from the management of these wastes would be reduced in a manner similar to that described in Section 7.1.5 (with modifications as discussed below).

The Interim Status Standards would further reduce the potential for the release of water contaminants and for resultant water quality impacts from the management of all wastes regulated under this alternative. As discussed under air quality, various requirements, such as those for inspections, repairs, contingency plans, and emergency procedures, would reduce the potential for spills and for other unplanned suddent and non-suddent discharges, thus reducing the potential for water quality impacts.

In addition, the Interim Status Standards would require that within one year after the effective data of the regulations that owners/operators of surface impoundments, landfills, or land treatment facilities intall, maintain, and operate a groundwater monitoring system. These owners/operators would also be required to prepare an outline of and time estimate for completion of a groundwater damage assessment program based on this monitoring.

The Interim Status Standards would also impose general requirements for controlling or containing spills and/or runoff from landfills, surface impoundments, tanks, waste piles, and land treatment facilities. For example, surface impoundment would have to maintain enough freeboard to prevent overtopping of the dike by overfilling, wave action, or storm event. Restrictions would also be placed on the management of wastes that could lead to the release of water contaminants. For example, the restrictions discussed under air quality on the management of incompatible, reactive, or ignitable wastes would reduce the potential for damage to storage, treatment, or disposal areas and for resultant releases of water contaminants. Additional restrictions related to preventing water quality impacts include a prohibition on placing bulk liquid wastes in a landfill unless the landfill has a functioning liner and leachate collection and removal system, the liner is chemically resistant to the waste, and the collection and removal system has a capacity sufficient to remove all leachate produced.

Following the Interim Status period, other changes under this alternative would further reduce the potential for the release of water contaminants and for the degradation of water quality. As discussed under air quality, these include requirements for making repairs or taking remedial action on a timely basis and for adding provisions to the contingency plan for controlling spills and unplanned non-sudden dischages. In addition, facility owners/operators not covered by the Interim Status Standards would be required to prepare an outline of and time estimate for completion of a groundwater damage assessment program. All owners/operators would also be required to prepare an outline of and time estimate for completion of a groundwater corrective action program to be implemented if the groundwater damage assessment program indicates the need for such action. Requirements would also be added for groundwater monitoring at land treatment facilities and at some tanks; however, groundwater monitoring would be eliminated at incineration facilities. The post-closure care period and associated groundwater monitoring activities would be extended from a time not to exceed 20 years to a period of at least 30 years.

On the other hand, leachate monitoring requirments would be eliminated under this alternative, and groundwater monitoring samples would have to be analyzed for fewer parameters characterizing water quality. Elimination of leachate monitoring would extend the time before potential water quality problems could be detected and would thus reduce the potential for the prevention of significant impacts to water quality. However, other revisions incorporated under this alternative would off-set much of the potential for an increase in significant water quality impacts. These include increases in the minimum number of monitoring wells; revisions in the siting of monitoring wells and in the frequency of sample collection and analysis; and requirements for groundwater damage assessment programs and groundwater corrective action programs. Reductions in the number of water quality parameters being analyzed under this alternative would increase the potential for some water quality problems to go undetected; however, in most instances the parameters still being analyzed are considered to provide essentially the same level of protection as those of the baseline regulations in detecting occurrences of groundwater contamination.

The surface water and groundwater human health and environmental standards would also be eliminated under this alternative. This would reduce the potential for non-point preventing sources (e.g., surface impoundments, landfills, storage areas) at permitted facilities from contributing to surface water and groundwater quality degradation, as compared to the baseline regulations. However, as discussed in Section 7.1.5, these human health and environmental standards would not have applied until after either a release of water contaminants or a reduction in groundwater or surface water quality violated the standard; they would not have been a means for initially preventing the release of water contaminants and subsequent water quality degradation.

The surface water human health and environmental standard would have required that all facilities be located, designed, constructed and operated in such a way that any surface or subsurface discharge from the facility into waters of the United States does not at any time cause a violation of Water Quality Standards promulgated or approved under Section 303 of the Clean Water Act, or constitute a spill of hazardous substances under Section 311 of the Clean Water Act. The groundwater hunan health and environmental standard would have required that facilities be located, designed, constructed, and operated in such a manner that they do not degrade any groundwater such that an Underground Drinking Water Source anywhere outside the facility property would at any time in the future be endangered*. Thus, under this alternative, water quality degradation would be increased to the extent that releases from non-point sources exceed the limits indicated above. However, any facility causing water quality degradation in excess of the requirements of the Clean Water Act or the Safe Drinking Water Act would still be subject to the provisions of those acts.

As discussed under air quality, there would likely be some shift in the types of methods used to store, treat, or dispose both regulated wastes and the wastes excluded from regulation under this alternative compared to the methods that would have been used to manage these wastes under the baseline regulations. Such shifts would change the types and quantities of water contaminants produced by the

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*See Section 7.1.5 for the defintion of endangerment.

management of specific wastes and could at any locality either enhance the indicated potential for beneficial or adverse water quality impacts. All effluents and any localized degradation of water quality would have to be in compliance with all applicable requirements (e.g., Clean Water Act, Safe Drinking Water Act, state standards).

8.5.1.6 Public Health Impacts. As discussed below, the regulations under this alternative would have the potential for increasing some of the public health benefits to be derived from the control of hazardous wastes through the baseline regulations and would also have the potential for reducing other public health benefits to be derived from the baseline regulations. Section 7.1.6 discusses public health impacts under the baseline regulations.

Slightly less total waste would likely be regulated under this alternative than under the baseline regulations. As discussed in Section 8.5.1.1, a lesser quantity of toxic, infectious, and corrosive wastes would be regulated. Those hazardous wastes excluded from regulation would not have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Based upon current practices and reported incidents, it is likely that much of this waste would not be managed by methods that were environmentally acceptable under the regulations. Consequently, there would be a greater potential for the release of air, water, and soil contaminants from the management of these wastes, as compared to the baseline regulations (see Section 8.5.1.4, 8.5.1.5, and 8.5.2.1).

There would also be a greater potential for the release of infectious agents. As a result, there would be less of a potential for preventing the occurrence of public health impacts associated with such contaminants (See Section 7.1.6).

With regard to the hazardous waste that would still be regulated, the requirements under this alternative would have the potential for affecting the release of air, water, and soil contaminants from the management of these wastes in various ways. Some of the requirements (e.g., elimination of human health and environmental standards) would result in an increase in the potential for the release of such contaminants relative to the baseline regulations while others (e.g., the Interim Status Standards) would result in a decrease, as discussed in Sections 8.5.1.4, 8.5.1.5, and 8.5.2.1. Changes to public health impacts would be commensurate with such changes in the release of air, water, and soil contaminants and infectious agents. These would be both increased and reduced public health benefits to be derived from the regulation of these wastes relative to the baseline regulations.

Increased public health benefits could further be derived from additional requirements imposed under this alternative. Facility permits would be reviewed at least once every 5 years rather being issued for the projected life of the facility as under the baseline regulations. Owners/operators of facilities managing hazardous wastes would have to turn over records of waste disposal locations to the local land authority upon closure of the facility. The owner of the property on which a disposal facility is located would also be required to record a notation on the property deed (or equivalent instrument) to, in perpetuity, notify any potential purchaser both that the land has been used to manage hazardous waste and that the land is subject to use restrictions. These restrictions include prohibitions against any use of the property that disturbs the integrity of the final cover, liners, any other components of the containment system, and the monitoring system unless it can be demonstrated that any such disturbance would not result in an increase in the potential hazard to human health and the environment. These requirements could further help prevent future public health catastrophes such as that which occurred at Love Canal in Niagara Falls, New York (see Section 7.1.6).

Additional restrictions would be placed on the disposal of hazardous uranium and phosphate surface mining and beneficiation wastes. These wastes are identified as hazardous under the radioactivity criteria of this alternative. Restrictions would be placed on using these wastes as fill around or under habitable structures. The wastes would also be prohibited from being incorporated into any building materials that are of potential use for the construction of habitable structures. Both uses take place in the current, unregulated situation. These requirements would thus reduce the potential for such disposal of these wastes to cause adverse health impacts by releasing radioactive emissions (radium 226 and its decay products) into habitable areas and dwellings.

Elimination of the requirement that contingency plans must include an outline of a program for familiarizing employees with emergency procedures and for drills on these procedures could reduce the potential for preventing public health impacts in the event of an emergency situation at the facility; however, this would be off-set by other, previously indicated changes in contingency plans. Elimination of the need to implement the contingency plan when there is a discharge that threatens human health only within the facility, but not outside the facility, would reduce the potential for preventing adverse impacts to facility employees.

8.5.2 Secondary Impacts. The major changes in secondary impacts (relative to the baseline regulations) that could occur as a result of implementation of this alternative are discussed in the following sections. These changes would result primarily from the net reduction in the quantity of waste that would be subject to regulation; the enactment of more stringent environmental requirements with regard to the storage, treatment, and disposal of hazardous wastes during the Interim Status period; the modification of some requirements for managing wastes following the Interim Status period; the enactment of more stringent requirements for tracking manifested waste shipments; the enactment of more stringent environmental requirements with regard to the storage, treatment, and disposal of hazardous 'special wastes'; and from modified costs to generators and costs associated with hazardous waste transport, storage, treatment, and disposal as a result of these revised requirements.

8.5.2.1 Physiography and Soil Impacts. The regulations under this alternative would have the potential to cause changes affecting physiography and soils, as compared to the baseline regulations. These changes would lead to localized beneficial and adverse impacts to physiography and soils, as compared to the baseline regulations.

The waste removed from regulation under this alternative (e.g., hazardous waste materials used as soil conditioners) would not have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Based upon current practices and reported incidents, it is likely that much of this waste would not be managed by methods that were environmentally acceptable under the regulations. To the extent this occurs, the potential for preventing adverse impacts to soils would be reduced relative to the baseline regulations. Section 7.2.1 describes the types of impacts to soils that could occur from such current methods and practices.

With regard to the hazardous waste regulated under this alternative, the requirements under this alternative would have the potential for affecting impacts to physiography and soils in various ways. Changes that could potentially have significant effects are discussed below.

The revised requirements would affect the release of air and water contaminants as described in Sections 8.5.1.4 and 8.5.1.5. Changes in impacts to soils would be commensurate with the changes in the release of such contaminants, as discussed in Section 7.2.1. There would be localized instances of both increased and reduced soil contamination, as compared to the baseline regulations.

With regard to hazardous 'special wastes', more total land could be required for waste management under this alternative than under the baseline regulations. There would likely be more off-site land use; there would be an indeterminable change in on-site land use (see Section 8.5.2.5). Increased land requirements, especially off-site requirements, would result in a greater potential for physical impacts to occur to soils and physiography. Potential impacts from increased facility construction would be essentially the same as those described in Section 7.2.1.

Disposal of the large volumes of hazardous 'special wastes' that could be brought under control of the full set of Section 3004 requirements could create a significant demand for low permeability clays. Such a demand could be especailly significant in areas having a high density of such hazardous waste generators. Local clay supplies in such areas may not be sufficient to meet the demand. Even where sufficient clays are available, their extraction would result in severe alternation of local topography.

With regard to other hazardous waste, less total land, off-site plus on-site, could be required for waste management under this alternative than under the baseline regulations. In the case of 13 percent off-site shipment of hazardous manufacturing wastes, there could be more off-site land use and less on-site land use. In the case of 25 percent off-site shipment, there could be less off-site land use and more off-site land use. Changes in impacts to soils and physiography would be directly related to these changes in land requirements; however, changes in off-site land use would likely cause greater impacts than changes in on-site land use.

8.5.2.2 Biological Impacts. The regulations under this alternative would have to potential for both increasing and reducing some of the benefits to flora, fauna, and ecological systems that would be derived from the control of hazardous waste through the baseline regulations. Section 7.2.2 discusses biological impacts that would occur under the baseline regulations.

Land requirements for facility construction and operation and for conjunctive developments would be modified under this alternative as summarized above. As a result, the potential for impacts to flora, fauna, and ecological systems from land disturbance would be accordingly modified.

Existing vegetation would be destroyed on additional lands disturbed by construction and operation of hazardous waste management facilities and conjunctive developments. Present plant succession would cease on such lands. Following rehabilitation of the site after closure of the facility, the plant community on the disturbed areas would likely differ in species composition and diversity. These construction and operational activities could also result in the direct destruction of animal habitat. Some of this destruction would be permanent; other areas would be impacted only temporarily and would, over a period of time, recover in value as a habitat. However, the habitat and, consequently, the widlife species composition following such recovery might be different from that which existed prior to disturbance of the area. In addition, the direct destruction of some wildlife could also result from activities which excavate, bury, overturn, clear, or grade large areas of previously undisturbed terrestrial habitat. On lands excluded from hazardous waste management activities under this alternative, flora, fauna, and ecological systems would not be subject to such impacts, as compared to the baseline regulations. In both cases, changes in off-site land use would cause greater impacts than changes in on-site land use.

These modification to the biological environment would be offset by other changes that could occur under this alternative. Less total waste would likely be regulated under this alternative than under the baseline regulations. As discussed in Section 8.5.1.1, a lesser quantity of toxic, infectious, and corrosive wastes would be regulated. Those hazardous wastes excluded from regulation would not have to be transported, stored, treated, or disposed in accordance with the Subtitle C regulations. Based upon current practices and reported incidents, it is likely that much of this wastes would not be managed by methods that were environmentally acceptable under the regulations. Consequently, there would be a reduced potential relative to the baseline regulations for preventing the release of air, water, and soil contaminants from the management of these wastes (see Section 8.5.1.4, 8.5.1.5, and 8.5.2.1). There would also be a greater potential for the release of infectious agents. As a result, there would be a reduced potential for preventing the occurrence of biological impacts associated with such contaminants (see Section 7.2.2). In addition, previously indicated changes in the off-site transport of hazardous wastes would lead to commensurate changes in the number of animal road kills.

With regard to the hazardous waste that would still be regulated, the requirements under this alternative would have the potential for affecting the release of air, water and soil contaminants from the management of these wastes in various ways. Some of the requirements (e.g., elimination of human health and environmental standards) would result in an increase in the potential for the release of such contaminants relative to the baseline regulations while others (e.g., the Interim Status Standards) would result in a decrease, as discussed in Sections 8.5.1.4, 8.5.1.5, and 8.5.2.1. Changes in impacts to bioloigcal systems would be commensurate with these changes in the release of air, water, and soil contaminants and infectious agents. These would be both increased and reduced benefits to the bioloigcal environment to be derived from the regulation of these wastes relative to the baseline regulations.

It should be noted, however, that due to changes in wastes being regulated and in requirements for management of regulated wastes, there could be shifts in the methods used to treat/dispose the wastes as described in Section 8.5.1.4. The potential for impacts to the biological environment would be modified to the extent of any such shift.

The bioloigcal environment could derive additional benefits from the requirement that facility permits be reviewed at least once every 5 years rather being issued for the projected life of the facility as under the baseline regulations. Elimination of the requirements that contingency plans must include an outline of a program for familiarizing employees with emergency procedures and for drills on these procedures could increase the potential for biological impacts to occur in the event of an emergency situation at the facility; however, this would be off-set by other indicated changes in contingency plans. Elimination of the requirements that after closure, all facilities must be secured such that any remaining hazardous wastes cannot be contacted by animal life, would have little practical effect since the baseline regulations would not truly prvent burrowing animals and animals foraging on plants in the site area from coming into contact with such waste.

8.5.2.3 Social Impacts

Demographic Impacts. With regard to generators of hazardous 'special wastes,' increased costs under this alternative could lead to some additional closings or relocations of plants and operations, and this could lead to additional population shifts as described in Section 7.2.3.1. With regard to generators of other hazardous wastes, lesser increases in costs under this alternative could lead to fewer plant closings or relocations, and this could lead to fewer population shifts. Some closings could, however, occur earlier under this alternative due to the requirements of the Interim Status Standards.

In addition, there could be both an increase in the number of construction workers needed at facilities managing hazardous 'special wastes' due to any increased amount of facility modification and construction and a decrease in the number of construction workers required at facilities managing other hazardous wastes due to any lesser amount of necessary facility modification and construction. There could also be an increase in the number of personnel required for hazardous wastes management activities at facilities managing 'special wastes' due to the more stringent operational requirements. There could be a decrease in the number of personnel required for hazardous waste management activities at facilities managing other hazardous wastes due to decreases in the quantity of such wastes being regulated. There could also be an overall decrease in the number of personnel required to administer and enforce the regulations due to reductions in both the quantity of hazardous wastes being regulated and the number of generators, disposers, and permittees being regulated. Again, necessary personnel would likely be needed earlier under this alternative due to the requirements of the Interim Status Standards. Population shifts could occur in response to changed personnel requirements as discussed in Section 7.2.3.1. Any such shifts would be expected to be small on a national scale; however, there could still be localized instances of relatively large influxes of workers, particularly for hazardous waste management facilities located near very small towns, or of relatively large outfluxes of workers, especially in the case where a plant being closed constituted the primary source of employment in an area.

Social Conditions. As discussed in Section 8.5.1.6, there would be both increased and decreased public health benefits to be derived from this alternative relative to the baseline regulations. The indicated increases (decreases) in public health benefits would accordingly provide increased (decreased) social benefits as discussed in Section 7.2.3.2. Resultant changes in chronic and acute health effects would correspondingly modify the social and economic costs associated with such effects, e.g., increased mortality, birth defects, lowered productivity, lost wages.

The indicated changes in the potential for population shifts would correspondingly modify the impacts associated with such shifts. As discussed in 7.2.3.2, any large, rapid, population influx could cause inflation, strains on the existing infrastructure, social tensions, changes in daily living patterns, and increased physical and mental disorders. Any large, rapid, population outflux could cause problems in maintaining the existing infrastructure, deflation, additional unemployment, social stress, changes in daily living patterns, and increased mental and physical health problems.

Public opposition to the siting and construction of hazardous waste management facilities could be reduced by the requirement for permits to be reviewed at least once every 5 years rather than not at all and by the increase in the period specified for post-closure care. With regard to facilities managing hazardous wastes other than 'special waste,' public opposition to such facilities could be further reduced by the need for fewer of these facilities. With regard to facilities managing hazardous 'special wastes,' public opposition to such facilites could be reduced by the more stringent environmental requirements under this alternative. However, any opposition that occurs could be exacerbated by possible increases in requirements for such facilities. The additon of the Interim Status Standards could also reduce opposition to some existing facilities.

Indicated changes in the contruction of hazardous waste management facilities and in the off-site transport of hazardous wastes could modify other social effects. The indicated increases (decreases) in facility contruction would increase (decrease) the potential for noise impacts, aesthetic impacts, land use impacts, water use impacts, and pressures on existing infrastructures that could be associated with such facilities. Indicated increases (decreases) in the transport of hazardous wastes would increase (decrease) the potential for vehicular accidents.

8.5.2.4 Hazardous Waste Management Facility Capacity.

Process Capacity. Less hazardous waste would be subject to Subtitle C requirements under this alternative than under the baseline regulations. However, increased quantities of hazardous 'special wastes' and reduced quantities of other hazardous wastes could be shipped off-site for treatment/disposal under this alternative.

As discussed in Section 7.2.4.1, under the baseline regulations there would potentially be sufficient off-site capacity available on a nationwide basis in 1980 to handle the regulated hazardous manufacturing wastes shipped off-site, both with and without growth in existing capacity. Also, there would potentially be sufficient off-site capacity on a nationwide basis in 1984 to handle the regulated hazardous manufacturing wastes shipped off-site in the care of 13 percent off-site shipment, both with and without growth in existing capacity. However, in the case of 25 percent off-site shipment in 1984, there would potentially be a nationwide shortfall of 2.6 million metric tons of environmentally adequate capacity for treating/disposing hazardous manufacturing wastes, based upon the specified growth in existing capacity. Without any growth in existing environmentally adequate capacity, this shortfall could be 4.9 million metric tons. As indicated, data are not available to extimate any potential for shortfalls in environmentally adequate on-site process capacity for regulated hazardous manufacturing wastes.

Consequently, under this alternative there would also potentially be sufficient off-site capacity on a nationwide basis to treat/dispose regulated hazardous manufacturing wastes shipped off-site in 1980 and also in 1984 in the case of 13 percent off-site shipment. In the case of 25 percent off-site shipment in 1984, there would be a reduction in the potential shortfall in off-site capacity. As a result, fewer permitted off-site facilities could be required in this latter case under this alternative as compared to the baseline regulations. Similarly, under this alternative there would also be reductions in the potential for any shortfall in on-site capacity necessary for treating/disposing regulated hazardous manufacturing wastes.

With regard to hazardous 'special waste,' there would be an increased potential for shortfalls in both environmentally adequate on-site and off-site capacity in 1980 and 1984. The increased potential for shortfalls in on-site capacity would result from increased facility closings due to requirement that facilities managing special wastes comply with all Section 3004 requirements rather than a limited portion of such requirements. The increased potential for shortfalls in off-site capacity would result from likely increases in the quantity of wastes being sent off-site; however, any increases in off-site shipments would also off-set some of the potential for increased shortfalls in on-site capacity.

Section 7.2.4.1 discusses other factors that could either lead to shortfalls or exacerbate the size of any estimated shortfall in both on-site and off-site process capacity, especially on a localized basis. Furthermore, the wastes removed from regulation under this alternative would still have to be treated/disposed, both on-site and off-site. While such wastes could be treated/disposed in non-permitted facilities, their management could increase the potential for an overall shortfall in available capacity; however, any resultant shortfall would be less than that under the baseline regulations. The Interim Status Standards could also lead to earlier closings of some facilities and thus increase the potential for shortfalls during the first few years after implementations of the Subtitle C regulations; however, the reduction in the generator limit would act to off-set this.

Physical Capacity. Based upon the methodology and assumptions disucssed in Section 7.2.4.2, relative to the baseline regulations there could be an increase in the total (regulated plus uneregulated) hazardous manufacturing wastes sent off-site during the period from 1980 through 1984, assuming 13 percent shipment off-site in 1984, and there could be a decrease in the total hazardous manufacturing wastes sent off-site during this period, assuming 25 percent shipment off-site in 1984.

Consequently, increased land area could be committed to off-site management of hazardous manufacturing wastes during this period in the case of 13 percent off-site shipment and less land area could be committed to off-site management of hazardous manufacturing waste during this period in the case of 25 percent off-site shipment. In the former case, after 1984 there could be an increase in the land area required off-site annually compared to total requirements under the baseline regulations. In the latter case, after 1984 there could be a decrease in the land area required off-site annually compared to the total requirements under the baseline regulations. In all instances there could be commensurate changes in on-site land requirements.

8.5.2.5 Land Use Impacts. With regard to those hazardous wastes other than 'special wastes,' less total land, off-site plus on-site, would be required for the construction of any storage, treatment, and disposal facilities needed under this alternative and for such conjunctive developments as construction of roads, power lines, and pipelines. Less additional land would be required since fewer wastes would have to be sent to permitted facilities; the waste removed from regulation could use existing facilities or other facilities that were not adequate under the baseline regulations. However, as indicated in Section 8.5.2.4, in the case of 13 percent off-site shipment there would be more total hazardous manufacturing wastes (those regulated plus those removed from regulation) sent off-site than there would be in the similar case under the baseline regulations. Thus, while less total land would be required, there could be more off-site land use and less on-site land use for hazardous manufacturing wastes in this case. In the case of 25 percent off-site shipment, there would be less total hazardous manufacturing wastes sent off-site than there would be in the similar case under the baseline regulations and, thus, there could be less off-site land use and more on-site land use.

It should be noted that while shifts to on-site land use could reduce off-site land requirements in the short term, such shifts could also accelerate the exhaustion of the relatively limited on-site physical capacity and could result in increased pressures for off-site facilities in the long term. Furthermore, the reduced potential under this alternative for increases both in resource conservation and recovery and in treatment practices leading to volume reduction (e.g., incineration) of these hazardous wastes would also provide a lesser potential for reducing total land requirements, both on-site and off-site, in the long term.

With regard to hazardous 'special wastes,' more total land could be required under this alternative for the management of all (regulated and unregulated) hazardous special wastes. While a lesser quantity of hazardous special wastes would be regulated, more land (on-site plus off-site) could be required for construction of the permitted facilities necessary for the management of regulated wastes under this alternative and for conjunctive developments. Those wastes removed from regulation could continue to use existing facilities or other facilities that were not adequate under the baseline regulations. There would likely be more off-site land use. Changes in on-site land use would depend on changes in the portion of wastes sent off-site and on changes in land requirements for individual facilities managing wastes on-sites.

With regard to all hazardous wastes, existing land uses would not change on lands excluded from hazardous waste management under this alternative; however, there could be localized changes in land use from any additional shifts to off-site management from on-site management or to on-site management from off-site management. To the extent that the management of wastes excluded from regulation under this alternative would result in additional land being contaminated through environmentally inadequate practices, there would be off-setting adverse impacts to existing land uses. Section 7.2.5 describes the types of impacts that could occur.

Existing land uses would, however, cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Following closure of hazardous waste management facilities and any necessary post-closure care, the land used for the facility could be available for new or, in some cases, previously existing uses. However, this alternative eliminates the requirement that all facilities must be designed such that the land is amenable to some acceptable use so that perpetual isolation and care to maintain isolation are not required. Thus, less land could be available for future use under this alternative than under the baseline regulations. On the other hand, this alternative eliminates the prohibiton against using sites at which hazardous wastes remain after closure (e.g., landfills) for residential, agricultural, or other purposes which disturb the integrity of the closed facility. All such uses would be allowable under this alternative providing that it can be demonstrated that any disturbances to the integrity of the final cover, liner, any other components of the containment system, and the monitoring system would not result in an increase in the potential hazard to human health or the potential for environmental contamination. This alternative would also affect future use of the land by requiring that the owner of the property on which a disposal facility is located must record a notation on the property deed (or equivalent instruments) that would in perpetuity notify any potential purchaser both that the land has been used to manage hazardous waste and that the land is subject to the use restrictions noted above.

8.5.2.6 Water Use Impacts. The potential for the degradation of groundwater and surface water quality would be modified under this alternative as indicated in Section 8.5.1.5. There would be instances of both reduced and increased localized improvements in water quality, as compared to the baseline regulations. To the extent that less degradation of water quality would result in an increased supply of surface water or groundwater being available to all consumers in the water use area, there would be an additional supply of groundwater or surface water potentially available to such consumers and fewer restrictions on the productive use of such surface water and groundwater supplies. Localized instances of increased water quality degradation would have the opposite impact.

Fewer permitted facilities would be required under this alternative for the management of hazardous wastes other than 'special wastes.' Less water would thus be required for these permitted facilities. Reductions in water use would, however, be off-set to the extent that water would still be consumed in the management of those wastes removed from regulation. Fewer permitted facilities could also be required for the management of hazardous 'special wastes.' However, the more stringent requirements under this alternative could increase the quantity of water required by individual facilities.

8.5.2.7 Resource Conservation and Recovery. The major changes in resource conservation and recovery would result from the previously indicated modifications in the wastes being regulated and in costs to hazardous waste generators and costs associated with hazardous waste transportation, storage, treatment, and disposal. As discussed in Section 8.5.1.2, these changes could provide an increased incentive for some generators of hazardous 'special wastes' to further modify their processes or operations so as to reduce and/or change the types and quantities of hazardous wastes generated and to increase the re-use of the wastes that were generated. However, these changes would provide less of an incentive for generators of other hazardous wastes to modify processes or operations so as to enable increased recycling of hazardous wastes as process feedstocks, to reduce the quantities of hazardous wastes generated by specific processes or operations, or to change the nature of wastes produced. Chapter 5 presents examples of the potential for increased resource recovery from and recycling of hazardous wastes.

This alternative would provide a further incentive for all generators to recycle, re-use, or recover hazardous waste materials. All hazardous waste materials that are used, re-used, or processed for energy recovery or that are stored for such purposes would be excluded from regulation under this alternative,* but would be subject to Subtitle C requirements under the baseline regulations. For example, waste oils or solvents incinerated for energy recovery would not be regulated. Similarly, all hazardous waste materials, except waste oils, that are used or re-used in a manner constituting disposal or that are being stored for such purposes would be excluded from regulation under this alternative.† For example, hazardous materials used for road construction or as a soil conditioner or as a de-icing agent on roads would not be regulated. Thus, generators would have an increased incentive to use or re-use such wastes rather than to dispose them.

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*However, it should be noted that EPA is planning to list waste materials that would still be regulated if used for such purposes.

†EPA is planning to list additional waste materials that would still be regulated if used in such a manner.

8.5.2.8 Energy Use. Energy use would be impacted under this alternative by changes in facility construction, facility operation, hazardous waste transport, resource conservation and recovery, and energy production.

With regard to hazardous 'special wastes,' the additional facility modification and construction that could be necessary for the management of such wastes under this alternative would result in increased energy use. More energy would also be used for the construction of new facilities under this alternative due to the more stringent requirements directed towards making these facilities more environmentally secure. There would also be increased energy use associated with the more stringent requirements for operation and closure of these facilities, as discussed in Section 7.2.8. The requirements of the Interim Status standards along with the additional 10-year period over which post-closure care could be required, would further increase the energy use associated with such wastes. Increase in energy use associated with any additional transport of hazardous "special wastes" would depend upon such factors as shifts in the portion of wastes managed on-site and off-site and changes in transport distances. The reduction in the quantity of such wastes being regulated would, however, off-set some of these increased in energy use. Furthermore, indicated changes in resource recovery activities could also lead to some net energy savings.

Many 'special waste' generators are energy producers (e.g., oil and gas drilling operations). Due to the more stringent requirements and increased costs associated with the management of these wastes, there could potentially be reductions in energy production.

With regard to other hazardous wastes, the lesser amount of facility modification and construction that would be necessary for the management of such wastes would result in a decrease in energy use. The reduction in the quantity of such wastes being regulated would also reduce energy use associated with facility operations, as discussed in Section 7.2.8. However, the requirements of the Interim Status Standards along with the lengthened post-closure care period could off-set some of this decrease in energy use. Reductions in energy use could also result from any reductions in the average distance over which these wastes could be transported. Furthermore, indicated changes in resource recovery and recycling activities could lead to a lesser potential for net energy savings to result from such activities.

8.5.2.9 Impacts to Special Interest Points. To the extent that the requirements of the Interim Status Standards and the more stringent regulation of hazardous 'special wastes' would reduce the disturbance, destruction, or intrusion upon special interest points, there would be a commensurate reduction in such adverse effects as discussed in Section 7.2.9. However, the exclusion of additional wastes from regulation under this alternative would reduce the potential for such beneficial effects.

Any additional lands, especially off-site lands, that would be disturbed by the requirements for facility construction and associated conjunctive developments under this alternative would increase the potential for the disturbance and/or destruction of such special interest points as sites of aesthetic, archaeological, historical, paleontogical, or recreational value. As indicated, more off-site lands could be required for the management of hazardous 'special wastes' while less off-site lands could be required for the management of other hazardous wastes.

9.0 MITIGATING MEASURES AND ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

In a sense, the Subtitle C regulations are themselves a mitigating measure acting to reduce the adverse environmental impacts of uncontrolled storage and disposal of hazardous wastes. Although these beneficial impacts are not discussed in this section, it is recognized that they far outweigh any adverse environmental impacts which may result from the regulations. The major adverse effects which would result from the regulations would be economic. These are discussed in the Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement). Most non-economic, adverse, environmental impacts associated with these regulations could be mitigated by making the corresponding portions of the regulations more strict (i.e., increasing the number of wastes defined as hazardous, decreasing the allowable permeability for soil liners in landfills, etc.). Many of these types of changes are addressed in the Alternatives Chapter, Section 8.3 (Greater Degree of Protection) and Section 8.5 (Phase I Alternative). Any such reduction in adverse environmental effects would, however, be accompanied by increased economic costs.

The major, non-economic adverse effects of these regulations would primarily be the continuation of impacts presently occurring and may be grouped into two categories. One group of impacts involves the redistribution of hazardous wastes and their associated environmental problems (which would be at least partially diminished). This would occur as existing treatment and disposal sites which do not meet the standards (including many on-site facilities) close down and the wastes are sent elsewhere. The second group of impacts arise from areas not covered or specifically excluded from the regulations. Again, any adverse impacts resulting from such exclusions would be continuations of existing impacts and would not be directly caused by the regulations.

9.1 Redistribution of Hazardous Wastes

When the regulations become effective, they could force the closure of a large number of facilities which currently accept hazardous wastes. A recent EPA study (U.S. Environmental Protection Agency, 1977c) indicated that environmental contamination from existing landfill sites may be more widespread than previously realized. Out of 50 randomly chosen sites which had never before been suspected of leaking and of which 32 were already being monitored, 43 sites were determined to be causing local groundwater degradation, 26 to such a degree that one or more EPA drinking water standards were exceeded. Poor groundwater quality was noted in six of the remaining sites, but could not be definitely linked to the disposal operation. Closure of a large portion of existing disposal sites, primarily on-site facilities, could create an immediate and potentially severe shortfall of facility capacity. Since the total capacity of all existing sites is not known, it is difficult to determine the ultimate impact of this relocation of wastes. However, it is essential that situations such as occurred in New Jersey do not recur on a national scale. Enactment of strict environmental regulations in New Jersey forced the closure of the last legal land disposal site for chemical wastes in 1976. Since then, the costs of acceptable disposal methods have increased tremendously, and many companies have been faced with the alternatives of paying much higher treatment costs or using illegal disposal methods. The result has been a series of indiscriminate dumping of hazardous wastes throughout New Jersey and in neighboring states (Richards, 1978).

Such a situation may be mitigated by one method or a combination of several methods. The one method, while temporary, would be to delay the closing of unacceptable facilities until there were acceptable alternative treatment, disposal, or storage methods for all of the wastes presently going to each facility. This could be accomplished by delaying action on permit application by such facilities for several years. The advantage of such a strategy would be that, since these sites already have large amounts of waste that must at some point be cleaned up, it would not create any significant new problems to continue using them for a short period of time. These sites should be prohibited from accepting any wastes from new sources and every effort should be made to relocate the wastes presently going to the sites as quickly as possible, but the consequences of immediately closing the site without providing acceptable alternatives could lead to the creation of new problems in previously uncontaminated areas.

Volume reduction, resource recovery, and recycling of wastes are other measures which would help mitigate the problems of finding more disposal capacity. These are partially addressed in the regulations by the mandate that "where practical, disposal of hazardous wastes shall be avoided and alternatives such as resource recovery, reuse, or other measures of recycling shall be employed." As a further method of coping with the short-term shortfall of capacity, this requirement could be extended to include treatment for volume reduction.

A third measure to cope with the shortfall of capacity is to provide assistance for the rapid expansion of existing facilities to the greatest extent possible. Such assistance could take the form of guaranteed loans, grants, large-scale demonstration projects, and provision of technical expertise.

In addition, it would undoubtedly be necessary to site and construct facilities in order to meet the increased demands for treatment/disposal. This process could be greatly expedited by effective cooperation between the permitting agencies (state or Federal), waste generators, and disposers in order to compile and evaluate information on needs, quantities and types of wastes generated, available transportation, and location of suitable disposal areas. Information and advice should be solicited from the state geologic surveys, local offices of the Soil Conservation Service, Fish and Wildlife Service, and other pertinent agencies early in the siting search. In addition, experience in states such California, Illinois, and New Jersey has indicated that there is substantial public resistance to the siting of new facilities, resulting in long delays and considerable expense. It is possible that a well-conceived public information program on both the national and local levels could help alleviate this problem. Points that could be emphasized are the required procedures to limit groundwater and air pollution, the necessity of disposing of the waste in an acceptable manner, and the physical and geologic conditions which make a particular location a suitable site. It might also be advisable to prohibit the construction of new plants which would generate significant quantities of hazardous wastes unless either an acceptable local hazardous waste disposal facility has sufficient excess capacity to handle the new wastes, or unless such a facility could and would be constructed in conjunction with the new generator. This requirement could help to off-set the public opposition to siting disposal facilities by providing the economic benefits of additional local employment and a larger tax base due to the presence of the generating facility. This requirement could also reduce transport distances, result in lower costs, and reduce potential for spills resulting from transport of hazardous wastes.

Relocation of waste shipments from existing environmentally unacceptable disposal sites to acceptable sites may produce some local impacts in the vicinity of the new sites. Since the regulations require strict compliance with all state and Federal laws regarding air and water quality, these impacts should be relatively minor. However, the creation of large facilities in remote areas (as may be required by public opposition or by the location of suitable geologic conditions) could result in the loss of potentially valuable habitat, range lands, or prime agricultural lands. In addition, some degree of socio-economic impact could occur as a result of the added manpower and support facilities which may be required to construct and operate the disposal facilities. The Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement) addresses the latter types of impacts; coordination of planning efforts with the Fish and Wildlife Service, and the USDA Soil Conservation Service should help mitigate the former. An increased potential for hazardous spills and vehicle emissions is also expected to result due to the necessity to transport more wastes off-site and to the probable longer distances to acceptable disposal facilities. Air emissions may also result from the construction and operation of new resource recovery facilities, though, again, these emissions are required to be within all applicable air standards.

Impacts could occur to water quality as a result of discharges of treated effluents from waste treatment facilities. Such discharges would have to meet all applicable water quality standards including those promulgated under the Clean Water Act (P.L. 92-500, as amended), and under the various state laws, and would have to be approved by the permitting agency. However, even though a discharge meets all applicable standards, it could still reduce receiving water quality up to the maximum allowable limit. Since this limit was picked to ensure adequate protection of both environmental and human health, such an impact should be minimal, though it may involve some loss of value to local water users. However, there are many potentially hazardous constituents of these wastes for which no standards have yet been promulgated. This may be due to lack of adequate substantiation of suspected human health effects, or to lack of information on tolerable levels to ensure the absence of chronic health effects. In addition, it is possible that some potentially harmful properties of these wastes are not even suspected at this time. In this respect, waste discharges could conceivably meet all applicable standards and still contribute to environmental degradation with potential human health effects. It should be emphasized that such effects are now occurring to a much greater degree without the controls which would be implemented by the proposed regulations. They could be further mitigated by requiring that all waste streams be sent to permitted treatment/disposal facilities.

In spite of any local increase in impacts which might occur, the net effect of the relocation of hazardous waste disposal operations to acceptable facilities in other areas would produce a marked decrease in the overall adverse environmental impact of the wastes.

An additional group of adverse impacts would be associated with increased paperwork requirements and the enlargement of the government bureaucracy to deal with those regulations. It is estimated that under the baseline regulations about 270,000 to 300,000 generators could be required to notify EPA following promulgation of the regulations. An additional 29,000 facility permit applications could also require processing. Further, monitoring reports and annual summaries of receipts of manifested wastes could produce up to 400,000 reports per year. Manpower to deal with such requirements is not presently available in either EPA, or in most state governments. The regulations could therefore require the establishment of new government jobs and procedures which could both increase the size and unwieldiness of many bureaucratic systems and the size of government payrolls. Reduced notification or reporting requirements would, however, weaken the effectiveness of control over hazardous wastes.

9.2 Impacts Unaffected by the Regulations

9.2.1 Siting. The baseline regulations prohibit locating hazardous waste facilities on active fault zones, in wetlands, on 100-or 500-year flood plains, in the recharge zone of sole source aquifers, or in the critical habitat areas of endangered species, with certain exceptions. In addition, the regulations require that landfills, surface impoundments, and landfarms be located, constructed, and operated so as to prevent landslides, slumping, and erosion.

However, other siting considerations that could have or that could cause adverse impacts are not addressed. These include siting facilities in areas prone to subsidence or to geothermal activity; in areas on migration pathways or rangelands of important regional (though not necessarily endangered) species; or in areas of prime agricultural lands. Although formally increasing the permit review process to include state geologic surveys, the Fish and Wildlife Service, and local soil conservation services may not be desirable due to resultant increased paperwork and processing times, there should be some means of ensuring coordination with these agencies in order to assure that all potential problems have been considered. The information requirements for permit applications could also be expanded to include ecological data for the site area that identifies any local migratory pathways and the occurrence of any browsing or burrowing animals which could obtain access to the material stored or disposed of at the site.

As discussed previously, it may also be desirable to examine siting considerations before beginning the construction of major new facilities generating hazardous wastes. This should be studied in light of both the local environmental impacts, as well as the location and capacities of potential treatment/disposal facilities.

In any case, all siting of hazardous waste facilities would also be subject to a number of additional constraints, besides those cited in the regulations. These include restrictions promulgated under the following laws protecting fish, wildlife, and natural resources:

- Endangered Species Act of 1973 (16 U.S.C. 1531-1543)
- Federal Aid in Wildlife Restoration Act (16 U.S.C 669)
- Protection of Wild Horses and Burros (16 U.S.C. 1331-1340)
- Fish and Wildlife Act of 1956 (16 U.S.C. 742-754)
- Fish and Wildlife Coordination Act (16 U.S.C. 661-667)
- Forest and Rangeland Renewable Resources Act (16 U.S.C. 1601-1610)
- National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347)
- Administration of National Wildlife Refuge System (16 U.S.C. 668)
- Open Space Land (42 U.S.C. 1500)
- Protection of Bald and Golden Eagles (16 U.S.C. 668)
- Wild and Scenic Rivers Act (16 U.S.C. 1271-1287)
- Wilderness Act and Amendments (16 U.S.C. 11-31-1136; P.L. 93-662)

Other constraints would include national, state, and local forests, parks, trails, and historic sites.

9.2.2 Transportation. The baseline regulations require that if the waste meets the DOT definition and criteria for a hazardous material (49 CFR 171.8 and 173), it must be handled in accordance with the provisions of applicable DOT regulations under 46 and 49 CFR. These regulations contain detailed requirements for the construction, inspection, handling, and labeling of hazardous materials and other containers. The baseline regulations for hazardous wastes also specify that transporters must not transport containers which are leaking or appear to be damaged, and that leaks which are discovered enroute be treated as emergency situations.

Except for the restrictions on accepting damaged containers, there are no other provisions in the baseline regulations designed to prevent spillage or other accidental releases during transport. This could be alleviated by requiring studies to determine a route from the generating site to the treatment/disposal site which presents the least chance of an accident and which would involve the least amount of damage to human health and the environment in general. Such studies might prove especially useful if the total ton-miles of hazardous waste transport increase.

9.2.3 Construction and Operation. The baseline regulations mandate that landfills, landfarms, and surface impoundments "shall be located, or constructed and operated, so as to prevent landslides, slumping or erosion." This requirement does not specifically include the implementation of a sediment control plan during construction activities, though the effective use of such a plan would mitigate most physical impacts of construction. Requirements to minimize the construction impact on wildlife would provide additional benefits. Such plans may be required by state or local statutes.

Although the baseline regulations require that "facilities shall have fencing completely surrounding all active portions of the facility," they do not make provisions for securing the facilities against small burrowing animals and birds. The case of waterfowl at ponds and lagoons may present particular problems. Burrowing animals may be excluded by constructing fences which are buried several feet in the soil, the exact depth determined by the types of animals which might be present in the region. Solution of the problem of birds may be more difficult, but may be attempted by growing non-palatable vegetation such as Phragmites (Martin and Uhler, 1951) or pine trees around the perimeters of the area. Intermittent noise makers may also be used when necessary.

The baseline regulations would prohibit endangerment of underground drinking water sources (UDWS). Such sources are defined as those which currently supply a public water system; or an aquifer with a total dissolved solids content of less than 10,000 mg/l; or an aquifer otherwise designated as usable by the Administrator. It is possible, especially in water-short areas, that some groundwaters that are not classified UDWS may at some point be required for salinity-tolerant industrial uses such as dust control, ash quenching, or cooling purposes. Contamination of these waters with hazardous wastes could prevent such use and require the use of freshwater instead, possibly contributing to water shortages. This occurrence could be avoided by extending the regulations to protect all groundwaters. Alternately, the Administrator could limit exemptions to this procedure to areas which are highly unlikely to experience water shortages, or could designate all aquifers in potential drought areas as UDWS.

Adverse impacts could occur as a result of potentially hazardous wastes which are not covered by the regulations* or which are produced by generators who produce less than the generator limit and are thereby excluded from regulation. These wastes would be subject to all other applicable state and Federal regulations, including the Clean Water Act, Safe Drinking Water Act, Clean Air Act, Subtitle D of RCRA, Federal Insecticide, Fungicide, and Rodenticide Act, and others.

Any remaining impacts resulting from these wastes not subject to the regulations could be further mitigated by specifically requiring proper labeling and disposal of all potentially hazardous wastes (while excluding generators producing less than 100 kilograms per month from the paperwork and other requirements of the regulations).

9.2.4 Closure. One additional area not specifically covered in the baseline regulations is the impact resulting from disposal sites which already have been abandoned or which would be abandoned rather than modified to meet the regulations. The Section 3004 regulations would require that facility owners/operators close all portions of their facilities which do not comply with the regulations. Such closure is to be in accordance with the specified closure procedures. However, most of the closure requirements are directed at new

*As discussed in Chapter 7, EPA is considering expanding the toxicity criteria to regulate a greater number of potentially hazardous wastes at a future time. An additional environmental statement or supplementary statement would be prepared covering this change, if warranted at that time.

facilities and those existing facilities able to obtain permits; previously abandoned facilities and those existing facilities which could not be modified to obtain permits could not satisfy many of the requirements (e.g., financial requirements, submission of closure plans before beginning operations, certification of closure in accordance with permit, and preparation of a survey plat showing types of waste and their location at the site). While some owners of these latter facilities could be located, there are no specific provisions for insuring proper closure, for financing the cleanup and closure, or even for locating previously abandoned facilities. While it is EPA's intent that all hazardous waste facilities be closed in accordance with the regulations, some abandoned facilities may have to be satisfactorily closed using public funds.

Lastly, it should be repeated that the regulations themselves are an important and potent mitigating measure. The administrating agencies must ensure that the location, design, construction, monitoring, and closing of all facilities are all carefully planned and that all provisions of the regulations are strictly followed and enforced. This point is emphasized by the recent study (U.S. Environmental Protection Agency, 1977c) which discovered that a large percentage of sites which were presumably secure and already being monitored were actually causing groundwater pollution.

10.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Subtitle C regulations may result in some localized adverse impacts, though as discussed previously, such impacts would essentially be continuations of adverse impacts which are already occurring. On the other hand, the regulations would also result in a significant overall reduction in the adverse impacts associated with hazardous waste management and would thus provide for the significant enhancement of the long term productivity of man's environment.

The major short-term adverse impacts would include economic impacts, which are discussed in detail in the Integrated Economic Impact Assessment (Regulatory Analysis Supplement), some localized instances of environmental degradation, and possible increased public opposition to the location of additional hazardous waste disposal sites. These must be balanced against the benefits derived from likely increases in resource recovery, improved air and water quality, and reduced damages to environmental systems and human health.

The possible increase in resource recovery would contribute to two beneficial effects. It would decrease the rate of depletion of raw materials through increasing emphasis on the development of separation technology and resource recovery. In addition, any increased resource recovery could result in decreases in the amount of waste generated, thereby extending the usable lifetimes of disposal facilities.

The control of hazardous wastes required by the regulations would end many of the incidents of water quality degradation which occur as a result of current disposal methods. Increases in water quality would effectively increase the water potentially available for various uses and should provide additional benefits through the prevention of adverse human health effects resulting from exposure to hazardous materials in drinking water supplies.

The permanent isolation of many of the harmful and persistent waste products from man's industries would have many beneficial effects on the environment and human health. As a result, bioaccumulation of these materials in the food chain would be decreased, as would many of the effects of chronic exposure to low levels of toxic contaminants.

11.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The requirements contained in the Subtitle C regulations would result in the essentially irreversible or irretrievable commitments of land, wastes, fuel, container materials, and clays, even though many of these resources are also presently being irretrievably committed by the haphazard methods currently employed in hazardous waste disposal.

Land commitments are currently being made for hazardous waste disposal. The regulations may cause a reduction in the number of small scattered disposal sites and an increase in the number of larger, more centrally located sites due in part to the economics involved with providing a secure facility. However, the prohibitions and restrictions on disposal of volatile, reactive, and ignitable wastes in landfills, surface impoundments, and landfarms would also necessitate either the upgrading or the construction of new incinerators and other treatment facilities. Closure of any existing facilities which could not be upgraded to meet the regulations and the construction of necessary replacement facilities would create additional demands for land and associated land use impacts.

Due to the requirements for the environmentally acceptable operation and closure of disposal sites, the land used for disposal would not actually be irretrievably lost to all uses. However, due to the nature of the wastes, future uses would be restricted to surface activities which do not require any excavation or other disturbance of the wastes buried below.

The wastes themselves represent a substantial quantity of potential resources, particularly in the case of heavy metals and other inorganic materials. At the present time, technology is not available to economically recover many of these materials, but at some point in the future such a procedure may become feasible. In that case, some of the permanent disposal methods employed as a result of this act could be regarded as irreversibly and irretrievably committing wastes to ultimate disposal. The required records of types and locations of wastes within landfills could, however, aid in recovery efforts.

Any increased transport of wastes would result in greater fuel consumption and the increased release of vehicular emissions, with associated human health effects. Containerization of hazardous wastes in landfills would result in the irretrievable loss of raw materials.

Large amounts of clays would be required for the construction of dikes and liners for landfills and surface impoundments. Additional amounts would be required as cover material during the operation of landfills and during closing procedures for landfills, landfarms, and surface impoundments. Since these clays would ultimately be contaminated by adsorbed wastes, they would be essentially irreversibly lost to future uses.

Fuels, electric power, lubricants, structural materials, capital, and manpower resources used in the construction of necessary new facilities and in the modification of existing facilities could be irretrievably lost to other uses. Additional capital and manpower resources used in complying with the operational requirements of the regulations, in administrating the regulations, and in enforcing the regulations would also be irretrievably lost to other uses. Any plant closings as a result of promulgation of the regulations would likely be irreversible. Any resultant population shifts could cause irreversible changes in daily living patterns in affected areas.

12.0 DISCUSSION OF COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The notice of availability of the Draft Environmental Impact Statement was published in the Federal Register on December 18, 1978. Copies of the statement were sent to Federal, state, and local agencies; environmental, health, and citizens groups; professional associations; trade associations; and solid waste management professional groups.

Information copies were made available at the 10 EPA Regional Office libraries and at the EPA library reading room, Room 2404, Waterside Mall, 401 M Street, S.W., Washington, D.C. Single copies were also furnished for review and comment upon request.

The 90-day review period expired officially on March 16, 1979. Comments on the Draft Environmental Impact Statement were received during this period from the following (no additional comments on the Draft Environmental Impact Statement were received after this period)*:

- American Textile Manufacturers Institute, Inc.;
- United States Department of Commerce;
- Department of Health, Education, and Welfare, Public Health Service;
- The Utility Solid Waste Activities Group and the Edison Electric Institute;
- Mobil Oil Corporation;

*Over 1,200 comments were also received on the proposed Subtitle C regulations during this period. Those comments are addressed in the background documents prepared for the Subtitle C regulations.

- American Petroleum Institute;
- Dow Chemical U.S.A.

These seven comments were considered and responded to in the preparation of the Final Environmental Impact Statement. The text of these comments is presented in Appendix O.

This chapter discusses the comments received on the Draft Environmental Impact Statement, the environnmental issues raised through those comments, and the resolution of the issues. Responses to the environmental issues raised by each commenter are presented below. Consideration of the comments and disposition of the issues raised are reflected, in part, by the revised text in other sections of the Environmental Impact Statement and, in part, by these point-by-point responses.

12.1 Comment Responses

Sections 12.1.1 through 12.1.7 present the environmental issues raised by each of the commenters and the resolution of these issues.

12.1.1 American Textile Manufacturers Institute, Inc.

Extension of Comment Period

Comment: The December 18, 1978 Federal Register notice states that the economic, environmental, and regulatory impact analysis for these proposed regulations is to be available for inspection on January 8, 1979. We have just received a copy of this report, and we are unable to review it in depth and prepare comments within the present comment period.

Response: Copies of the Draft Environmental Impact Statement for the proposed Subtitle C regulations were available at the ten U.S. EPA regional offices and Headquarters on January 8, 1979, for the express purpose of allowing the public ample time to review and comment on the document prior to individual mailings.

12.1.2 United States Department of Commerce

12.1.2.1. Foreign Shipments

Comment: According to the Section 3002 differences discussed in the Preface, generators who ship hazardous waste to a foreign country are required to inform the foreign government. Are generators required to inform foreign countries if the material is only in transit through their country? (In the case of material being shipped through the Panama Canal to be disposed of at sea, is the generator required to notify Panama?)

Response: Generators who ship wastes to a foreign country will be required to notify EPA in advance of the initial shipment in any calendar year. EPA will then notify others as appropriate. With regard to in transit shipments, generators must comply with national and international laws, e.g., Panamanian Law. See the February 26, 1980, Federal Register, Part 262, for further information.

12.1.2.2 Long-Term Land Capacity

Comment: Epic long-term capacity of land filling was not addressed in Section 7.2.5. It is stated that "existing land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Some agricultural, grazing, forest, recreational, and other lands could be removed from their existing uses." With a hazardous waste production of 4.7 million metric tons per year (Table 5-21), it seems that 1.3 square miles of land could be filled with a 20-foot thick layer each year. Elsewhere in the document and in recently-issued proposed regulations in the Federal Register, EPA discusses total current volumes of hazardous waste in the 35 million ton per year range, a figure that is expected to grow rapidly in the next few decades. How many years can we continue land filling on the scale this implies before the decrease in available land through waste containment has a significant effect on food production and other land uses?

Response: The use of land for hazardous waste management is just one of many factors that would affect the long-term availability of land for both food production and other uses. Other factors that would also affect long-term land availability and productivity include economic growth, population growth, energy development, technologic innovation, water availability, environmental pollution, and regulatory policies. Long-term land availability and productivity would depend upon extremely complex interactions among these and other factors and would have to be the subject of a comprehensive in-depth study in its own right. At this time, it is not possible to determine with any reasonable degree of accuracy how these interactions will resolve themselves and how they will thus affect long-term land availability and productivity for specific uses.

The EIS discusses those land use impacts that are attributable to promulgation of the Subtitle C regulations. Section 7.2.4.2 indicates the changes in on-site and off-site land requirements that could result from the baseline regulations. Section 7.2.5 describes long-term land use impacts that could result from these changes in land requirements and from other changes likely to result from the baseline regulations.

The DEIS does indicate that the regulations might result in increased land use for the environmentally acceptable management of hazardous waste. However, the primary reason behind additional lands being required for hazardous waste management under the regulations is the need to provide acceptable facilities for managing those wastes that are currently being generated, but that are not being managed in an environmentally acceptable manner. The DEIS notes that, to the extent that the regulations would prevent other lands from being contaminated by improper disposal, dumping, storage, or treatment of hazardous wastes under current practices and regulations, there would be a potential for offsetting land use benefits. The DEIS also notes in Section 7.1.2.1 that, due to increased costs associated with both hazardous waste generation and management under the regulations, generators would have an incentive to modify processes so as to reduce the amounts of hazardous waste produced by their processes and so as to enable increased recycling of hazardous wastes as process feedstocks. To the extent that such modifications occur, less waste would have to be disposed in the long-term. This would also potentially provide offsetting land use benefits.

It should be noted that Table 5-21 does not indicate that hazardous waste generation is 4.7 million metric tons per year. As stated in the text, Table 5-21 shows the total quantity of hazardous wastes contained in selected waste streams that were studied to determine their potential for energy recovery.

12.1.2.3 Agricultural Use of Closed Sites

Comment: Section 7.2.5 of the Draft EIS states that "Sites at which hazardous wastes have not been removed would be precluded from residential and agricultural uses, and may be precluded from some recreational and grazing uses following closure." If the intent of limiting the use to non-agricultural purposes is to keep highly persistent molecules out of the food chain, it will not work due to wild animals, insects, and birds foraging on plants in the site area. We recommend this concept be reviewed.

Response: This comment has been considered in the revision of the proposed Subtitle C regulations. Modifications to post-closure requirements (including stipulations on the future use of hazardous waste sites) have been considered and are addressed in the Phase I Alternative (See Sections 4.5 and 8.5).

12.1.2.4 Probability of Marine Accidents

Comment: With regard to Section 5.2.3.5, an impact that is not discussed is the possibility of a marine accident that would cause the release of up to 1,500 tons of hazardous waste into the Mississippi River or Gulf intercoastal waterways. A discussion of the probability of it happening, similar to the discussion on page 7-190 (Section 7.2.3.2) for highway transportation, would be useful.

Response: Section 7.2.3.2 discusses the potential change in the number of vehicular accidents that could result under the baseline regulations from a change in the quantity of hazardous waste being sent off-site by truck.

As indicated in Section 5.2.3.5, most hazardous waste material transported by waterway is sent to a resource recovery facility. Those waste materials sent to resource recovery facilities would not be identified as a solid waste under the Subtitle C regulations and would thus not be subject to the regulations.

The total quantity of hazardous waste materials transported by barge appears to be small, relative to highway transport. Data are not, however, available to estimate the quantity of waste presently transported by barge that could be subject to the regulations nor to estimate the change in the quantity of such waste that would be transported by barge under the baseline regulations. Consequently, the potential change in the number of marine accidents that could result under the baseline regulations cannot be estimated.

Section 7.1.5.1 has however been expanded to include a generic discussion of the potential for any changes in the quantity of regulated waste being transported by barge to result in changes in marine accidents. (It should be noted that Section 5.2.3.5 contains background information, not the impact assessment.)

12.1.3 Department of Health, Education, and Welfare, Public Health Service

12.1.3.1 Generator Limit

Comment: The EPA Standards, as proposed, would not apply to a generator producing less than 100 kilograms of hazardous waste per month. While this amount might not be considered significant for some chemicals, 100 kilograms of radioactive material or infectious material could present a substantial problem if proper handling, storage, transportation, and disposal practices are not observed.

Response: This comment has been considered in the revision of the proposed Subtitle C regulations. Section 7.1.6.1 discusses potential impacts that could result from the exclusion of such wastes from control under the baseline regulations. Sections 8.3 and 8.4 discuss the potential impacts that could result from alternative generator limits.

12.1.3.2 Storage Without a Permit

Comment: The proposed standards would not apply to a generator who stores hazardous wastes less than 90 days. Has the issue of regulating all generators been considered since the improper storage, handling, treatment, or disposal of hazardous wastes may represent a sustained threat to health irrespective of the time factors involved?

Response: This comment has been considered in the revision of the proposed Subtitle C regulations. Under the proposed regulations, those generators who accumulate wastes, prior to off-site disposal, for less than 90 days without a permit are still required to comply with the container standards specified in Section 3002. One additional requirement is being considered for on-site accumulation without a permit and is addressed in the Phase I Alternative (see Sections 4.5 and 8.5). Other changes with regard to the accumulation of wastes without a permit in storage tanks are being considered and will be addressed in the Phase II Alternative to be added in Part 2 of the final Environmental Impact Statement.

12.1.3.3 Number of Generators

Comment: On page S-19 of the DEIS it is estimated that 430,000 to 460,000 generators would have to comply with hazardous waste regulations. An indeterminant number of "special waste" generators could also have to comply. These figures are inconsistent with the statement noted on page 58946, column 3, of the December 18, 1978, Federal Register. That reference estimates approximately 270,000 waste generating facilities. This discrepancy should be resolved since the actual number of generators will have a drastic effect on the estimates of paperwork required under this regulation, numbers of generators affected, and the potential health and safety impact on the general population.

Response: The DEIS estimate of the number of generators required to comply with the regulations has been revised downward. The revision has been made to account for the effect of the waste automotive oil transfer of liability contract on the number of regulated generators.

12.1.3.4 Phasing of Generators

Comment: Using the figures in the Federal Register, it is estimated that approximately 270,000 waste generating facilities and 10,000 transporteres will be regulated, although only about 30,000 of that number will require treatment, storage, or disposal permits. Generators would be phased over a 5-year period with the larger producers brought into compliance first.

We do not agree with this philosophy and believe that through the application of the regulations to everyone, many generators can immediately be brought into "voluntary" compliance with little effort. It is recognized that some firms may require time extensions to achieve compliance, but this extension should be on a case-by-case basis.

Response: The phasing of generators under the regulations is one of many alternative approaches that were considered in the development of the Subtitle C regulations. This alternative is analyzed in the DEIS in Section 8.2, but was not included in the proposed Subtitle C regulations.

12.1.4 The Utility Solid Waste Activities Group and The Edison Electric Institute

12.1.4.1 Quantitative Estimates

Comment: The DEIS lacks quantitative estimates which measure impact assessments in absolute terms. In this most crucial aspect of an impact statement, the DEIS is seriously deficient because of the lack of quantitative and specific data and information, especially in key decision-making areas. Typically, when assessments are attempted in the DEIS, they are presented on a comparative, qualitative basis, presumably based on the judgment of EPA and their contractors. This absence of quantitative, absolute data and information effectively frustrates any attempt to distinguish clearly either absolute or incremental effects or impacts of the proposed or alternative actions. (See Appendix O for specific examples indicating the qualitative nature of the impact assessment).

Response: As is indicated in the DEIS, extremely limited data are currently available with regard to both the generation and the management of hazardous waste. To the extent that the limited data allow, impacts are assessed quantitatively in the DEIS. However, while every effort has been made to make the analysis as quantitative as possible, data limitations for the most part, necessitate a generic and qualitative assessment of impacts. Section 7.3 indicates the significant uncertainties present in the impact assessment.

Although the specific magnitude of impacts may not always be known, the types of impacts that could occur (both beneficial and adverse) are identified. Also identified are the types of impacts that may be significant, the types of impacts that cannot presently be mitigated, and data gaps and uncertainties that need to be resolved. These are some of the important environmental considerations with regard to decision-making and program planning.

12.1.4.2 Incomplete Data Base

Comment: The value and meaningfulness of the qualitative assessments are further weakened by the fact that they have been based on a limited data base representative of only the manufacturing industries. (See Appendix O for excerpts from the DEIS which outline the limitations in the data base used to support impact assessments.) The completeness of even that data base was called into question in Section 7.1.3.3. While there would seem to be ample justification to question the selection of the manufacturing industries data base as the basis for impact assessments in the DEIS, this comment relates not to the matter of data base selection, but to the inappropriateness of the DEIS subjective/qualitative judgments (based on manufacturing industry waste information) as applied to other industries' wastes. The differences in waste characteristics and treatment and disposal practices between industries and industrial groupings are extremely significant. This was recognized to a great extent by EPA in establishing the "special wastes" category.

Notwithstanding the special waste categorization, the proposed regulations do apply to and will have significant impacts on non-manufacturing industries. Yet, there has been no effort made to evaluate just what the impacts will be for these industries and whether or not the regulations are accordingly justified. This is a serious deficiency in the DEIS which significantly limits its usefulness to support decision-making.

Response: It is agreed that the regulations would have significant impacts on both manufacturing and non-manufacturing industries. As indicated in Section 7.0, the emphasis of the impact analysis is necessarily directed toward manufacturing industries because most available data concerning hazardous waste generation and management relate to manufacturing industries. Impacts from the regulation of non-manufacturing industries are addressed to the extent that the available data allow (see, for example, Sections 6.1.2, 7.1.3.3, and 7.1.3.6).

Due to the significant differences that exist in waste characteristics and management practices among both the various manufacturing and non-manufacturing industries, any detailed assessment of the overall potential impact of the regulations on various manufacuturing and non-manufacturing industries would essentially require the preparation of an entire separate assessment for each and every industry. Such an undertaking is not manageable within the scope of this Environmental Impact Statement. Furthermore, the extensive data limitations previously indicated (and reaffirmed by the public comments on the proposed regulations) along with the extreme waste-specific, process-specific, and site-specific nature of most impacts would at this time preclude the preparation of a meaningful comprehensive assessment for most industries, and especially for non-manufacturing industries. It should be noted that, for the most part, the major impact of the regulations on industry would be economic in nature. The major economic impacts of the regulations on various industries are analyzed in the Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement), not in the EIS.

12.1.4.3 Meaningfulness of Alternatives

Comment: We question the meaningfulness of EPA's alternatives selection on two accounts. First, EPA does not provide any support or foundation to demonstrate that the alternatives that were selected actually do bracket the anticipated overall objectives and resultant impacts. We believe that such a demonstration by EPA is in order. Our basic contention in suggesting such a need is that unless the "world" that is to be affected (in this case, by the proposed or alternative regulations) is reasonably well known and defined, one cannot reasonably assume that the appropriate "bracket" has been established or that the resultant impacts have been bracketed. More specifically, and as reviewed previously, EPA has stated that the focus of its assessment has been with respect to manufacturing industries and that in many of these, the number of hazardous waste generators are not known. Alternatively stated, EPA has assessed the impacts of the regulations (i.e., proposed and alternatives) based on a "sample" of the "world" that will be impacted while it has demonstrated no support that its "sample" is representative.

If it were discovered that the "sample" used by EPA in its analysis was not representative, it is possible that the impacts such as plant closings or community out-migration could become extremely significant. Given that EPA has not quantified the absolute impacts of each of its alternatives or quantified the incremental quantitative impacts among the alternatives and the proposed action, the reviewer has no reasonable way of accepting that the alternatives are meaningful ones which truly bracket the impacts from "whatever set of regulations that are ultimately promulgated. . . ."

Response: The latter part of the comment indicates that variances in data would change the predicted impacts that could occur under the alternatives analyzed and could thus invalidate EPA's selection of alternatives used to bracket anticipated impacts. Based upon this, it appears that there is some confusion about the difference between the brackets (constraints) imposed by the set of alternatives used for the assessment and the constraints imposed by the adequacy and/or representativeness of the existing data base. This difference is very important and needs to be addressed before responding to the first part of the comment.

The set of alternatives provides the framework for assessing impacts by defining those wastes and activities that are excluded from regulation and by defining those wastes and activities that are to be regulated and the manner in which they are to be regulated. The set of alternatives thus limits both the "world" that is to be affected by the regulations and the types of impacts that can potentially occur and be assessed within that world. This bracketing occurs independent of data considerations and exists whether or not data is available to assess impacts within these limits. While the adequacy and representativeness of the existing data base does, without question, affect the reliability of the assessment of the set of alternatives, the data base does not in any way affect those brackets (constraints) imposed by the set of alternatives.

With regard to the issue that there is no support to demonstrate that the set of alternatives truly brackets the impacts from the set of regulations to be ultimately promulgated by EPA, it should first be noted that during the development of the Subtitle C regulations numerous issues have been reviewed by EPA and numerous regulatory options have been considered for promulgation by EPA (see the Background Documents for a discussion of the major issues raised and the major regulatory options considered). For reasons discussed in response to comment 12.1.4.4, it was not possible for the EIS to assess each and every regulatory option considered; as a result, it was necessary to select and develop a manageable set of meaningful alternatives for analysis purposes.

The various regulatory options considered reasonable for promulgation by EPA under the mandate of Subtitle C were used in selecting such a set of alternatives. To insure that the set of alternatives reasonably brackets the anticipated impacts from the regulations that are ultimately to be promulgated, the regulatory options included in the set of alternative were put at the limits at which they were considered for promulgation. For example, while EPA proposed a generator limit of 100 kilogram per month, EPA also considered as reasonable proposing a generator limit as high as 1,000 kilograms per month or eliminating the generator limit entirely and regulating all hazardous waste generators. The set of alternatives selected imposes generator limits between zero and 1,000 kilograms per month and thus brackets the regulatory options considered reasonable.

By setting the regulatory options at the limits considered for promulgation, the set of alternatives thus reasonably brackets the regulations considered for promulgation and thus reasonably bracket the impacts anticipated from these and intermediate regulations. Obviously, if the regulations that are ultimately promulgated contain options not previously considered by EPA, it is possible that not all significant impacts would be bracketed; however, it is not possible to anticipate such developments. As is discussed above, the validity of the data base available for impact assessment does not in any way affect the brackets imposed by threse alternatives.

It should be noted that a new alternative, the Phase I Alternative, has been added to enable the assessment of additional regulatory options now being considered for promulgation as part of the Phase I regulations. A second new alternative, the Phase II Alternative, is to be added in part II of the final EIS so as to enable the asssessment of additional regulatory options being considered for promulgation as part of the Phase II regulations.

12.1.4.4 Analysis of Each Regulatory Option

Comment: Second, we question the meaningfulness of the alternatives since each alternative represents a combination of many different regulatory mechanisms and controls. For example, the lesser degree of control alternative involves elimination of the identifying characteristics test of hazardousness, increasing the generator cutoff to 1000 kg/month, and other changes. Similarly, enhanced degree of control involves elimination of the special waste standards, no generator cutoff, and expansion of the identifying characteristics applicability. Thus, when assessing the impact of an alternative, the DEIS is presenting the combined impact of a number of regulatory options. By this method of evaluation, the importance/significance of each of the regulatory options which make up a whole alternative is lost. For example, if 90 percent of the benefits accruing from the enhanced degree of control are achieved by eliminating the cutoff and very little benefit is achieved through expanding the identifying characteristics test (at probably considerable additional cost and inconvenience), these factors would be essential to the development of meaningful and cost effective regulations. The alternatives as they are presently structured do not allow for this type of regulatory option "sensitivity analysis."

The alternatives evaluation, in our opinion, should be structured so as to test the impact of each regulatory option, in and of itself. Thus, those options having real and significant benefits could be identified and included in the final regulations. Conversely, those options that have questionable or limited benefits but real and significant costs could be excluded.

Response: First, it is not meaningful, nor even possible, to assess a regulatory option by itself. A regulatory option takes on meaning only in relation to the remainder of the regulations. For example, a generator cutoff has no real meaning unless characteristics for identifying hazardous waste are defined along with requirements for managing of the waste to be regulated. Without defining a complete set of regulations, it is not possible to fully assess the impact of any regulatory option since the effects of excluded portions of the regulations would not be taken into account. For example, if landfill requirements, transport requirements, and/or reporting requirements were not specified, it would not be possible to provide a complete or even accurate assessment of the environmental or economic impacts of different generator cutoff limits.

Similarly, changes in other parts of the regulations would result in changes in the impacts from the various components of a specific regulatory option. For example, the overall impacts of generator cutoffs of zero or 1,000 kilograms per month would vary considerably depending upon how toxic wastes were defined, depending upon whether retailers and farmers were regulated or excluded from regulation, and depending upon whether incinerator destruction efficiencies were required to be 99.9 or 99.99 percent. Thus, a truly accurate assessment of each regulatory option, in and of itself, would require both that an entire set of regulations be specified for the assessment and that the regulatory option be assessed for all variations of all other regulatory options. Furthermore, every assessment of each regulatory option would have to include all the primary and secondary impacts addressed in the DEIS.

Second, a large number of different regulatory options have been considered in the development of the Subtitle C regulations. See the background documents prepared on the Subtitle C regulations by EPA for a discussion of the major regulatory options considered. The background documents consider specific changes on a one-at-a-time basis. As is discussed in Section 4.0, these regulatory options could be structured into an enormous number of different sets of regulatory alternatives. Consequently, for reasons discussed above, it would not be practical, nor even manageable, to attempt to provide a complete assessment of each and every regulatory option. Thus, the only reasonable approach was the development of a manageable set of meaningful alternatives for assessment purposes. This is what was done.

12.1.4.5 Relative/Qualitative Nature of Alternatives Assessment

Comment: As was the case for the impact assessment of the proposed regulations, the DEIS presents assessments of the impacts of the alternatives which are for the most part qualitative in nature and seriously deficient with respect to absolute/quantitative measures of impacts. Because the alternatives are assessed in such a qualitative/subjective fashion, the meaningfulness of the assessments cannot be determined and the overall value of the evaluation of alternatives is questionable.

The problem is further compounded by the fact that, in comparing an alternative to the proposed regulations, the comparison is carried out in relative terms. Thus, we are told that a particular alternative will have a greater or a lesser impact than the proposed regulations without being told how much greater or how much lesser that impact will be. Further, we are given no indication of how significant or important this particular difference in impact is. When this is viewed in light of the fact that we have not been presented an assessment in quantitative terms of the impact of the proposed regulations--to which we are comparing the alternative--the value and credibility of the DEIS to support federal agency decision-making is open to significant doubt. (See Appendix O for specific excerpts of qualitative analyses presented in the comment letter.)

Response: As is indicated in the response to comment 12.1.4.1, impacts are assessed quantitatively in the DEIS to the extent that the limited data available allow. Data limitations, for the most part, necessitate a generic and qualitative asessment of the impacts of both the baseline regulations and the alternative.

Although the specific magnitude of changes in impacts may not always be known, the evaluation of the alternatives identifies the types of impacts (both beneficial and adverse) that could occur under each alternative and relates them to the types of impacts that could occur under the baseline regulations. Also identified are those types of changes in impacts that may be significant, those types of impacts that cannot presently be mitigated, and data gaps and uncertainties that need to be resolved. These are some of the important environmental considerations with regard to decision-making and program planning.

12.1.4.6 Relationship Between Waste Volume and Impact

Comment: In comparing the impacts of the proposed regulations to those of the alternatives, and in fact, in assessing the impacts of the alternatives, EPA's assessments often contained an underlying assumption that degree of hazardousness was directly related to waste volume. This is obviously an incorrect assumption; one, in fact, to which EPA would certainly not subscribe. However, as a result of a lack of information and a lack of other available assessment means, EPA often assessed the alternatives in terms of the volumes of wastes generated. As a result of the inclusion of this incorrect assumption, the results of EPA's analysis could be extremely misleading.

This point can best be demonstrated by the example of the assessment of the phasing alternative. The phasing alternative consisted of increasing the volume of waste under control at a rate of 20 percent per year, resulting in all wastes being subject to control after an initial five year period. In assessing this particular alternative, EPA's analysis was directed at the volume of waste under control without giving consideration to the threat to public health, welfare and the environment inherent in the waste, regardless of volume.

Specifically, a "straight line" type of approach is implied in the analyses. That is, if 20 percent of the total wastes is managed, then 20 percent of the ultimate benefit is achieved at 20 percent of the cost. This is obviously an overly simplistic approach, and, indeed, may well ignore reality. For example, management of relatively small wastes could yield far greater proportionate benefits if such wates had high risks or high potential for environmental harm. Ultimately, it may be possible to control less than the amount of wastes currently expected by EPA with far less dislocation and greater benefit.

We suggest that a more meaningful approach to analyzing this alternative would entail focusing on "threat" or "risk" potential of wastes and the step-wise management of those posing the greatest risk/threat first and the least risk/threat last. In the analysis of such an approach, the benefits/disadvantages that may accrue to society by allowing monitoring of the results (i.e., actual cost/benefit) at the end of years one through "n" could be assessed and allow for "re-focus" of the regulations as a function of time.

Response: EPA agrees that the degree of hazard posed by various wastes is not necessarily directly related to their relative waste volumes. As discussed below, the impact assessment does not contain the underlying assumption that the degree of hazard is directly related to the waste volume.

With regard to the Phasing Alternative, Section 4.2 discusses different methods by which phasing could be implemented and presents the rationale for the selection of the phasing method analyzed in the impact statement and for the elimination of other phasing options. The method selected emphasizes a volume approach to phasing. A method based upon a degree of hazard approach was also considered and determined not to be a reasonable alternative due to data limitations and program management and enforcement problems. The elimination of this method as an alternative in the impact statement does not, however, imply that the impact assessment assumes that the degree of hazard is directly related to waste volume.

Sections 4.3 and 4.4 present the rationale for the selection of the Enhanced Public Health and Environmental Protection Alternative and the Lesser Degree of Public Health and Environmental Protection Alternative. As discussed in response to comment 12.1.4.4, these alternatives were developed to bracket the impacts of the regulations ultimately promulgated by EPA. To this end, the Enchanced Protection Alternative regulates all the waste already subject to the baseline regulations plus other additional wastes. Similarly, the Lesser Degree of Protection Alternative regulates only a portion of the total waste already controlled under the baseline regulations.

The analysis of the Enhanced Protection Alternative does indicate that the regulation of the additional waste would provide greater protection than that afforded under the baseline regulations. However, this does not in any way imply that the analysis assumes that the degree of hazard is directly related to the waste volume. Rather the conclusion is based upon the fact that since this alternative regulates all the waste already subject to the baseline regulation, the regulation of the additional volume of waste, which contains both highly hazardous and moderately hazardous waste, must necessarily result in enhanced protection as compared to the baseline regulations.

Similarly, the analysis of the Lesser Degree of Protection Alternative does indicate that the regulation of a lesser quantity of waste would provide less protection than that afforded under the baseline regulations. Again, this does not in any way imply that the analysis assumes that the degree of hazard is directly related to the waste volume. Rather the conclusion is again based upon the fact that since this alternative regulates only a portion of the waste already subject to the baseline regulations, the regulation of this lesser volume of waste, which contains less highly hazardous and moderately hazardous waste, must necessarily result in less protection than that provided by the baseline regulations.

12.1.4.7 Overall/Comparative Assessment of Alternatives

Comment: The DEIS describes the proposed regulations and four alternative sets of regulations. It presents an impact assessment (albeit qualitative) for the proposed regulations and individual assessments for each alternative relative to the proposed regulations. There is, however, no overall/comparative assessment indicating, all things considered, how the proposed regulations and the alternatives "stack up" one against the other. This is in direct contradiction to the EPA guidelines for impact statements on regulatory actions (see Appendix O) which require that "the reasons why the proposed action is believed by the Agency to be the best course of action shall be explained."

Obviously, EPA has decided that the proposed regulations, in an overall sense, are preferred as compared to each of the alternatives. However, the rationale for why the proposed regulations are preferred is not presented. Each of the alternatives and the proposed regulations are compared in specific areas. That is, the phasing alternative may require less paperwork than the proposed regulations and from that standpoint is preferred. Similarly, the lesser degree of control alternative will result in greater emissions of air, water and soil contaminants and from that standpoint may be inferior to the proposed regulations. What is lacking, however, is an analysis combining the positive and negative aspects of each of the alternatives in comparison to the proposed regulations and demonstrating the overall desirability of the proposed regulations.

We feel that such an overall/comparative assessment considering economic, social and environmental costs and benefits is required. Since the DEIS does not include economic cost estimates (this information is supposedly included in the Economic Impact Analysis which is referenced), the least that the DEIS could do is to present an analysis from the standpoint of the environmental and social considerations which have been addressed. As it currently stands, we feel that the document is inconclusive and does not present EPA's reasoning for its selection of the proposed regulations.

<u>Response</u>:

The proposed and final regulations were prepared on the basis of protecting human health and the environment. Likewise, alternatives were established to emphasize the objects of RCRA and to be consistent with the scope of actions feasible under RCRA. The overall/ comparative assessment is addressed in the Regulatory Analysis prepared for Subtitle C. Comments were sought to assist the Agency in establishing the best of several options. For further information, see the Regulatory Analysis which is referenced in the preamble of the final regulations.

12.1.4.8 Impact Assessment with Respect to Utility Industry Wastes

Comment: The DEIS does not include, nor does it purport to include, an impact assessment of the proposed regulations with respect to utility industry wastes whether these wastes be high volume wastes and included in the special wastes category or otherwise. The draft impact statement does point out that certain utility wastes, because of unique characteristics, have been included in the "special wastes" category wherein (provided they are found to be hazardous under an identifying characteristics test of Section 3001), they would only be subject to some of the Subpart D requirements. No impact assessment is, however, presented with respect to the impact of even those limited requirements on the electric utility industry wastes which fall under the special waste category (see Appendix O for specific examples). Moreover, no assessment is presented with respect to the impact of the entire set of regulations on all other utility wastes which are not included in the special waste category.

Response: A detailed assessment of the overall potential impact of the regulations on various industries, such as the electric utility industry, would essentially require the preparation of an entire separate assessment for each and every industry. The extensive data limitations previously indicated (and reaffirmed by the public comments on the proposed regulations) along with the extreme waste-specific, process-specific, and site-specific nature of most impacts would preclude the preparation of a meaningful comprehensive assessment for most, if not all, industries at this time. For the most part, the major impact of the regulations on industry would be economic in nature. The major economic impacts of the regulations on various industries are analyzed in the Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement).

12.1.4.9 Electric Utility Waste

Comment: Notwithstanding an admitted lack of information on the electric utility industry and its wastes, the DEIS refers in numerous instances to wastes resulting from the combustion of coal as "potentially hazardous" (see Appendix O for examples of statement, presented in Chapters 6 and 7). In reality, in accord with the regulations, every waste is potentially hazardous until a specific determination based on the Section 3001 testing procedures is made. Identification, at this stage, of a particular waste as being potentially hazardous (without any knowledge of whether or not it will be determined to be hazardous or, if so, to what extent), is patently irresponsible. Industries whose wastes have been identified and characterized as such could suffer serious consequences purely from such a characterization. Clearly, because of the obvious implications, it is incumbent upon EPA to refrain from giving inappropriate and damaging "labels" to wastes when, in fact, it is acting without factual data and information.

Response: The intent of Chapter 6 is to present available data with regard to various sources that have been previously identified as potential generators of hazardous waste. It was not, however, meant to be implied that all wastes generated by these sources would be identified as hazardous waste under Subtitle C. Sections 6.1.2 and 7.1.3.3 have been modified to clarify this intent with regard to both electric utility wastes and the other wastes discussed.

12.1.4.10 Reported Groundwater Contamination

Comment: Table 7-10 lists 57 cases of groundwater contamination caused by leakage of wastewater from surface impoundments. One of these 57 cases is reported as iron and manganese pollution from an electric utility industry source. However, no detail or further information is given on the impact, if any, on public health or the environment. Moreoever, in referring to this particular table in the DEIS, EPA refers to the table as presenting incidents of groundwater contamination due to hazardous waste disposal. This is obviously in conflict with the title of the table, "Origins and Pollutants in 57 Cases of Ground Water Contamination in the Northeast Caused by Leakage of Waste Water from Surface Impoundments," and certainly, without presenting any further information, seems to be a rather careless use of the characterization "hazardous."

Response: Table 7-10 is based upon a study of groundwater contamination in the Northeast by Miller et al. This study is referenced in Appendix N of the DEIS (Appendix P in the final EIS).

It is agreed that sufficient data does not exist to determine which of the wastes listed in Table 7-10 would be identified as hazardous under Subtitle C. The text in Section 7.1.5.3 has been modified to eliminate identifying all wastes listed in Table 7-10 as hazardous waste.

The intent of the table is to illustrate the potential for ground-water contamination to occur from present unregulated practices. Even though it is not possible to identify exactly which wastes in the table would be considered hazardous under the regulations, the table does indicate the likelihood of potentially harmful leachate to be released from surface impoundments managing hazardous wastes under current practices.

12.1.4.11 Recovery Potential

Comment: At a broader level, the DEIS has not considered recovery and utilization potential of utility industry wastes or the extent to which such potential may be foreclosed by the proposed regulations. (A complete discussion of reuse and recovery is included in the overall comments on the Subtitle C regulations in the appendix entitled "Summary Report on Large Volume Electric Utility Industry Solid Wastes as a Resource for Recovery and Utilization.")

Response: As is discussed in response to comment 12.1.4.8, a detailed assessment of the potential impacts of the regulations on individual industries is beyond the scope of the EIS. Furthermore, the limited data available (see Section 5.4) precludes the preparation of a meaningful assessment of changes in hazardous waste utilization for most, if not all, industries (including the electric utility industry) at this time.

With regard to the referenced Summary Report, the information presented is much too general to be of use in assessing the impact of the regulations on the utilization of utility waste. For example, the data presented does not even allow a determination of which, if any, of the utility waste being utilized for various purposes would be both hazardous and subject to the regulations. It should be noted that the Subtitle C regulations would apply only to a limited portion of the waste materials that have a potential for utilization. For example, waste materials that are recycled or recovered or whose re-use does not constitute disposal would not be subject to the regulations. Wastes whose re-use constitutes disposal would be subject to the regulations only if the wastes are hazardous under the Subtitle C regulations.

12.1.4.12 Coal Consumption

Comment: In a similar vein, the DEIS has not considered the impact of the regulations, vis-a-vis reduced coal consumption, on U.S. plans to develop our coal reserves extensively in order to achieve energy independence.

Response: The Subtitle C regulations are just one of many factors that could have an impact on U.S. coal development and consumption. Other factors that would also affect coal development and consumption include Federal and state restrictions on the development of certain specific coal reserves, manpower and equipment constraints, water availability, economic growth, technologic innovation, energy conservation, availability of alternative energy supplies, and various other environmental regulations. Future coal development and use would depend upon complex interactions among these and other factors and would have to be the subject of a comprehensive in-depth study in its own right. There have been many in-depth studies in recent years that have attempted to project future coal consumption. Due to the significant uncertainties associated with the above factors, these studies have arrived at widely varying estimates of future coal consumption. It is not possible to determine with any reasonable degree of accuracy at this time the interrelationship of the Subtitle C regulations and the future developmentof U.S. coal resources.

To the extent practical, the discussions of energy use impact (Sections 7.2.8, 8.3.2.8, and 8.4.2.8) have however been expanded to address the potential for the regulations to impact energy production.

12.1.5 Mobil Oil Corporation

12.1.5.1 General Deficiencies

Comment: The Agency has not justified the regulations with adequate supporting data and as a result, they have severely under-estimated the impacts of the proposal. This has resulted in gross deficiencies in the Agency's Environmental Impact and Regulatory

Analyses. We support the detailed comments on this aspect submitted by the American Petroleum Institute and the Manufacturing Chemists Association.

Response: The American Petroleum Institute's comments on the DEIS are addressed in Section 12.1.6. The Manufacturing Chemists Association did not submit comments on the DEIS.

12.1.5.2 Degree of Hazard

Comment: The Agency has failed to differentiate the relative degrees of hazard posed by different types of wastes, has not assessed the potential risk to the environment in setting stringent performance standards, and has not addressed the risk to the environment in setting a policy where almost all non-municipal waste materials will be hazardous wastes. The overly broad definition of hazardous waste combined with the stringent requirements for management will be counterproductive and lead to the situation where compliance is impossible because of the shortfall of approved facilities. Due to overloaded facilities, there could be a greater risk to the environment.

Response: The DEIS assesses the potential impacts that could result from the baseline action (Section 7) and from two alternatives structured to provide a greater degree (Section 8.3) and a lesser degree (Section 8.4) of environmental protection. Due to differences in the definition of hazardous waste among these three alternative actions, each of the three alternative actions provides for the regulation of significantly different quantities of hazardous waste. The assessment of these three alternative actions thus addresses the overall impacts that would result from the regulation of significantly different quantities of hazardous waste, including changes in any potential shortfall of hazardous waste management capacity. The Phase I Alternative added in Part I of the final EIS provides a further assessment of the impacts from the regulation of different quantities of hazardous waste.

Modifications to the technical standards for treatment, storage, and disposal will be included in the Phase II regulations and will be addressed in Part II of the final EIS.

12.1.5.3 Alternatives

Comment: The Agency's difficulties in meeting court mandated promulgation dates are appreciated; however, no proposed regulation should be promulgated without an adequate background in fact. A regulation characterized in the introduction as extraordinarily complex, difficult, and comprehensive, requires an adequate and complete environmental impact statement which does not in our judgement exist for the regulation as a whole and certainly not as related to major impacts on oil drilling and production operations. The environmental impact statement should be expanded to more completely evaluate impacts of selected and alternate regulatory choices.

Response: The discussions of energy use impact (Sections 7.2.8, 8.3.2.8, and 8.4.2.8) have been expanded, to the extent practical, to address the potential for the regulations to impact energy production.

A detailed assessment of the overall potential impact of the regulations on various industries, such as the oil production industry, would essentially require the preparation of an entire separate assessment for each industry. The extensive data limitations previously indicated (and reaffirmed by the public comments on the proposed regulations) along with the extreme waste-specific, process-specific, and site-specific nature of most impacts would preclude the preparation of a meaningful comprehensive assessment for most, if not all, industries at this time. For the most part, the major impact of the regulations on industry would be economic in nature. The major economic impacts of the regulations on various industries are analyzed in the Integrated Economic Impact Assessment of Hazardous Waste Management Regulations (Regulatory Analysis Supplement).

The issue of the need for evaluation of selected and alternative regulatory choices is addressed in the response to comment 12.1.4.4.

12.1.5.4 State Responsibilities

Comment: The impact analysis appears to inadequately assess state resources and the ability of the states to implement the regulation and assure costly continued compliance. In the case of oil drilling and production, comprehensive regulations using alternate proven approaches are already in place.

Response: The analysis of state resources and of the ability of states to implement the regulations and assure continued compliance is a regulatory issue, not an environmental issue. As such, it is addressed in a separate document -- "Operational Resource Impact Analysis: Resource Conservation and Recovery Act of 1976, Subtitle C", Final Report, March 1980. It should be noted that RCRA mandates that states be authorized to carry out their own program in lieu of the Federal program, provided that specified conditions are met. Authorization would be granted by EPA only to those states that are in compliance with all the specified requirements. EPA will evaluate all applications for authorization to determine those states that are to be granted authorization.

12.1.6 American Petroleum Institute

12.1.6.1 Contravention of NEPA's Mandate

Comment: The DEIS, although deficient as to some of the NEPA Section 102(2)(c) requirements, demonstrates that EPA's proposal will violate NEPA Sections 101(b)(3) and (4) by imposing requirements which will cause more harm than good. For example, the DEIS predicts that there may be substantial shifts from on-site to off-site disposal. Such shifts will result in greater hauling distances causing increased air pollution and congestion in many areas.

The DEIS points to another impact of the proposed regulations which is contrary to NEPA's purposes of maintaining land for a variety of uses; that is, "[m]ore total land, off-site, plus on-site, would be required for hazardous waste management under the Subtitle C regulations than for hazardous waste management under current practices."

The DEIS explains that "[e]xisting land uses would cease, either permanently or temporarily, on all land converted to hazardous waste management uses. Some agricultural, grazing, forest, recreational, and other lands could be removed from their existing uses."

Response: The DEIS indicates both the beneficial and the adverse impacts that could result from promulgation of the Subtitle C regulations. The DEIS does indicate that the regulations might result in more hazardous waste being sent off-site and that the regulations would result in increased land use for environmentally acceptable management of hazardous waste. However, the primary reason behind any additonal waste being sent off-site is that the waste was not being managed on-site in an environmentally acceptable manner to begin with. Furthermore, the primary reason behind additional land being required for hazardous waste management under the regulations is the need to provide acceptable facilities for managing those wastes that were not previously being managed in an environmentally acceptable manner. The DEIS notes that to the extent that the regulations would prevent other lands from being contaminated by improper disposal, dumping, storage or treatment of hazardous wastes under current practices and regulations, there would be a potential for offsetting land use benefits.

The DEIS complies with all the requirements specified in Section 102(2)(c) of NEPA. Section 102(2)(c) requires that environmental impact statements analyze:

- The environmental impact of the proposed action;
- Any adverse environmental effects which cannot be avoided should the proposal be implemented;
- Alternatives to the proposed action;
- The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity;
- Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

These points are all specifically addressed in the DEIS in Chapters 7, 9, 8, 10, and 11 respectively.

12.1.6.2 Costs and Benefits

Comment: The DEIS fails to assess whether benefits justify costs. As an instrument to be used in the decision-making process, the failure of the DEIS to address costs and benefits indicates that EPA did not balance the "pros and cons" of the proposed program in order to minimize environmental and economic disruptions. Further, the failure to estimate costs and benefits makes the consideration of alternatives to the proposed action impossible. The DEIS is particularly deficient in its discussion of the alternatives it considered to the proposed program. This glaring omission to balance costs with benefits is not corrected by the Draft Economic Impact Analysis. As explained in detail in Part III of the American Petroleum Institute comments, the Draft Economic Impact Analysis omits costs incurred by several important segments of the petroleum industry.

Response:

The intended purpose of the DEIS is to assess the impact of the proposed Subtitle C regulations on human health and the environment. The intended purpose of the Draft Economic Impact Analysis (DEIA) is to assess the cost impact of the proposed Subtitle C regulations. The DEIA, which accompanied the December 18, 1978 proposed regulations, qualitatively discussed the potential impacts of complying with these regulations. There are large benefits from the regulation of hazardous waste; however, many are extremely difficult to quantify. EPA has not attempted to quantify the economic benefits from avoiding human health damage. A chapter on benefits of the hazardous waste regulatory program, included as part of the Econmic Impact Analysis associated with the final regulations, contains a generic discussion on this subject.

12.1.7 Dow Chemical U.S.A.

12.1.7.1 Extension of Comment Period

Comment: The Dow Chemical Company respectfully petitions that the due date for public comment on EPA's proposed regulations implementing Sections 3001, 3002, and 3004 of the Resource Conservation and Recovery Act of 1976 proposed in the December 18, 1978 Federal Register (43 Fed. Reg. 58946 et seq.), and now set to expire on March 16, 1979, be extended until at least 60 days after the proposal of all regulations implementing Subtitle C. Although the regulations for Sections 3001, 3002, and 3004 were proposed on December 18, 1978, the background documents were not available for review until January 8, 1979, and published copies of the draft Environmental Impact Statement (EIS) were not available for distribution until early February. The integrated permit regulations pursuant to Section 3005 of the RCRA have not yet been proposed. Regulations for Sections 3003, 3006, 3010, and 4004 were previously proposed in mid-1978 before the characteristics of hazardous waste described in proposed Section 3001 were fully developed. This piece-meal proposal and promulgation has made coherent overall assessment of the changes occurring among the individual Sections of the regulations impossible.

Response:

EPA has provided the public with ample time for comment on the draft Environmental Impact Statement for the proposed Subtitle C regulations. Although copies were not individually distributed until February 1979, they were made available for review in the EPA regional offices as well as Headquarters on January 8, 1979.