

United States International Trade Commission

Solid and Hazardous Waste Services: An Examination of U.S. and Foreign Markets

Investigation No. 332-455
USITC Publication 3679
April 2004



U.S. International Trade Commission

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ABSTRACT

The environmental services sector, including the solid and hazardous waste services industry, is the focus of increasing international attention. The sector has received special emphasis in the World Trade Organization (WTO), as the reduction or elimination of barriers affecting trade in such services has been identified in the Doha Ministerial Declaration as one of the principal goals of the present negotiating round. Moreover, environmental issues have become increasingly tied to international trade and investment, such that the environmental impact of trade agreements is more likely to be evaluated and considered as a critical component of the policy under consideration.

This report provides an overview of U.S. and foreign markets for solid and hazardous waste services; examines trade and investment in solid and hazardous waste services markets, including barriers affecting such trade and investment; and discusses existing regulatory practices. With regard to the geographic coverage of this report, information is presented on both developed- and developing-country markets.

The global market for solid and hazardous waste services is dominated by developed countries, with the United States, Western Europe, and Japan ranking as the world's largest markets for such services. In most developed countries, the solid and hazardous waste services sector is considered a mature and competitive industry, while solid and hazardous waste services markets in many developing countries are small, but rapidly growing. Among the countries discussed in this report, high-income economies typically generate more solid waste than the middle-income economies. In addition, high-income countries manage a greater share of their waste, are more likely to employ modern waste management techniques, and are more likely than developing economies to maintain and enforce strict waste management regulations, as developing economies may lack the economic and political capacity to finance extensive waste management programs or maintain strict regulations.

The extent of cross-border trade and investment in solid and hazardous waste management services differs dramatically among the countries examined in this study, but is greatest among high-income countries where stringent regulation and consistent enforcement create steady demand for waste management services and encourage the development of waste management capacity. Few of the countries selected for discussion in this report have explicit restrictions on trade in solid and hazardous waste management services. However, regulations and practices that pertain to all sectors, or to related sectors such as architecture and engineering, can potentially affect trade in the waste management industry.

PREFACE

On July 1, 2003, the U.S. International Trade Commission (Commission) received a letter from the United States Trade Representative (USTR) requesting that the Commission conduct two investigations under section 332(g) of the Tariff Act of 1930 on discrete segments of the environmental services industry.¹ The USTR requested that the first of these reports focus on solid and hazardous waste services. In response to the request, the Commission instituted investigation 332-455 on July 29, 2003.

The USTR requested that the Commission's report include:

- an overview of foreign and domestic markets for solid and hazardous waste services;
- an examination of trade and investment in solid and hazardous waste services markets, including barriers affecting such trade and investment, if any; and
- a discussion of existing regulatory practices.

The USTR requested that, for the purposes of this investigation, the Commission define the solid and hazardous waste industry to include the collection of solid and hazardous waste from households and industry; the treatment and disposal of solid and hazardous waste by various means; the collection, separation, and sorting of recyclable materials; waste compacting; waste reduction services; and incidental services. The USTR also requested that the Commission include information on both developed- and developing-country markets.

Copies of the notice of investigation were posted at the Office of the Secretary, U.S. International Trade Commission, Washington, DC, 20436, and the notice was published in the Federal Register (68 F.R. 46223) on August 5, 2003.² Nothing in this report should be construed to indicate the Commission's finding in an investigation conducted under other statutory authority covering the same or similar subject matter.

¹ See appendix A.

² See appendix B. For summaries of the public submissions received in response to this investigation, see appendix D.

Executive Summary

Introduction

On July 1, 2003, the U.S. International Trade Commission (Commission) received a letter from the United States Trade Representative (USTR) requesting that the Commission conduct two investigations under section 332(g) of the Tariff Act of 1930 on discrete segments of the environmental services industry, with the first of these reports focusing on solid and hazardous waste services (appendix A). The environmental services sector has received special emphasis in the World Trade Organization (WTO), as the reduction or elimination of barriers affecting trade in such services has been identified in the Doha Ministerial Declaration as one of the principal goals of the present negotiating round. The USTR indicated that information on environmental services markets would be useful in conducting WTO negotiations on environmental services, the environmental review of this element of the current WTO negotiations, and future negotiations and reviews.

The Solid and Hazardous Waste Services Market

In 2001, the year for which the most recent global data are available, solid waste management services and hazardous waste management services respectively accounted for 43 percent and 6 percent of the \$279 billion worldwide environmental services market. The United States is the world's largest market for solid and hazardous waste services, while other key markets for such services include Western Europe and Japan. In 2001, the world's largest solid and/or hazardous waste services firms included Onyx (a subsidiary of French firm Veolia Environment, solid and hazardous waste services), Sita (a subsidiary of French firm Suez, solid waste services), Waste Management (United States, solid waste services), Allied Waste (United States, solid waste services), and RWE Entsorgung (Germany, solid waste services).

Relevant literature indicates that differences in technology (between methods of disposal, between countries, and over time) influence the conditions of supply in the industry. Changes in the amount of waste generated and in the state of regulation influence the conditions of demand. These fundamental determinants of supply and demand, in conjunction with other forces such as economic growth and the relative prices of energy and recyclable materials, influence the market structure of the industry.

There seems to be a significant relationship between economic welfare and the character of national solid and hazardous waste services markets. In most developed countries, the environmental services sector as a whole, and the solid and hazardous waste services segments in particular, are considered mature industries characterized by reduced profitability and excess capacity, which are driving consolidation. Further, high-income countries manage a greater share of their waste, are more likely to employ modern waste management techniques, and are more likely to maintain and enforce strict waste management regulations than developing economies. By

contrast, solid and hazardous waste services markets in many developing countries are small, but are experiencing rapid growth. Many developing countries have expressed significant interest in environmental issues, going so far as to pass strict environmental legislation, but they sometimes lack the resources to enforce their environmental policies. Private sector participation in the solid waste industry also seems to be related to per capita income levels. Solid waste management industries in high-income countries tend to be dominated by private firms, while in many middle-income countries, waste removal is still considered a public-service that state and local governments undertake themselves.

Certain other market characteristics, particularly in the hazardous waste segment, seem to be unrelated to income. Although high-income economies typically generate more solid waste than middle-income economies, hazardous waste generation in a given country does not seem to be closely related to a country's level of development. Additionally, the hazardous waste management industry is dominated by the private sector in almost all of the sample countries in this investigation, regardless of income level.

Trade and Investment

The extent of cross-border trade and investment in solid and hazardous waste management services differs dramatically among the economies examined in this study. Such activity tends to be most common among high-income countries where stringent regulation and consistent enforcement create steady demand for waste management services and encourage the development of waste management capacity. Affiliate sales associated with direct investment in the waste management services industries are likely one or two orders of magnitude larger than cross-border trade of such services.

Approximately 30 percent of WTO member states— and eight of the twelve economies¹ discussed in this report— made commitments on refuse disposal services under the General Agreement on Trade in Services (GATS) (appendix C). Restrictions specific to trade in refuse disposal services are limited. However, broad measures that apply to purchases or rentals of property, equity holdings, residency requirements for directors, tax and subsidy measures, and visa provisions such as quotas and length of stay may have an impact on the foreign provision of solid and hazardous waste management services, as may measures specific to related sectors such as architecture and construction.

¹ Among the economies discussed in this report, Australia, Canada, China, the Czech Republic, the European Union, Japan, South Africa, and the United States scheduled GATS commitments on refuse disposal services. Chile, Egypt, Malaysia, and Mexico did not schedule GATS commitments on such services.

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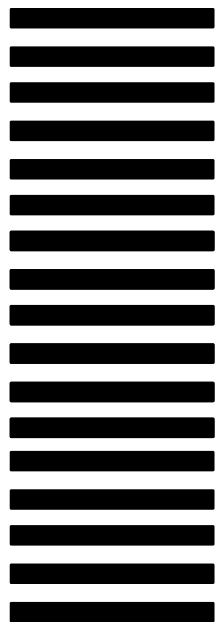
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CHAPTER 1

INTRODUCTION

Environmental services, including solid and hazardous waste management services, are increasingly important both locally and internationally. With the generation of waste on the rise, communities view proper collection, treatment, and disposal as ever more critical. Demand for solid and hazardous waste services is growing as a result of several factors, including the rapid increase in waste generation resulting from urbanization and population growth; growing awareness of environmental issues; the development and enforcement of environmental legislation; and technological and economic development. Additionally, the transboundary nature of certain environmental issues¹ has encouraged international environmental cooperation, which has likely precipitated increased demand for related services.

The solid and hazardous waste services industry, together with the entire environmental services sector, has received special emphasis in the World Trade Organization (WTO), as the reduction or elimination of barriers affecting trade in environmental services has been identified in the Doha Ministerial Declaration² as one of the principal goals of the present negotiating round. It is believed that as trade in such services grows, exporters, importers, and the environment itself may benefit from increased competition that generally reduces costs, increases service quality, improves efficiency, and/or introduces services that were previously unavailable. Environmental issues also have become increasingly tied to international trade and investment, such that the environmental impact of a trade agreement is more likely to be evaluated and considered as a critical component of the agreement under consideration. For instance, the United States is required by Executive Order³ to perform environmental reviews (ERs) of certain major trade agreements. The environmental review process involves environmental groups and the public in the development of trade agreements,⁴ informs trade negotiators of the possible environmental implications of such agreements, and identifies opportunities for environmental cooperation between the United States and its trading partners.

This report provides an overview of U.S. and foreign markets for solid and hazardous waste services; examines trade and investment in solid and hazardous waste services markets, including barriers affecting such trade and investment, if any; and where

¹ Pollution often traverses national borders (transboundary migration), prompting the need for multinational action and cooperation.

² World Trade Organization (WTO), *Ministerial Declaration: Adopted on 14 November 2001*, WT/MIN(01)/DEC/1, Nov. 20, 2001.

³ Executive Order 13141, *Environmental Review of Trade Agreements*, 64 F.R. 63169, Nov. 18, 1999.

⁴ For example, the U.S. Trade Representative recently announced that the United States would seek additional input from the public on the anticipated environmental effects of a multilateral trade agreement under the Doha Development Agenda. USTR, *Zoellick Announces United States Will Seek Additional Public Input on Environmental Trade Effects*, press release, Sept. 9, 2003.

possible, discusses existing regulatory practices.⁵ With regard to the geographic coverage of this report, information is presented on both developed- and developing-country markets.⁶

The Scope of the Solid and Hazardous Waste Services Industry

For the purpose of this study, solid and hazardous waste services are defined to include the collection of solid and hazardous waste from households and industry;⁷ the treatment and disposal of solid and hazardous waste by various means; the collection, separation, and sorting of recyclable materials; waste compacting; waste reduction services; and incidental services such as testing and monitoring services related to waste disposal. Solid waste typically is defined as nonhazardous waste material generated by households, institutions, commercial establishments, and industries which is discharged from their premises for collection. Solid waste also includes non-hazardous agricultural wastes, mining and quarrying wastes (material that is extracted in the process of mining), and energy production wastes such as fly ash from power plant furnaces. Hazardous waste is defined by the United States Environmental Protection Agency as waste that is toxic, flammable, corrosive, radioactive, explosive, or otherwise dangerous.⁸ Such waste may include motor oil, diesel fuel, gasoline, paint, solvents, batteries, pesticides, infectious or otherwise dangerous medical wastes from hospitals and clinics, asbestos materials, radioactive wastes, and other substances. In general, information regarding the management of high-level nuclear waste (the cleanup of nuclear wastes related to nuclear power generation, or the production or disposal of nuclear weapons) was not collected for this report. However, industry data on hazardous waste services such as that published by Environmental Business International, Inc. (EBI) may reflect, *inter alia*, high-level nuclear waste management activities. Hazardous waste generally originates from the same sources as solid waste, although the collection, transportation, and disposal methods differ. Methods used to manage the waste stream include landfilling, incineration, composting, dumping and incineration at sea, waste recycling, and waste minimization.

The environmental services division of the World Trade Organization (WTO)'s *Services Sectorial Classification List*⁹ (also known as the W/120) is divided into four subgroups, identified by corresponding Central Product Classification¹⁰ (CPC) codes: sewage services, CPC 9401; refuse disposal services, CPC 9402; sanitation and

⁵ Such regulatory practices may include national and subnational environmental regulations, as well as multinational conventions or agreements on environmental issues that may have an effect on this market.

⁶ For more information regarding the parameters of this report, see appendices A and B.

⁷ The study includes the transportation of waste, insofar as waste is transported during the collection process and between various transfer, treatment, and disposal facilities.

⁸ U.S. Environmental Protection Agency (EPA), Hazardous Waste Overview - Definitions, Identification and Regulations, found at Internet address <http://www.epa.gov/fedsite/hazwaste/definition.html>, retrieved Oct. 23, 2003.

⁹ WTO, MTN.GNS/W/120, July 10, 1991.

¹⁰ United Nations Statistical Division, 1991.

similar services, CPC 9403; and other environmental services.¹¹ Solid and hazardous waste services are captured in the refuse disposal services category, which includes collection, treatment, and disposal services,¹² incidental transportation services, and waste reduction services.¹³ The W/120 is important to the General Agreement on Trade in Services (GATS), as most Member countries use it as a basis for their schedules of specific commitments.¹⁴ However, some WTO Members contend that this classification does not reflect current market conditions,¹⁵ and are promoting the use of a new classification scheme during the current round of WTO services negotiations.¹⁶

In general, cross-border trade in waste products is a goods issue and is not included within the scope of the solid or hazardous waste services trade. However, regulations affecting trade in wastes may affect the provision of services if such trade involves the cross-border transfer of waste between treatment or disposal facilities. Thus, such regulations are addressed within the study. In contrast, cross-border trade in sorted recyclable waste products falls completely outside the scope of this report, as many of these products are valuable commodities that recycling facilities sell as inputs to manufacturing processes.

¹¹ The OECD and the Statistical Office of the European Communities (Eurostat) have developed a system that classifies industrial activities under three broad headings: pollution management, cleaner technologies and products, and resource management. The United States, the EU, Canada, and Japan reportedly consider this system to be more applicable to the current state of affairs in the industry than the W/120. OECD/Eurostat, *Environmental Goods and Services Industry Manual for the Collection and Analysis of Data*, 1999.

¹² Wholesale trade services of waste and scrap are excluded.

¹³ Quantitative analysis of the solid and hazardous waste services industries is difficult as no comprehensive international statistical definitions exist, classification criteria are considered inadequate, and definitions often differ from country to country.

¹⁴ The terms and conditions under which WTO signatories accord market access and national treatment to foreign firms is provided within national schedules of specific commitments. A commitment also discourages signatories from imposing new measures that would restrict entry into the market or the operation of the service. In most schedules, commitments are split into two sections: the “horizontal” commitments that apply to all of the sectors included in the schedule, and industry-specific commitments that apply to trade in services in a particular sector or subsector.

¹⁵ Members report that the fundamental issue is that the environmental services industry has evolved in recent years. When crafted, the W/120 adequately addressed the environmental services industry. However, the classification system is now viewed by some to be outdated and incomplete. Identified shortcomings of the W/120, as it applies to environmental services, include its lack of emphasis on pollution prevention, sustainable resource management, facilities development, or services provided directly to industry.

¹⁶ For more information, see appendix C.

The Global Market for Solid and Hazardous Waste Services

In 2001, the most recent year for which global data are available, solid waste management services and hazardous waste management services¹⁷ accounted for 43 percent and 6 percent of the \$279-billion worldwide environmental services market, respectively.¹⁸ The United States is the world's largest market for solid and hazardous waste services. In 2000, the United States accounted for \$45 billion, or 34 percent, of the global market for solid and hazardous waste services.¹⁹ Other key markets for such services included Western Europe and Japan (figure 1-1), which respectively accounted for 30 percent and 26 percent of the combined global market for solid and hazardous waste management services.²⁰ The global solid and hazardous waste services industry has been consolidating as large firms have merged to expand their range of goods and services offerings, thereby improving their competitive posture. In 2001, the world's largest solid and/or hazardous waste services firms included Onyx (a subsidiary of French firm Veolia Environment, solid and hazardous waste services), Sita (a subsidiary of French firm Suez, solid waste services), Waste Management Inc. (United States, solid waste services), Allied Waste (United States, solid waste services), and RWE Entsorgung (Germany, solid waste services).²¹

Typically, the most prominent consumers of solid waste management services are municipalities, and industrial and commercial clients. Principal consumers of hazardous waste management services include government agencies, and chemical and petroleum production and processing facilities.²² Both public-sector and private-sector firms participate in most solid and hazardous waste services markets throughout the world. In 2001, the private sector accounted for 69 percent of revenue generated by the U.S. solid waste management services industry, and for 96 percent of revenues generated by the U.S. hazardous waste services industry.²³ In many other developed markets, the public/private ratios for solid and hazardous

¹⁷ Environmental Business International (EBI), a principal source of the data presented in this study, defines the solid and hazardous waste management industries to include collection, transportation, and transfer of solid waste; recycling operations; composting; solid waste disposal at landfills and incinerators; and the management of medical, nuclear, and hazardous industrial waste.

¹⁸ EBI, *The Global Environmental Market by Segment*, attachment to an e-mail message, received July 31, 2003.

¹⁹ More specifically, in 2000, the United States accounted for \$39.8 billion, or 34.5 percent, of the global market for solid waste management services, and \$5.2 billion, or 30.1 percent, of the global market for hazardous waste management services. Environmental Business International (EBI), *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

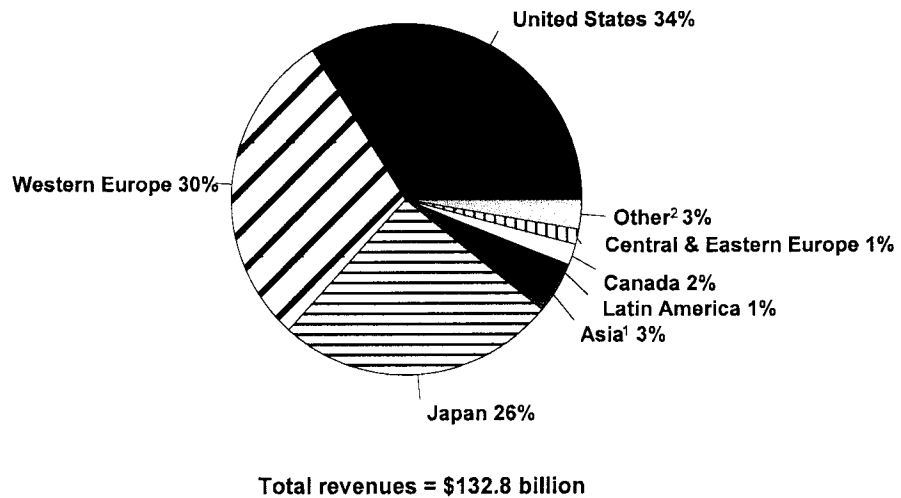
²⁰ EBI, *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

²¹ *Environmental Business Journal*, vol. XV, No. 11/12, 2003, p. 3.

²² EBI, *EBI's Products by Industry Segment*, found at Internet address <http://www.ebiusa.com/segments.html>, retrieved Jan. 29, 2004.

²³ EBI, *EBI Report 2000: The U.S. Environmental Industry and Global Market*, Sept. 2001, p. 1-3.

Figure 1-1
Solid and hazardous waste management: Global market, 2000



¹ Does not include Australia, Japan, or New Zealand.

² Other includes Australia and New Zealand (1.4 percent), the Middle East (1.0 percent), and Africa (0.3 percent).

Source: Environmental Business International, *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

waste services revenues are similar to those of the United States.²⁴ Industry revenues are dependent on factors including regulations and their enforcement, changes in technology, and economic and population growth.

In most developed countries, the environmental services sector as a whole, and the solid and hazardous waste services segments in particular, are considered mature industries characterized by reduced profitability, decelerating growth, increasing consolidation, excess capacity, and intense competition. Growth has slowed because of fundamental market changes. Evidence from several countries suggests that environmental services often grow rapidly following privatization²⁵ and promulgation of sweeping environmental regulations and legislation.²⁶ Initially, the services

²⁴ In developing countries, the public sector generally accounts for a greater share of overall environment expenditure.

²⁵ Many environmental services initially were developed as “public goods” or had characteristics of a natural monopoly, often due to a combination of the economics of establishing and providing the service, and a desire to ensure fair and equitable provision. Natural monopolies often have significant barriers to entry due to the large initial investment required. Consequently, where environmental services remain public goods, the private sector is often either denied access by government regulation or has no economic motivation to participate. Forms of private participation currently observable within the global environmental services sector include management service contracts, development of turnkey projects, build-operate-own and build-operate-transfer deals, joint ventures, and full ownership of establishments through greenfield investment and acquisition.

²⁶ Aparna Sawhney and Rupa Chanda, *Trade in Environmental Services: Opportunities and Constraints*, Indian Council for Research on International Economic Relations, New Delhi, May 2003.

providers often faced excess demand due to a backlog of existing work that needed to be completed under the new regulations. In the United States and other developed countries, most waste-generating firms have had time to comply with the environmental standards, and have moved forward toward reducing or eliminating waste before it is generated, further reducing the need for environmental services.²⁷ Consequently, cleaner technologies— those that reduce pollutants at the source— and resource management are likely to be areas of future emphasis and growth, although industry revenues will derive principally from providing waste management, pollution control, waste cleanup, and other “end-of-pipe” services.

In many developing countries, solid and hazardous waste services markets are small, but are experiencing rapid growth. In these countries, the environmental reform process is just beginning, often in response to a critical need for environmental improvements. Many countries have expressed significant interest in environmental issues, going so far as to pass strict environmental legislation. However, many of these countries lack the funds to carry out their ambitious environmental programs.²⁸ Industry reports that this lack of capital is the most significant hurdle facing the development of solid and hazardous waste management markets in newly industrializing countries.²⁹

Approximately 30 percent of WTO Member States made commitments on refuse disposal services under the GATS.³⁰ Restrictions on trade specified in these commitments are limited. However, measures included in Member countries’ horizontal commitments--which generally focus on purchase or rental of property, equity holdings, residency requirements for directors, tax and subsidy measures, and visa provisions such as quotas and length of stay³¹--as well as measures affecting related sectors such as architecture, engineering, or construction may have an important impact on the foreign provision of waste management services. Potential impediments to trade that fall outside the scope of the GATS may increase the cost of supply, reduce demand, or eliminate the provision of the service altogether. For example, as governments are among the principal consumers of solid and hazardous waste services, preferential public procurement practices may serve as restrictions on the foreign provision of a service.

Approach

This report presents an overview of the global market for solid and hazardous waste services, organized by region. Chapter two of this report presents a literature review

²⁷ Industry representative, interview with USITC staff, Washington, DC, Nov. 5, 2003.

²⁸ It would reportedly cost a total of \$70 billion per year to manage municipal solid waste in developing countries. Data contained in David Waskow, International Policy Analyst and Trade Policy Coordinator, Friends of the Earth-USA, Washington, DC, written submission to the Commission, Nov. 5, 2003.

²⁹ Industry representative, interview with USITC staff, Washington, DC, Nov. 12, 2003.

³⁰ For more information regarding GATS commitments on refuse disposal services, see appendix C.

³¹ A large share of all environmental services trade, including solid and hazardous waste services trade, likely takes place through modes 3 and 4; i.e., production and consumption occur inside the territorial/legal jurisdiction of the importing state.

of extant work on service technologies, market trends, trade, and investment in the solid and hazardous waste services industries. Chapters three through seven examine solid and hazardous waste in the United States, Canada and Mexico, Europe, Asia and the Pacific, and certain developing-country markets in other world regions. These chapters follow a similar format that includes a market overview for each region, an examination of the trade and investment environment insofar as data permit,³² and a discussion of future prospects for the solid and hazardous waste services industry. In addition, each chapter includes profiles of selected markets, in which market and trade information for key regional markets is presented. Chapter 8 summarizes the information presented in previous chapters to reveal current trends in the global solid and hazardous waste services market. Additional information – including the USTR’s request letter, the Federal Register notice, data on disposal methods, an overview of GATS commitments and negotiations on solid and hazardous waste services, positions of interested parties, and a glossary of terms – can be found in the appendices to this report.

³² The Commission had gathered for presentation in this report the most up-to-date and detailed trade and investment data available. There is a considerable paucity of data in this field. For this reason, the Commission complements available data with characterizations of trade flows and balances where necessary and appropriate.

CHAPTER 2

SOLID AND HAZARDOUS WASTE SERVICES: INDUSTRY OVERVIEW AND LITERATURE REVIEW

Introduction

This chapter provides background on the types of materials included in solid and hazardous waste streams and the technologies of collection, treatment, and disposal. As noted, differences in technology (between methods of disposal, between countries, and over time) influence the conditions of supply in the industry. Changes in the amount of waste generated and in the state of regulation influence the conditions of demand. These fundamental determinants of supply and demand, in conjunction with other forces such as economic growth and the relative prices of energy and recyclable materials, influence the structure of the industry. This chapter draws on a variety of sources in discussing these economic considerations, including published economic analyses, industry and trade journals, and published data.

Data pertaining to solid and hazardous waste pose special challenges in terms of definitions and comparability between geographic locations and over time. For example, the U.S. Environmental Protection Agency (EPA) estimates the types of materials entering the solid waste stream based on production and materials flows passing through the economy, adjusted for international trade and estimates of product lifetimes and supplemented with survey data. Alternately, the composition of certain solid waste streams can be estimated directly by sampling the contents of landfills, as in the University of Arizona's Garbology Project.¹ The trade publication *Biocycle* estimates the amount of U.S. municipal solid waste (MSW),² and its distribution among management technologies such as landfilling, recycling, and incineration, by gathering data from state-level authorities. *Biocycle* estimates of

¹ William Rathje and Cullin Murphy, *Rubbish! The Archeology of Garbage* (Tucson: University of Arizona Press, 2000).

² The definition of municipal solid waste (MSW) varies from country to country, as do most other definitions pertaining to waste flows and disposal. For the purposes of this chapter, the term as used here generally excludes hazardous waste. The Organization for Economic Cooperation and Development (OECD) describes municipal waste as "waste collected and treated by or for municipalities," including "waste from households, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden waste, street sweepings, the content of litter containers, and market cleansing waste" and excluding municipal sewage waste and municipal construction and demolition waste. (*OECD Environmental Data Compendium 2002: Waste* (Paris: OECD), p. 10) OECD data on solid waste generated by sector for the United States consists only of municipal solid waste. OECD data for other countries includes a significant quantity of waste generated by the agriculture, manufacturing, mining, energy, water, construction and other sectors. It is not clear where data on such waste streams fits into U.S. data reporting systems.

annual generation of MSW in the United States can be as much as 50 percent higher than EPA estimates.³ The variety of methods used to compile waste-related data, and the discrepancies between them, imply that many of the characterizations of the industry below should be considered as tentative.

Activities and Technology

Solid Waste

Sources of Solid Waste

An estimated 60 percent (\$24.5 billion) of U.S. solid waste management revenues in 2001 were generated by public-sector customers, with the other 40 percent (\$16.3 billion) originating in the private sector. By contrast, 31 percent (\$12.7 billion) of revenues were earned by public-sector entities, while the balance of U.S. revenues were earned by the private sector.⁴ This implies that the public sector in the United States pays the private sector to supply about half of the solid waste management services it consumes while supplying the other half itself. Waste management services purchased by the public sector generally include disposal services for MSW, which is generated by households and small industrial or commercial establishments that rely on the municipal disposal system, as well as disposal services for government entities. Small industrial or commercial establishments may also contract directly with private firms to dispose of their waste, or engage in self-disposal (for example, households may haul trash in a private vehicle directly to a local landfill or recycling center).

The physical composition of solid waste varies widely from country to country, in a way which reflects consumption patterns at different levels of income. For example, one study found that about 75 percent of solid waste in urban areas of India consists of putrescent matter (primarily food wastes), with another 15 to 20 percent consisting of ceramics, dust, ash, and stones. In the United States, by contrast, less than 40 percent of waste is putrescent matter, while over 60 percent consists of materials such as paper, plastic, rubber, leather, glass and metals which represent discarded or worn-out manufactured goods.⁵ These materials are relatively scarce in developing-country waste, and are often removed by scavengers before the waste reaches an

³ Richard C. Porter, *The Economics of Waste* (Washington, DC: Resources for the Future, 2002), p. 4.

⁴ Environmental Business International, Inc. (EBI), *EBI Report 2000: The U. S. Environmental Industry and Global Market*, Sept. 2002, pp. 1-3, 1-4. Of the private-industry revenues originating from private-sector clients, about 60 percent (\$9.8 billion) is estimated as paid for by industrial clients and about 40 percent (\$6.5 billion) by commercial or other clients.

⁵ USITC calculations based on table 1-1 in Porter, *The Economics of Waste*, p. 3.

organized disposal process, or during that process.⁶ The lower ratio of putrescent matter to manufactured material in U.S. wastes may be due, in part, to greater consumption of processed foods and to the use of household garbage disposals, which direct wastes to water and wastewater treatment facilities. Waste is the by-product of consumption, and these patterns are consistent with the higher share of food in the material consumption of developing countries and the higher share of manufactures in the material consumption of developed countries.⁷ In the course of development, the composition of waste may gradually evolve in the direction implied by developed-country consumption patterns.⁸

These patterns of waste composition have implications for collection and disposal techniques. Putrescent matter is moist and relatively resistant to compaction. It can be landfilled, composted, or burned at an incinerator or waste-to-energy facility, but generally cannot be recycled by other means. Its moisture content may also cause breakdown in the operation of compacting garbage trucks, which are expensive to repair.⁹ Putrescent matter is biodegradable. The process of biodegradation causes release of greenhouse gases such as methane and carbon dioxide, which are noxious at ground level and (in the case of methane) explosive. Recovered methane can be used for energy generation, as will be discussed in the section on landfills below. The disposal of “hard” manufactured materials such as paper, glass, and metal yields nonbiodegradable wastes. These wastes are both easier to compact and more likely to be recyclable than biodegradable wastes. Paper waste is amenable to the greatest number of techniques of disposal, as it is recyclable, biodegradable, and compostable (though with less efficiency than food wastes), and can be burned in incinerators.

Collection

About two-thirds of the costs of MSW management in the United States are related to collection and transportation of the material from the point of generation to the location of processing and ultimate disposal.¹⁰ This can include temporary storage or containerization of the waste at a transfer station. Part of these costs relate to the

⁶ In Jakarta, for example, scavengers regularly tore apart MSW that had already been machine-compacted and baled by the city’s sanitation agency. See Carl R. Bartone, Janis D. Bernstein, and Frederick Wright (1990), *Investments in Solid Waste Management: Opportunities for Environmental Improvement*. Policy, Research and External Affairs Working Paper No. 405 (Washington, DC: World Bank, Infrastructure and Urban Development Department, 1990), pp. 18-19.

⁷ U.S. International Trade Commission, *The Dynamic Effects of Trade Liberalization: An Empirical Analysis* (Publication 3069, Oct. 1997), pp. 10-10 to 10-15.

⁸ Data arising from the Calcutta Municipal Corporation show that between 1970 and 1993 the share of municipal wastes in Calcutta (now Kolkata) accounted for by paper, polythene, plastic, glass, metal, and rubber increased from 5.35 percent to 12.15 percent, with the share of “vegetable and putrescible fractions” remaining fairly steady at 40.37 percent in 1970 and 41.00 percent in 1993. Of the latter, coconut shells alone account for 6.20 percent of municipal wastes and rising. See Snigdha Chakrabarti, Indian Statistical Institute, “Economics of Solid Waste Management: A Survey of the Existing Literature,” 2003, processed.

⁹ Porter, *The Economics of Waste*, p. 52.

¹⁰ Jerry A. Nathanson, *Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control*, 4th addition (Upper Saddle River, New Jersey and Columbus, Ohio: Prentice-Hall, 2003), p. 339.

labor-intensive nature of garbage truck operations; unionized sanitation workers, particularly in public-sector operations, have significant bargaining power.¹¹ Municipal garbage-compacting trucks can reduce waste volumes by over 50 percent. For materials that will eventually be landfilled, most of the volume reduction takes place in this compacting operation.¹² Waste collection operations have relatively few economies of scale and thus are naturally decentralized to the municipal level, though some large firms own and operate collection facilities.

Waste collection is an even more labor-intensive activity in developing countries, where carts or non-compacting vehicles may be used, accompanied by crews with baskets, shovels, or cans. The use of non-closed vehicles can lead to spillage back onto the street. As noted above, capital-intensive compaction technologies may be less appropriate for developing-country waste, because of its high share of putrescent matter. In addition, large and wide trucks may not fit through narrow developing-country streets.¹³ Alternatively, households may bring trash to neighborhood bins or “skips,” which are periodically emptied. In poorer countries, a significant share of trash may go uncollected because neither households nor governments are willing or able to fund a comprehensive collection program.

The high costs of transportation provide strong incentives for the establishment of transfer stations. For example, the number of landfills in the United States has decreased sharply over time, from nearly 8,000 in 1988 to 2,142 in 2000;¹⁴ thus, the average distance from individual households and commercial establishments to the landfill has correspondingly increased. This has provided incentives for the establishment of transfer stations. Transfer stations permit the achievement of some economies of scale, as compacted waste from up to eight individual trucks can be consolidated onto a single tractor-trailer which then makes only one trip to the landfill and back.¹⁵ The incentives to establish transfer stations vary depending on transport costs, the initial capital cost of the transfer station, and the degree of realizable economies of scale associated with consolidation into larger trucks. Typical estimates indicate that the economical limit for one-way waste hauling by an individual truck is approximately 12-20 miles.¹⁶

¹¹ Linda N. Edwards and Franklin R. Edwards, “Wellington-Winter Revisited: The Case of Municipal Sanitation Collection,” *Industrial and Labor Relations Review*, vol. 35, No. 3, Apr. 1982, pp. 307-318.

¹² By contrast, incineration can reduce volume of MSW by about 90 percent and weight by about 75 percent. Nathanson, *Basic Environmental Technology*, p. 343.

¹³ Porter, *The Economics of Waste*, pp. 51-52.

¹⁴ “The State of Garbage in America,” *Biocycle*, vol. 42, No. 12, Dec. 2001, p. 43.

¹⁵ Nathanson, *Basic Environmental Technology*, p. 341.

¹⁶ Porter, *The Economics of Waste*, p. 50 and studies cited thereat; and Nathanson, *Basic Environmental Technology*, pp. 341.

Methods of Disposal¹⁷

Landfilling

Removal of municipal solid wastes to centralized locations outside city limits is a practice that dates to ancient times. The modern sanitary landfill incorporates a number of technological processes that distinguish it from an open dump. These include:

- pre-preparation of the site, preferably with an impermeable liner to minimize contamination of groundwater by leachate;
- spreading out and compacting the waste with heavy machinery, which prolongs the life of the landfill by reducing volume;
- covering the waste each day with a layer of compacted soil, which minimizes gas release into the atmosphere;
- monitoring of water quality of leachate¹⁸ and, if necessary, collection and treatment of leachate to an appropriate standard.¹⁹

The relative costs of landfilling depend on the value of land in alternate uses. Landfills tend to be more prevalent in lightly populated areas than in densely populated locations where real estate values are higher. Costs associated with landfilling also have reportedly increased as regulatory standards have increased over time.²⁰ Owing to the presence of regulatory costs, economies of scale in landfilling are significantly greater than in waste collection. Thus, there has been a trend toward fewer and larger landfills, with each one being supplied with waste from a growing number of sources.

Closed landfills may be restored and converted to such uses as parks, golf courses, or in some cases paved over and put to commercial use. Regulatory standards and liability issues usually preclude closed landfills from being reconverted to residential use.

¹⁷ For a comparison of the predominant disposal methods employed in certain countries and U.S. states, see appendix C.

¹⁸ Leachate is the contaminated liquid by-product of solid waste that has percolated through the soil or some other medium. Environmental Protection Agency (EPA), "Terms of Environment," found at Internet address <http://www.epa.gov/OCEPAterms/lterms.html>, retrieved Mar. 17, 2004; and Nathanson, *Basic Environmental Technology*, p. 511.

¹⁹ Nathanson, *Basic Environmental Technology*, pp. 361-370.

²⁰ For example, in the United States, the Resource Conservation and Recovery Act (RCRA) of 1976 banned open dumping. A 1988 EPA report prepared under the Hazardous and Solid Waste Amendments of 1984 led to the promulgation of new regulations in 1991, which were phased in during 1991-1998. These regulations, known as the Solid Waste Disposal Facility Criteria, in many cases represented a significant tightening of existing state standards; in other cases state standards were and remain higher. The criteria require that solid waste landfill operators demonstrate their ability to pay for closure, postclosure care, and cleanup of landfills; prevent hazardous waste from being accepted; control insects and rodents; monitor methane gas leakage; and cover landfills with six inches of soil at the end of each day. Operators of landfills must not burn wastes or accept liquid wastes, and may not locate in environmentally unsafe areas. (Porter, *The Economics of Waste*, p. 60). See chapter 5 for more information on the U.S. regulatory system.

Landfill gas is produced as a result of the natural decomposition of the organic component of solid waste. After aerobic bacteria absorb the oxygen in the soil, anaerobic bacteria produce methane and other gases, which can pass through soil or rise to the surface, accumulating in basements and similar structures. If not captured, methane mixed in sufficient concentrations with air can be explosive, and can also cause death by poisoning if directly inhaled. Minimization of such hazards without commercial recovery of the gas is accomplished by gathering the gas in a perforated pipe installed in a “vent layer” of the landfill cap and releasing the gas through a pipe. Facilities for landfill gas recovery are costly, but the production of a saleable product may compensate for these costs and, if profitable, pay for other costs of maintaining a closed landfill. The potential profitability of a landfill gas recovery operation is difficult to determine *ex ante*.²¹

Commercial recovery of methane is accomplished through the use of gas extraction wells and membrane permeation systems, which permit separation of the saleable methane from CO₂ and other unsaleable gases. In a sufficiently moist landfill, gas production occurs rapidly at first and is mostly complete after about 20 years. However, the rate of decomposition, and thus the rate of gas production, can be accelerated by adding moisture.²² Natural gas can be sold or used to generate electricity which can be sold to the grid. Landfill gas recovery operations are regulated primarily for air pollution purposes.²³

Incineration

In most cases, incineration of MSW is performed for the purposes of waste-to-energy conversion, though a small amount of incineration for pure volume reduction appears to take place in Japan and other countries. As a technology for reducing the volume and weight of solid waste, incineration often outperforms such alternatives as shredding, pulverizing, baling, and (for organic wastes) composting, reducing volume by about 90-95 percent and producing both “bottom ash” and “fly ash,” which rises in flue gases. Much of the fly ash can be recaptured with air pollution control technologies, and then tested to see if it warrants disposal as hazardous waste.²⁴ Bottom and fly ash can also be combined with lime and water to form road construction base material. This method of ash disposal is particularly popular in Europe.²⁵ Some incinerator ash is also landfilled in what are known as “monofills,” a specialized form of hazardous-waste disposal facility.

The relative cost of land affects the incentives for incineration. A higher share of MSW is incinerated in affluent, land-poor areas than in land-abundant locations. Incineration is usually a revenue-generating operation since the vast majority of incinerators worldwide are waste-to-energy operations, using the combustion process to heat boilers which drive steam turbines for electricity generation. Since incineration is a continuous-flow process, it is significantly more likely to be efficient from an engineering standpoint, and profitable from an economic standpoint, when

²¹ Porter, *The Economics of Waste*, pp. 67-69.

²² Nathanson, *Basic Environmental Technology*, pp. 367-368.

²³ EPA, found at Internet address <http://www.epa.gov/docs/epacfr40/chapt-I.info/60tc.htm/>, retrieved Nov. 14, 2003.

²⁴ Nathanson, *Basic Environmental Technology*, p. 343.

²⁵ Porter, *The Economics of Waste*, p. 77.

the incinerator receives a continuous flow of waste. This enables the full economies of scale of the incinerator equipment to be exploited. For this reason, it is customary for incinerators to engage in contracts with governments in order to guarantee a stream of inputs. Nonetheless, reductions in available materials resulting from increased recycling or cost reduction efforts by business, combined with increases in regulatory costs have meant that many incinerators operate below capacity. This, in turn, has led to the closure of facilities or to significantly higher tipping fees relative to landfills.²⁶

Recycling

Metal, glass, plastic, paper, and other manufactured materials that enter the waste stream can potentially be withdrawn therefrom and reprocessed for use as production inputs. Recycling is commonly associated with the materials described above, which are the focus of household trash sorting for curb pickup or delivery to the recycling center. However, some states classify composting; the recovery of scrap autos, motor oil, construction and demolition debris, household batteries, or ash; and “food-to-people” programs as recycling while others do not.²⁷ The absence of a uniform definition creates both a potential lack of comparability in data for different geographical locations and across time, as well as difficulties in interpreting the results of government-mandated recycling targets.²⁸

In practice, recycling can be accomplished through a variety of technologies, including household hand sorting and curbside collection of sorted or unsorted materials. Specialized recycling trucks now exist, which store paper and commingled glass, metals, and plastics in separate compartments. The commingled materials can be delivered to a materials recycling facility (MRF) which uses a combination of electromagnetic separation, vibration, air blowing, and hand sorting to separate the materials into marketable components, while paper (newsprint, cardboard, and mixed paper including magazines and junk mail) is handled in a separate stream.²⁹

The recovery rate is highest for materials for which the cost of recycled materials is low relative to virgin materials. The relative energy costs of producing recycled and virgin materials are a significant determinant of total relative costs. For example, aluminum, which accounts for less than 1.5 percent of MSW, provides the largest share of recycling revenue (perhaps more than 50 percent) because of the high energy costs associated with extracting aluminum from bauxite ore.

²⁶ Ibid., pp. 70-85; and Jeffrey Morris, “Competition Between Recycling and Incineration,” prepared for Gowling, Strathy and Henderson on behalf of the City of Toronto, Ontario, 1996, found at Internet address <http://www.mindfully.org/Plastic/Recycling-And-Incineration.html/>, retrieved Nov. 14, 2003.

²⁷ “The State of Garbage in America,” *Biocycle*, p. 46.

²⁸ For example, in 1997 Chicago announced that it was meeting a state-level goal of 25 percent recycling, half of which was accounted for by yard waste used as landfill cover. Since landfill cover is useful (*on* the landfill, rather than *in* it), this counted as recycling even though the yard waste included so much glass and other debris as to be uncompostable. In 1996 New York City raised its reported recycling rate from 14 percent to the legally mandated 25 percent by counting as recycled abandoned autos that the city towed and sold to junkyards, as well as construction debris that was pulverized and used for road construction at the Fresh Kills landfill. Porter, *The Economics of Waste*, p. 4.

²⁹ Nathanson, *Basic Environmental Technology*, pp. 352-360.

In principle, the incentives for recycling should vary with both the prices of recoverable materials (positively) and the price of land (also positively). When land is expensive, other things being equal, markets encourage both recycling and incineration at the expense of landfills. The propensity to recycle is also influenced by other economic and noneconomic factors. A large share of the recyclable waste stream is paper, a combustible material that is in high demand by incinerators. Recycling is encouraged by government policies such as mandated targets for recycling, container deposit legislation, and requirements that manufacturers gather and dispose of the packing waste they produce.³⁰

Regardless of data issues, it seems clear that the share of U.S. waste managed through recycling has increased sharply since the late 1980s, going from about 8 percent of MSW in 1990 to 31 percent in 2001.³¹ It is unclear whether economic incentives such as land scarcity or rising prices for recyclables are primarily responsible for this trend. Landfill tipping fees and the prices of recyclable materials such as aluminum, newspaper, and cardboard have increased only modestly in the last 15 years, and at times have undergone price reversals, while the increase in the share of MSW devoted to recycling has increased virtually without pause. This suggests that consumer attitudes and changes in household behavior may have had a significant effect on recycling rates. It is interesting to note that the initial upsurge in recycling corresponds in time with the 1987 odyssey of the garbage barge *Mobro 4000* from Queens, New York. The *Mobro* was denied landing rights by five states and two Latin American countries, due to allegations that samples of its contents contained hazardous waste.³² This story was widely covered by the news media and likely had an effect on public discussion of solid waste treatment policy and recycling.³³

Illegal disposal

While illegal disposal is not per se an activity of the solid and hazardous waste services industry, a brief mention of this phenomenon is warranted in order to complete the picture of the flow of materials in the industry. The service of handling and treating wastes is costly. Haulers pay tipping fees to landfills and incinerators, and in some cases, businesses and households pay fees (other than mandatory local taxes) directly to haulers. Alternately, households may have to buy or rent designated bags or cans in order to receive curbside hauling service. Any attempt to implement a “pay-as-you-throw” principle, and thus to align private and social costs of waste removal and treatment, may create incentives to avoid payment by illegal dumping (also known as “midnight dumping” or, in Britain, “fly tipping”). Illegal

³⁰ Such a requirement was imposed in Germany in 1991, and led to the “Green Dot” program, which is implemented as a separate materials collection system, *Duales System Deutschland (DSD)*, operated by a consortium of German manufacturers and running in parallel to government municipal waste collection. Porter, *The Economics of Waste*, pp. 33-34.

³¹ “The State of Garbage in America,” p. 43.

³² A retrospective account is given by Aaron Rutkoff et al., “BP Shulman Makes A Stink Over Unwanted Garbage Barge,” found at Internet address <http://www.queenstribune.com/anniversary2003/garbagebarge.htm/>, retrieved Nov. 14, 2003.

³³ In retrospect, as the *Mobro*’s voyage was an anomalous and nonrecurring event, it was probably not an indicator that the United States was running out of landfill space.

dumping can take place in a variety of forms, including littering or the unauthorized use of commercial dumpsters by households. Hazardous wastes may also be illegally dumped. According to some estimates, as much as 13 percent of used oil in the United States may be dumped illegally, purportedly as a consequence of policies in about two-thirds of the states that prohibit used oil disposal except by special treatment.³⁴ Thus, an increase in the relative price or the regulatory restrictions associated with any mode of disposal can cause both substitution toward other modes of disposal, and possibly an increase in illegal dumping, which may reduce the revenues available to the waste management industry, but is particularly difficult to quantify.

Hazardous Waste

Hazardous waste is defined in the regulatory system by the potential effects of the waste. For example, in the United States, the Resource Conservation and Recovery Act (RCRA) of 1976 as amended³⁵ defines hazardous waste as solid wastes that “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...”³⁶ Hazardous waste generation is concentrated among a few sources. In 2001, 19,000 different sources produced 37.1 million metric tons³⁷ of hazardous waste in the United States, but the top 50 sources accounted for about two-thirds of the total.³⁸ In practice, a large share of waste classified as hazardous in the United States originates in the chemical and petrochemical industries. More specifically, in 2001 the top 17 generators of hazardous waste in the United States were all either chemical firms or refiners.³⁹ The management of medical wastes and nuclear wastes⁴⁰ accounted for approximately 27 percent and 18 percent,

³⁴ H. Sigman, “Midnight Dumping: Public Policies and Illegal Disposal of Used Oil,” *RAND Journal of Economics*, vol. 29, No. 1, Spring 1998, pp. 157-178.

³⁵ USC Title 42, Chapter 82.

³⁶ The text of RCRA is available at the Legal Information Institute, U.S. Code Collection, found at Internet address <http://www4.law.cornell.edu/uscode/42/6903.html/>, retrieved on Nov. 17, 2003.

³⁷ Metric units generated by USITC calculation.

³⁸ U.S. Environmental Protection Agency, *The National Biennial RCRA Hazardous Waste Report (Based on 2001 Data)*, found at Internet address <http://www.epa.gov/epaoswer/hazwaste/data/brsol/national.pdf/>, retrieved Nov. 17, 2003, pp. 1-3, 1-4; and USITC calculations.

³⁹ U.S. Environmental Protection Agency, *The National Biennial RCRA Hazardous Waste Report*, pp. 1-4. Basic chemicals, petroleum and coal refining, and rubbers, plastics, synthetic fibers and related industries accounted for 58.5 percent of all recorded hazardous wastes in 2001 (p. 1-7 and USITC staff calculations).

⁴⁰ As mentioned in chapter 1, information regarding the management of high-level nuclear wastes generally was not collected for this report.

respectively, of total revenues of the U.S. hazardous waste services industry in 2001, while the management of industrial wastes accounted for the balance of revenues.⁴¹

Methods of Disposal

Hazardous wastes are disposed of by a large variety of methods. The top six methods, accounting for over two-thirds of U.S. managed hazardous wastes for which the disposal or treatment method is recorded, are (1) deepwell or other underground injection, (2) aqueous organic treatment, (3) aqueous inorganic treatment, (4) landfill/surface impoundment, (5) energy recovery,⁴² and (6) incineration.⁴³ Aqueous treatment of wastes involves oxidation/reduction reactions to neutralize acidic or metallic contamination. Technologies that are similar to those used to dispose of nonhazardous solid wastes generally are modified to deal with the toxic nature of hazardous wastes. For instance, buried hazardous waste drums may include additional filtering layers to control leachate. The transportation of hazardous waste is more heavily regulated than the transportation of solid wastes. In the United States, hazardous waste transportation includes labeling of containers and trucks and the maintenance of manifests for tracking purposes.⁴⁴

Siting

There is an extensive literature on the siting of hazardous waste facilities. Many people are unwilling to live close to a hazardous waste facility, even if it is regulated.⁴⁵ The relative scarcity of publicly acceptable sites for hazardous waste disposal as compared to solid waste disposal requires the transport of hazardous wastes over longer distances on average and makes the realization of economies of scale in disposal or treatment relatively more important.⁴⁶ The conflict between desires of homeowners to avoid living near a hazardous waste facility and broader social desires for disposal or treatment of such wastes can also lead to postponement of final disposal and treatment decisions and increase incentives for illegal “midnight” dumping.⁴⁷

⁴¹ *EBI Report 2000*, p. 11-2.

⁴² This refers to on-site use of chemical byproducts as fuels, including fuel blending. Fuel blending prior to energy recovery at another site is classified separately by the EPA.

⁴³ U.S. Environmental Protection Agency, *The National Biennial RCRA Hazardous Waste Report*, pp. 2-35.

⁴⁴ Nathanson (2003), pp. 373-395.

⁴⁵ V. Kerry Smith and William Desvouges, “The Value of Avoiding a LULU: Hazardous Waste Disposal Sites,” *Review of Economics and Statistics*, vol. 68, No. 2, May 1986, pp. 293-299. The acronym LULU denotes “locally undesirable land use.”

⁴⁶ See Bruno S. Frey, Felix Oberholster-Gee and Reiner Eichenberger, “The Old Lady Visits Your Backyard: A Tale of Morals and Markets,” *Journal of Political Economy*, vol. 104, No. 6, pp. 1297-1313, Dec. 1996, which analyzes this phenomenon in the case of a Swiss search for a nuclear waste depository.

⁴⁷ Robert Cameron Mitchell and Richard T. Carson, “Property Rights, Protest, and the Siting of Hazardous Waste Facilities,” *American Economic Review*, vol. 76, No. 2, May 1996, pp. 285-290.

Waste Generation and Demand

Across countries, the generation of MSW increases both as population increases and as per capita income increases, but is probably more closely tied to population than to income. World Resources Institute data cited in Beede and Bloom (1995) indicate that Australia's per capita generation of MSW by weight was less than four times that of Mozambique in 1990, though Australia's per capita income was over 27 times that of Mozambique. Similar patterns hold for other countries. The authors' estimates based on cross-country data imply that the elasticity of national MSW generation with respect to population is around 1.04 (i.e., a one-percent increase in population leads to about a one-percent increase in MSW), while the elasticity with respect to per capita income is around 0.34 (i.e., a one-percent increase in per capita income leads to about a one-third percent increase in MSW). Estimates on time-series data for Taiwan and the United States yield income elasticities which are higher than the cross-country estimate, but still less than 1. Thus, it seems likely that the global distribution of MSW is disproportionately in developed countries when viewed in proportion to population, but disproportionately in developing countries when viewed in proportion to national income.⁴⁸

There is evidence that countries prioritize environmental issues according to per capita income, following a hierarchy-of-needs approach in which the lowest-income countries direct limited resources to address the most urgent problems by adopting technologies that are appropriate to their particular needs. Increases in income may result in the assignment of resources to additional environmental problems.⁴⁹ For example, even small improvements in per capita income are associated with improvements in drinking water quality, because of the high rate of mortality and morbidity associated with water-borne diseases. Air and water pollution have sometimes been said to follow "environmental Kuznets curves" with an inverted U-shape, getting worse as countries advance from low-income to middle-income status and then improving, although this finding has been questioned by more recent research.⁵⁰ The World Bank's *World Development Report 1992* reported a positive association between MSW per capita and per capita income across the entire range of per capita income, reinforcing the idea that waste production increases with per capita income. While affluent countries are likely to devote more resources to all environmental problems, this finding may suggest that demand for solid and

⁴⁸ David N. Beede and David E. Bloom, "Economics of the Generation and Management of Municipal Solid Waste," *NBER Working Paper* No. 5116, (Cambridge, Mass.: National Bureau of Economic Research, May 1995).

⁴⁹ See Nemat Shafik and Sushenjit Bandyopadhyay, "Economic Growth and Environmental Quality: Time-Series and Cross-Country Evidence," World Bank Working Paper No. 904, 1992, (Background Paper for World Development Report 1992) for an early example of this research.

⁵⁰ For a general review of the literature on the association of environmental policy with per capita income, see Simone Borghesi (1999), "The Environmental Kuznets Curve: A Survey of the Literature," found at Internet address <http://www.feem.it/NR/rdonlyres/1D089671-FFCF-42F9-BA15-DEB9E2A581F1/138/8599.pdf>, retrieved Dec. 9, 2003. For recent findings questioning the conventional inverted-U shape found with respect to air pollution, see William T. Harbaugh, Arik Levenson, and David Molloy Wilson, "Reexamining the Empirical Evidence for an Environmental Kuznets Curve," *Review of Economics and Statistics*, vol. 84, No. 3, Nov. 2002, pp. 541-551.

hazardous waste management may be even more likely to be concentrated in developed countries than demand for other environmental services. The findings of this report, as illustrated in chapter 8 (figure 8-1), also suggest that there is a positive relationship between per capita income and per capita MSW generation.

Industry Structure

Size and scale of firms

Because of the economies of scale in landfilling and incineration, large firms have a comparative advantage in the solid waste management market. As discussed above, the steadily declining number of landfills in the United States has been linked to the push for greater economies of scale in this market segment. There are approximately 12,000 private firms and municipalities that provide solid waste services in the United States. Three of these firms – Waste Management, Inc. (WMI), Allied Waste Industries, and Republic Services – account for 47 percent of private revenues from MSW, and the top 13 firms account for 58 percent of such revenues. In the subcategory of waste-to-energy (incineration), three firms (Ogden Projects, Wheelabrator Technologies, and American Ref-Fuel) account for 54 percent of revenues.⁵¹ As the United States is the world's largest market for solid waste management services, it follows that if the degree of technological economies of scale in landfilling and incineration in the U.S. market were captured in other markets, the number of sustainable firms in those markets would be correspondingly smaller. A possible exception is Japan, where the total quantity of MSW incinerated is about 20 - 30 percent larger than the U.S. level, depending on whether waste-to-energy incineration or all incineration is included. Thus, it is in principle possible that the size of the Japanese market allows either a larger minimum efficient scale of incinerator, or more incinerators, or both.

Organization of firms

As alluded to above, there are economies of scale for industrial landfills. This is also true for incinerators, due to the engineering characteristics of process flow technologies. There may be further economies of scale in jointly operating a network of transport facilities, transfer stations, and landfills over a large geographical area in such a manner as to take full advantage of the potential tradeoffs between scale economies and transport costs.

There are also advantages to internalization of related activities within firms, either through vertical integration or self-provision of services. Advantages (both technical and financial) in vertical integration between hauling and disposal activities include stability in disposal prices as companies are reluctant to raise tipping fees on their own trucks. Also, control of collection routes ensures a constant supply of materials into company-owned landfills and prevents defections when competitors reduce tipping fees. Of course, the key to this integration is to maximize what industry participants call the “internalization ratio,” the amount of waste hauled by the firm

⁵¹ *EBI Report 2000*, pp. 9-31 and 9-32.

that is disposed of in company-controlled facilities. The higher the percentage, the more stable the firm's operating environment.⁵²

In the case of hazardous waste, internalization is most likely to take place between the production and disposal of hazardous waste - that is, firms generating the waste are likely to dispose of the waste on-site. This facilitates cost reduction by motivating waste minimization and increasing opportunities for the recovery of the productive value of waste chemical streams.⁵³

Corresponding with the increasing internalization of hazardous waste management within the waste generating industries themselves is a decline in revenues generated by the U.S. hazardous waste industry, which fell from about \$6.5 billion in 1992 to \$2.7 billion in 2001 (not adjusting for inflation) and likely will continue to decline.⁵⁴ International comparison data show a similar pattern, with the United States possibly being ahead with regard to on-site management of hazardous waste and corresponding reductions in total revenue generation. Using national definitions (which are generally comparable over time if not across countries), total production of hazardous waste in weight terms has declined 80 percent in the United States from 1995-99, and has declined over 50 percent from recent historic peaks in Mexico (71 percent reduction during 1997-2000), Korea (65 percent reduction during 1992-2000), the Czech Republic (64 percent reduction during 1996-99), and Poland (69 percent reduction during 1996-2000). More modest declines from recent historic peaks have occurred in Japan, Finland, Hungary, the Netherlands, Norway, the Slovak Republic, Switzerland, and the United Kingdom.⁵⁵ Production of hazardous wastes may be on the increase in France, Germany, Italy, Russia, and some other countries, though for certain countries a lack of recent data makes this unclear. Also, there is significant volatility in year-to-year figures, which may result from changes in definitions and/or enforcement. Nonetheless, the evidence is fairly strong in support of a secular downward trend in the total amount of hazardous waste available for processing throughout the developed world, and the amount that presents itself to the market for processing by hazardous waste management firms.

⁵² *EBI Report 2000*, p. 9-33.

⁵³ In EPA's *The National Biennial RCRA Hazardous Waste Report*, there is a very close correspondence between the identities of the 50 largest hazardous waste generators and hazardous waste managers. The list of 50 largest hazardous waste managers does not include any of the three firms mentioned by EBI as the largest firms in hazardous waste management. None of these three firms had revenues exceeding \$1 billion in 2001.

⁵⁴ *EBI Report 2000*, pp. 11-11, 11-15.

⁵⁵ *OECD Environmental Data 2000: Waste*, pp. 17-18 and USITC calculation. A corroborating piece of evidence with respect to nuclear waste, for which data may be better than for other components of hazardous waste streams, is that total spent nuclear fuel arisings in the OECD-25 by weight have declined by 15 percent from their peak in 1992 thru 2001 (*Ibid.*, p. 27). A sharp drop in nuclear waste in the United Kingdom appears to account for much of this decline.

International Transactions

There are three types of international transactions pertaining to solid and hazardous waste services recorded in U.S. data. These include:

- merchandise trade transactions, which record physical shipments of waste across borders;
- services transactions on the current account, which record payments for waste management services such as treatment or disposal; and
- sales by overseas affiliates of multinational firms providing waste treatment or disposal services, both those arising from U.S. direct investment abroad and from foreign direct investment in the United States.

In some instances, the treatment of a particular shipment of waste may involve more than one of these activities. For example, waste may be shipped physically from country A to country B, with the producer of waste in country A paying a firm in country B to manage the waste. From the standpoint of country A, this would be recorded as an export of waste as merchandise, and an import of services on the services portion of the current account. Alternately, a producer of waste may ship waste to another firm within its own country for management, with the waste management firm being an affiliate of a foreign-owned firm. This transaction would not be recorded either on the merchandise trade or services portions of the current account. However, data reflecting the operations of the waste management firm will appear in surveys of direct investment, and the waste management firm itself may engage in related transactions which affect balance-of-payments data. These examples may not exhaust the ways in which the treatment and disposal of solid and hazardous waste can affect data on international transactions.

Only a small fraction of solid and hazardous waste crosses international borders. Data on international trade in solid wastes are spread across a number of different categories, some of which are specific to the type of material being traded and some of which do not always distinguish between material for final disposal and material for recovery and reuse. Internationally traded hazardous wastes are declared by manifest by many countries under the Basel Convention. The smaller the country, the more likely that waste will be traded across international borders. Available OECD data on hazardous wastes imply that for a number of countries, exports and/or imports of hazardous wastes exceed 10 percent of local production of such wastes. These countries include Austria, Denmark, Ireland, Luxembourg, the Netherlands, Sweden, and Switzerland. In most cases, countries engage in two-way trade in hazardous wastes, although some countries tend to run a persistent surplus or deficit. Consistent net importers of hazardous waste (and thus, probable net exporters of hazardous waste services) include Canada, Mexico, France, Spain, and the United Kingdom. Consistent net exporters of hazardous waste (and thus, probable net importers of hazardous waste services) include Austria, Denmark, Germany, Ireland, Italy, Luxemborg, and Switzerland.⁵⁶ The data in table 2-1 suggest that international provision of waste-related services is much more likely to take place through FDI-related activity of affiliates than through arms' length trade in services. In some cases, one country may physically ship wastes to another country, which then

⁵⁶ *OECD Environmental Data 2002 - Wastes*, pp. 17-19.

Table 2-1
Selected indicators of U.S. international transactions in waste and waste services,
2001-2002 and Jan.-Sept. 2003

Type of trade/Product or industry definition	2001 full year	2002 full year	2003 Jan.- Sept.
<i>Million dollars</i>			
Sales of affiliates associated with direct investment			
Waste management and remediation services:			
Foreign direct investment in the United States . . .	1,809	(²)	(²)
U.S. direct investment abroad ¹	270 - 860		
Trade in private services, unaffiliated			
Waste treatment and depollution services:			
U.S. exports	25	20	(²)
U.S. imports	5	14	(²)
Merchandise trade of certain wastes			
HS 3825 ³ :			
U.S. exports	(²)	4.2	4.5
U.S. imports	(²)	1.5	5.8

¹ USITC estimate based on the assumption that sales are proportionate to employment in this and two other non-disclosed industries, taking the upper and lower bound estimates implied by the reported ranges of employment and rounding to the nearest \$10 million. The value is not reported to avoid disclosure of data pertaining to individual firms.

² Not available.

³ HS 3825 includes municipal waste, sewage sludge, clinical waste, residual products of the chemical and allied industries and certain other wastes. Sewage sludge accounts for about 3 percent of total U.S. trade in HS 3825.

Source: U.S. Department of Commerce and USITC calculations.

manages the wastes and receives payment for a service. This pattern may suggest that imports of wastes are statistically associated with exports of waste-related services and vice-versa. Such a pattern is not obviously confirmed by the data. The fact that market values assigned to the physical wastes are apparently very low, and moreover may differ markedly for different types of wastes, make such a pattern more difficult to observe in the data if in fact it exists.

U.S. Data on International Transactions

U.S. international transactions relating to waste and waste services are of several types, and pertain to:

- transactions of affiliates associated with direct investment (U.S. direct investment abroad and foreign direct investment in the United States)

- unaffiliated (arms' length) transactions in services
- merchandise trade in solid or hazardous waste itself, which may be transported across borders for purposes of treatment. Exports of waste may be associated with imports of waste treatment services and vice versa, though there may be exceptions to this rule.

Table 2-1 compares selected indicators pertaining to sales by affiliates, unaffiliated trade in private services, and merchandise trade in waste. The definition of waste services may not be identical for affiliated and unaffiliated services trade, and the definition of waste traded as merchandise may not conform precisely to the definitions employed elsewhere in the report. The trade classification HTS 3825 is defined as “residual products of the chemical or allied industries, nesoi,⁵⁷ municipal wastes, sewage wastes, other wastes specified in note 6 to chapter 38.” In particular, HTS 3825, as reported, does not include wastes associated with the petrochemicals industry, which may be treated as hazardous waste but which may often be recycled. The 4-digit code may also exclude other relevant waste.

From table 2-1 it is possible to infer that sales by affiliates associated with direct investment in the waste management services industries are one or two orders of magnitude larger than unaffiliated sales of such services (hundreds of millions or billions of dollars annually as opposed to tens of millions of dollars). It also appears likely that sales by affiliates of foreign-owned firms in the United States are several times larger than sales by U.S.-owned affiliates abroad, even though the value of the latter is uncertain owing to data disclosure issues. Finally, the values assigned to the waste traded are very low (millions of dollars a year) as compared to the values of services associated with waste treatment. Data for HS 3825 are not available prior to 2002.

Table 2-2 shows the country-by-country breakout of U.S. merchandise trade in wastes captured by HS 3825. The largest share of U.S. trade (42 percent of the total) is with Canada, in relation to which the United States is a net importer of waste, suggesting that U.S. firms are providing waste management services to the Canadian market. The United States is a net exporter of wastes under HS 3825 to other major trading partners for the 21 months (January 2002-September 2003) for which data are available. The most significant of these are the United Kingdom (15 percent of total U.S. waste trade), China (6 percent) and El Salvador (5 percent).

Table 2-3 presents the main types of waste traded under HS 3825. The largest share of such trade comprises various chemical waste flows (HS 3825.49 through HS 3825.90), which may be either treated as hazardous wastes or recycled. The United States is a heavy net exporter of chemical wastes in all categories except HS 3825.90, a large and miscellaneous category in which trade is nearly balanced. Imports of municipal waste, sewage sludge, clinical waste, and most categories of chemical wastes are dominated by imports from Canada.

⁵⁷ Not elsewhere specified or included.

Table 2-2
U.S. merchandise trade under HS 3825,¹ Jan. 2002 - Sept. 2003

COUNTRY	Exports			Imports			Total trade Jan. 2002– Sept. 2003	Share of total
	2002	Jan.-Sept. 2002	Jan.-Sept. 2003	2002	Jan.-Sept. 2002	Jan.-Sept. 2003		
	<i>Dollars</i>						<i>Percent</i>	
Canada	43,065	38,222	146,245	1,302,898	844,038	5,197,947	6,690,155	41.6
United Kingdom	524,948	66,592	1,745,697	13,238	13,238	98,581	2,382,464	14.8
China	797,691	722,727	132,094	17,972	17,972	54,779	1,002,536	6.2
El Salvador	465,000	0	332,449	0	0	0	797,449	5.0
Brazil	329,797	230,440	104,209	0	0	215,595	649,601	4.0
Mexico	366,780	285,825	106,000	63,695	14,528	55,733	592,208	3.7
Italy	8,637	8,637	378,792	0	0	0	387,429	2.4
Taiwan	188,924	102,119	184,247	0	0	0	373,171	2.3
Haiti	151,635	97,039	137,594	0	0	0	289,229	1.8
Netherlands	32,839	32,839	138,628	0	0	94,975	266,442	1.7
Korea	221,865	217,822	16,517	6,110	6,110	0	244,492	1.5
Indonesia	198,100	90,100	7,377	0	0	0	205,477	1.3
Dominican Republic	74,485	36,162	108,413	0	0	0	182,898	1.1
Peru	11,543	0	170,082	0	0	0	181,625	1.1
Other	812,513	527,435	819,861	87,620	52,397	108,166	1,828,160	11.4
Total	4,227,822	2,455,959	4,528,205	1,491,533	948,283	5,825,776	16,073,336	100.0

¹ HS 3825 is defined as “residual products of the chemical or allied industries, nesoi, municipal waste, sewage wastes, other wastes specified in note 6 to chapter 38.”

Source: USITC Dataweb.

Table 2-3
U.S. merchandise trade under HS 3825, Jan. 2002 - Sept. 2003, by subcategory

HS category	Description	U.S. domestic exports	Principal destinations	U.S. imports for consumption	Principal suppliers
		<i>Dollars</i>		<i>Dollars</i>	
3825.10	Municipal waste	568,475	Mexico, Peru, Singapore, Australia, United Kingdom	535,515	Canada
3825.20	Sewage sludge	132,520	Korea, Mexico	53,035	Canada, Belgium
3825.30	Clinical waste	19,259	Mexico, Netherlands	624,188	Canada
3825.49	Waste organic solvents, other than halogenated	327,118	Jamaica, Sweden, South Africa, Taiwan, Germany	31,253	Canada, United Kingdom, Mexico
3825.50	Wastes of metal-pickling liquors, hydraulic fluids, brake fluids and antifreeze fluids	2,294,920	China, Haiti, Dominican Republic, Ukraine, Panama	0	None
3825.61	Other wastes from the chemical and allied industries, mainly containing organic constituents	99,368	Italy, France, China, Canada	7,893	Germany, Canada, Mexico
3825.69	Other wastes from the chemical and allied industries, other than those mainly containing organic constituents	142,685	Dominica, Dominican Republic, Argentina, Taiwan, Germany, Canada	17,319	China, Mexico, Bahamas
3825.90	Residual products of the chemical industries, nesoi, other wastes nesoi, specified in note 6 to chapter 38	5,136,449	United Kingdom, El Salvador, Brazil, Italy, Taiwan	6,048,306	Canada
Total		8,756,027		7,317,309	

Source: USITC Dataweb. "Principal destinations" and "principal suppliers" are those accounting for 5 percent or more of the total, in descending order of importance.

CHAPTER 3

UNITED STATES

Introduction

As the world's largest market for waste management services, the U.S. market is mature, competitive, and highly regulated. In recent years, no major regulations or legislation affecting waste management services have emerged to stimulate new growth in the market, and thus, the U.S. market for waste management services is in the process of consolidating. The United States has recently become a net importer of solid and hazardous waste services, owing to efforts by leading U.S. firms to focus on domestic businesses. Although nearly all U.S. solid waste management firms operate only in the domestic market, one of the leading U.S. solid waste management firms has a leading market position in Canada. Moreover, a few U.S. hazardous waste management firms provide services in Canada and Mexico.

This chapter presents an overview of the U.S. market's size, key suppliers and consumers, principal technologies, and regulation; addresses the nature and extent of U.S. trade and investment in the industry; and discusses the future outlook for the U.S. market for waste management services.

Market Overview

The United States generated about 208 million metric tons¹ of municipal solid waste (MSW) in 2001 (table 3-1),² reflecting a decrease of about 3 million metric tons, or 1 percent, below the previous year, and an increase of 22 million metric tons over 1990. Municipal solid waste generation per capita has remained relatively stable since 1990 but decreased 5 percent during 1999-2001.³ The EPA estimates that

¹ Metric units generated by USITC staff calculation.

² U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSW), *Municipal Solid Waste in the United States: 2001 Facts and Figures*, EPA530-R-03-001, Oct. 2003. The EPA does not report data on total solid waste. EPA estimates include data for containers and packaging; durable goods such as furniture, appliances, and consumer electronics; nondurable goods such as newspapers and clothing; and other wastes such as food scraps and yard trimmings. Solid wastes excluded from EPA data on municipal solid waste include municipal sludge, industrial nonhazardous waste, construction and demolition (C and D) debris, and agricultural, oil and gas, and mining wastes. Industry estimates for solid waste generation, which include data for certain solid waste excluded from EPA data on MSW, exceeded 363 million metric tons in 2001, considerably higher than EPA's estimates for MSW and based on methodologies substantially different from the one developed by EPA.

³ Expressed in pounds per person per day, generation totaled 4.5 in 1990 and 4.4 in 2001. EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*.

Table 3-1
Selected characteristics of the U.S. solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Waste generation/treatment	The United States generated 208 million metric tons of municipal solid waste (MSW) ¹ in 2001, virtually all of which was managed. ²	The United States generated 36 million metric tons ³ of RCRA hazardous waste in 1999, virtually all of which was managed. ⁴
Waste prevented or reduced at source	50 million metric tons in 2000, which reduced the solid waste stream by 19 percent. ^{2, 5}	(⁶)
Market size (2002)	\$42.8 billion; 11,200 firms. ⁷	\$4.9 billion; 1,200 firms. ⁷
Employment (2002)	276,000 employees. ⁷	38,300 employees. ⁷
Trade (2002)	Exports- \$503 million; imports- \$1.3 billion. ⁷	Exports- \$95 million; imports- \$220 million. ⁷
Nature of industry	Highly consolidated, with the top 3 firms accounting for almost 50 percent of industry revenues. Publicly traded companies and private companies together account for 69 percent of the market, while government municipalities account for the remaining 31 percent of the market. ⁷	Highly consolidated, especially in the medical waste industry. ⁷
Key market participants (and location of parent)	Waste Management (U.S.); Allied Waste (U.S.); Republic Services (U.S.); Onyx (France). ^{7, 8, 9}	Clean Harbors, Inc. (U.S.); Onyx (France); Philip Services (U.S.); Medical waste-Stericycle (U.S.). ^{7, 9}
Principal methods of waste treatment and disposal	Landfills account for the largest share of solid waste disposal in the United States (55 percent in 2001), followed by recycling (including composting)(30 percent) and incineration (15 percent). ²	Land disposal (69 percent) principally by deep-well/underground injection, thermal treatment (11 percent), recovery operations (8 percent), and other methods (11 percent). ^{2, 10}
Key legislation	Solid Waste Disposal Act (SWDA); Resource Conservation and Recovery Act (RCRA); Pollution Prevention Act (PPA). ¹¹	Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). ¹²
Regulatory authorities	Environmental Protection Agency (EPA); state and local level environmental agencies. ¹³	

See footnotes at end of table.

Table 3-1—continued

Selected characteristics of the U.S. solid and hazardous waste services market

Item	Solid waste	Hazardous waste
GATS commitments	U.S. commitments grant full market access and national treatment for the provision of refuse disposal services through cross-border supply (mode 1), consumption abroad (mode 2), and commercial presence (mode 3). However, these commitments only apply to a specified set of environmental activities, and are limited to services contracted by private industry. ¹⁴	
Other measures affecting trade and investment	OECD decisions on the control of transboundary movement of wastes destined for recovery operations. ¹⁵ Bilateral Agreement governs transboundary movement of solid waste concerning recycling with Canada. ¹⁶	OECD decisions on the control of transboundary movement of wastes destined for recovery operations. ¹⁵ Bilateral agreements govern transboundary movement of hazardous waste concerning recycling and disposal with Canada and recycling with Mexico. ^{16, 17}

¹ Total does not include municipal sludges; industrial nonhazardous wastes; construction and demolition debris; and agricultural, oil and gas, and mining wastes. Industry estimates for solid waste generation, which include data for municipal solid waste as well as certain solid waste excluded from EPA data, exceeded 363 million metric tons in 2001. These industry estimates were generated using methods that are substantially different from the one developed by EPA.

² U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSW), *Municipal Solid Waste in the United States: 2001 Facts and Figures*, report No. EPA530-R-03-001, Oct. 2003.

³ Data shown for generation are reported by large quantity generators (LQGs) as defined under the Resource Conservation and Recovery Act (RCRA). Industry sources estimate that LQGs represent approximately 60 percent of total hazardous waste generated in the United States.

⁴ EPA, OSW, *The National Biennial RCRA Hazardous Waste Report: Based on 1999 Data*, June 2001.

⁵ Solid Waste Association of North America.

⁶ Not available.

⁷ Environmental Business International, Inc. (EBI), *Environmental Business Journal*, vol. xvi, No. 5/6, 2003, p. 5; EBI, e-mail messages to Commission staff, received Jan. 22, 2004.

⁸ Standard & Poor's, *Industry Surveys: Environment and Waste Management*, Apr. 24, 2003.

⁹ Corporate annual 10-K reports.

¹⁰ Applies to treatment and disposal of RCRA hazardous waste reported by LQGs in 1999.

¹¹ SWDA (1965): 42 U.S.C. 6991 et seq.; RCRA (1976): 42 U.S.C. 321 et seq.; and PPA (1990): 42 U.S.C. 13101 and 13102 et seq.

¹² RCRA (1976): 42 U.S.C. 321 et seq.; CERCLA (1980): 42 U.S.C. 9601 et seq.

¹³ U.S. EPA, established in 1970, states that it develops and enforces regulations to implement federal and environmental laws, and conducts and sponsors research, environmental education, and programs to encourage pollution reduction and energy conservation, as indicated at the EPA website, <http://www.epa.gov/>. Information on state and local government environmental agencies may be found at websites maintained by states, counties, and municipalities individually.

¹⁴ General Agreement on Trade in Services (GATS), *United States: Schedule of Specific Commitments*, GATS/SC/90, Apr. 1994.

¹⁵ OECD, Decision C(92)/39/final, revised May 2002.

¹⁶ Agreement Between the Government of the United States of America and the Government of Canada Concerning the Transboundary Movement of Hazardous Waste, Oct. 28, 1986, as amended in 1992. By an exchange of letters, the amendment in 1992 extended the agreement to include solid waste.

¹⁷ Annex III to the Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area: Agreement of Cooperation Between the United States of America and the United Mexican States Regarding the Transboundary Shipments of Hazardous Wastes and Hazardous Substances ("La Paz Agreement"), Nov. 12, 1986.

residential consumers generate 55 percent to 65 percent of municipal solid waste, with nonresidential consumers contributing the remainder.

The United States is the world's largest market for solid waste management services, including MSW and other nonhazardous waste, with revenues totaling \$42.8 billion and employment estimated at 276,000 in 2002.⁴ During 1990-2002, revenues increased at an average annual rate of 4 percent.⁵ Approximately 11,200 companies supplied solid waste management services to industrial and municipal consumers in the United States in 2002. In 2001, private and publicly-traded companies accounted for 69 percent of industry revenues, while government-affiliated entities accounted for the remaining 31 percent of such revenues. Despite the large number of service providers, the U.S. market for solid waste management services is highly consolidated. The three largest firms in terms of revenue— Waste Management, Inc. (WMI), Allied Waste Industries, and Republic Services- all of which are U.S.-owned, accounted for approximately 47 percent of total U.S. solid waste management revenues in 2001.⁶ These firms have vast collection, transportation, transfer, recycling, and disposal operations throughout the United States, with each firm's revenues exceeding \$2 billion in 2002.⁷ Other waste services firms operate in smaller geographic areas or provide fewer services, and their revenues are considerably lower than the three market leaders. The rapid pace of mergers and acquisitions among solid waste services firms in the 1990s has slowed in recent years, as leading national and regional firms have sought instead to improve operating efficiency, constrain costs, and purchase certain strategic assets from one another to improve their position in the price-sensitive U.S. market.⁸

Approximately 20,000 large quantity generators (LQGs)⁹ in the United States produced a total of 36 million metric tons of hazardous waste in 1999,¹⁰ accounting for about 60 percent of all hazardous waste generated domestically.¹¹ Whether this represented an increase or decrease over previous levels is not clear due to the EPA's recent reclassification of certain hazardous waste as "special waste."

⁴ Environmental Business International, Inc. (EBI), *Environmental Business Journal* vol. XVI, No. 5/6, 2003, p. 5; and EBI, e-mail messages to USITC staff, received Jan. 22, 2004.

⁵ Calculated by USITC staff based on EBI sources, e-mail messages to USITC staff, received Jan. 22, 2004.

⁶ EBI, *The U.S. Environmental Industry & Global Market*, p. 9-30.

⁷ Corporations' annual reports on Form 10-K to the SEC and profiles by Datamonitor, found at Internet address <http://www.ebsco.com/>, retrieved Jan. 6, 2004.

⁸ Standard & Poor's, *Industry Surveys: Environmental and Waste Management*, Apr. 24, 2003.

⁹ An LQG is defined under U.S. law in the Resource Conservation and Recovery Act of 1976 (RCRA) as a generator that exceeds certain specified generation levels of RCRA-classified hazardous waste in a single month or accumulated at any time.

¹⁰ EPA, OSW, *The National Biennial RCRA Hazardous Waste Report (Based on 1999 Data)*, Executive Summary, EPA530-S-01-001, June 2001. Data reported for 1997 and 1999 are not comparable to data reported prior to 1997.

¹¹ Industry representative, e-mail response to USITC staff, Dec. 16, 2003.

The United States is likely the world's largest single-country market for hazardous waste management services,¹² with market revenues of \$4.9 billion in 2002. During 1990-2002, market revenues decreased at an average annual rate of 2 percent.¹³ The U.S. industry for such services comprised approximately 1,200 firms and 38,300 workers in 2002.¹⁴ The number of firms has decreased in recent years, as factors such as excess capacity, high capital costs, corporate debt, price, competition, and low profit margins have encouraged merger and acquisition activity among leading firms.¹⁵ In September 2002, Clean Harbors, Inc. (U.S.) acquired Safety-Kleen Corp.'s (U.S.) chemical services business, nearly doubling Clean Harbors' annual revenues to more than \$600 million¹⁶ and established the firm as the largest operator of hazardous waste treatment facilities in North America. As of December 2002, Clean Harbors had hazardous waste management properties located in 36 U.S. states, Canada, Mexico, and Puerto Rico.¹⁷ Other leading firms providing hazardous waste services in the U.S. market include Onyx (France), Safety-Kleen, Heritage (U.S.), Philip Services (U.S.), Teris (subsidiary of French firm Suez), and WMI.¹⁸ Principal consumers of hazardous waste services include utilities; chemical, petroleum, pharmaceutical, and other industrial generators of large quantities of hazardous waste; educational institutions; medical and health care providers; other environmental service entities; and government agencies.¹⁹

The U.S. medical waste management services industry, considered a segment of the U.S. hazardous waste industry,²⁰ earned revenues exceeding \$1.5 billion in 2002. Stericycle, Inc. (U.S.) accounted for approximately 25 percent of this industry's revenues in 2002,²¹ while its largest competitor filed for bankruptcy and ceased operations in the same year.²² After completing 66 acquisitions during 1993-2002, Stericycle reported having the only fully integrated, national medical waste management network in the United States, serving more than 5,000 large medical waste generators, such as hospitals and pharmaceutical manufacturers, and approximately 285,000 small medical waste generators, such as outpatient clinics and

¹² Industry representative, telephone interview by USITC staff, Oct. 29, 2003.

¹³ Calculated by USITC staff based on EBI sources, e-mail messages to USITC staff, Jan. 22, 2004.

¹⁴ Environmental Business International, Inc. (EBI), *Environmental Business Journal* vol. XVI, No. 5/6, 2003, p. 5; and EBI, e-mail messages to USITC staff, received Jan. 22, 2004.

¹⁵ EBI, *The U.S. Environmental Industry & Global Market*, p. 11-1.

¹⁶ Clean Harbors, Inc., annual report on Form 10-K, fiscal year ended Dec. 31, 2002.

¹⁷ *Ibid.*

¹⁸ *Ibid.*; and EBI, *The U.S. Environmental Industry & Global Market*, p. 11-3.

¹⁹ Clean Harbors, Inc., annual report on Form 10-K.

²⁰ Industry analysts generally classify and estimate revenues for the medical waste management services segment as part of the hazardous waste services industry. States usually regulate medical waste as a solid or "special" waste rather than as a hazardous waste under the RCRA, although definitions and requirements vary among the states.

²¹ Stericycle, Inc., annual report on Form 10-K, fiscal year ended Dec. 31, 2002, found at Internet address <http://www.sec.gov/>; "Stericycle Upped Medical Waste Operating Margins, Analyst Notes," *Milwaukee Journal Sentinel*, Oct. 26, 2002, at Internet address <http://www.jsonline.com/>, retrieved Aug. 22, 2003; and EBI, "\$400-Million Stericycle Continues Acquisition Campaign Into 2002," *Environmental Business Journal*, vol. 14, No. 7/8, 2002.

²² "Embattled Med/Waste Files for Bankruptcy," *Waste News*, Feb. 18, 2002; and EPA, final report on removal actions at the former Med/Waste Inc. incinerator facility in Hampton, SC, Jan. 2003.

medical and dental practitioners' offices.²³ The \$500-million U.S. market for low-level radioactive waste management, another segment of the U.S. hazardous waste services market, is served by only a small number of approved disposal sites.²⁴ A 12-fold increase in disposal costs for low-level radioactive waste during 1986-96 has led generators to sharply reduce their production of such waste.

The majority of the U.S. solid waste stream is managed at waste disposal facilities, although the share of the waste stream sent to such facilities has decreased from 90 percent in 1980 to 70 percent in 2001 in light of ambitious recycling programs. Landfilling is the most prevalent method of disposal, having accounted for 56 percent of municipal solid waste management, by weight, in 2001. In that year, 116 million metric tons of municipal solid waste was disposed in landfills, about 9 percent less than in 1990.²⁵ The number of municipal solid waste landfills has decreased substantially, from about 8,000 in 1988 to 1,858 in 2001. At the same time, the average size of landfills and the number of waste transfer stations have grown,²⁶ as increasingly rigorous federal environmental standards beginning in 1989 led landfill owners either to upgrade operations with more costly technologies and expand landfill size to achieve greater economies of scale, or to cease operations.²⁷ The southeast and western regions host the greatest number of municipal solid waste landfills, owing to more affordable and available land. In 29 U.S. states, landfill capacity is considered adequate for more than 10 years,²⁸ although Pennsylvania, the state that imports the most waste from outside its borders, is among the states that may soon face a shortfall in capacity.²⁹

Waste-to-energy (WTE) facilities disposed of about 15 percent of the U.S. municipal solid waste stream in 2001. Despite the high capital costs associated with the construction of such facilities, 97 WTE facilities were operating in the United States in 2001.³⁰ Many of these facilities are located in the northeastern United States where land is relatively limited and expensive. In 2001, WTE facilities processed 31 million metric tons of solid waste, approximately equal to the previous year when industry data indicated such facilities generated 2,800 megawatts of renewable energy, equivalent to providing energy to 2.4 million homes.³¹

Recycling programs recovered an estimated 62 million metric tons of material from the U.S. municipal solid waste stream in 2001, accounting for about 30 percent of the waste stream, up from 16 percent in 1990, and 10 percent in 1980.³² By weight, the leading materials recovered in 2001 included paper and paperboard (34 million metric tons, or 54 percent of all recycled municipal solid waste), yard trimmings (15 million metric tons, or 23 percent), metals, especially steel (5 million metric tons, or

²³ Stericycle, Inc., annual report on Form 10-K.

²⁴ EBI, *The U.S. Environmental Industry & Global Market*, p. 11-34.

²⁵ Solid Waste Association of North America (SWANA), "Pushing the Envelope on Waste Reduction and Recovery," Jan. 30, 2003, found at Internet address <http://www.swana.org/WhyPolicy.asp/>, retrieved July 12, 2003.

²⁶ EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*.

²⁷ EBI, *The U.S. Environmental Industry & Global Market*, ch. 9.

²⁸ EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*.

²⁹ EBI, *The U.S. Environmental Industry & Global Market*, p. 9-4.

³⁰ EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*.

³¹ SWANA, "Pushing the Envelope on Waste Reduction and Recovery."

³² EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*.

9 percent), glass (2 million metric tons, or 4 percent), and plastics, textiles, wood, rubber and leather, other materials, and food and other wastes (about 1 million each, comprising the remaining 10 percent). Recycling rates for the two highest generated waste materials – paper and paperboard, and yard trimmings – amounted to 45 percent and 57 percent, respectively, in 2001. The largest amount of recovered materials, by weight, comes from commercial establishments. Growth in municipal recycling has slowed since the mid-1990s, as recycling costs exceeded disposal costs, and sales of recycled materials were not sufficient to cover the difference.³³ In 2001, 9,704 curbside recycling programs and 3,846 yard-trimming composting programs operated in the United States, as the incidence of these programs grew by 5 percent and 1 percent, respectively, in that year. Recyclable materials are sorted and processed at about 540 facilities nationwide, including 480 materials recovery facilities (MRFs), 43 mixed waste processing facilities, and 16 mixed waste composting facilities.

Construction and demolition waste, which reportedly accounts for 15 to 30 percent of the U.S. solid waste stream,³⁴ is typically managed through depositing the debris in municipal solid waste landfills or landfills devoted specifically to construction and demolition waste.³⁵ Diversion of construction and demolition waste from disposal facilities is considered a particularly important strategy for municipalities and recycling businesses, as these waste materials have established end-use markets and cost less to recycle than to transport to landfills.³⁶

In 1990, in response to rising generation of solid waste, federal legislation was passed that made waste reduction at the source the top priority of U.S. waste management policy. Source reduction methods include changing the design or composition of products or packaging so as to reduce the quantity of materials used or to facilitate reuse, lengthening a product's useful life, providing packaging that reduces spoilage or damage, and managing food scraps or yard waste through on-site composting or other alternative disposal methods. Through such waste prevention efforts, 50 million metric tons of municipal solid waste were prevented from entering the U.S. waste stream in 2000, resulting in a waste stream that was 19 percent smaller than it would have been in the absence of such efforts.³⁷

As relatively little solid waste travels far for treatment or disposal, most waste management services activity occurs within state borders. However, transportation of solid waste across state borders, chiefly to other U.S. states, is growing, as 47 states exported some solid waste in 2000, up from 13 states in 1989.³⁸ Where shipments of solid waste cross state lines in the United States, industry sources report that

³³ Standard & Poor's, *Industry Surveys: Environment and Waste Management*, Apr. 24, 2003.

³⁴ Ibid.

³⁵ EPA, "Managing C & D Debris," found at Internet address <http://www.epa.gov/epaoswer/non-hw/debris/manage.htm/>, retrieved Dec. 15, 2003. Construction and demolition waste is not included in data on municipal solid waste reported by EPA.

³⁶ Standard & Poor's, *Industry Surveys: Environmental and Waste Management*, Apr. 24, 2003.

³⁷ EPA, OSW, *Municipal Solid Waste in the United States: 2001 Facts and Figures*; and SWANA, "Pushing the Envelope on Waste Reduction and Recovery."

³⁸ Environmental Industry Association, facsimile to the Commission, Sept. 9, 2003.

differences in terms of waste management standards and classification of specific wastes may create challenges and increase operating costs for waste management firms.³⁹

In 1999, 1,575 EPA-permitted treatment, storage, or disposal (TSD) facilities reported managing 24 million metric tons of hazardous waste.⁴⁰ Because most of the hazardous waste TSD infrastructure in the United States existed prior to the restrictions on such facilities instituted under the Resource Conservation and Recovery Act (RCRA) and liability for site contamination under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), many TSD facility closures have occurred in recent years.⁴¹ In 1999, 69 percent of managed hazardous waste was subjected to land disposal, principally through deep-well or underground injection (61 percent) and also through disposal in dedicated landfills (5 percent) and surface impoundment (3 percent).⁴² About 11 percent of managed hazardous waste was thermally treated in incinerators with or without energy recovery. Recovery operations accounted for 8 percent of managed hazardous waste, concentrated chiefly in fuel blending (4 percent) and metals recovery for reuse (3 percent). The remaining 11 percent was managed through stabilization processes or other means. Five U.S. states⁴³ managed 64 percent of the country's hazardous waste in 1999.

With regard to medical waste, treatment and disposal operations include incineration, autoclaving, and other technologies that employ grinding and heating waste.⁴⁴ Changes in regulations in 1997 have prompted the closure of numerous on-site hazardous waste incinerators, as many owners or operators have decided not to undertake the increased costs of regulatory compliance. Further, certain off-site incinerators have closed in recent years as waste management firms have increased the use of waste minimization, separation of various hazardous and nonhazardous waste materials, and non-incineration treatment and disposal options for certain hazardous waste.⁴⁵

In the United States, responsibility for public oversight of solid waste management, including functions such as primary planning, regulation, and enforcement, resides at the state and local government levels.⁴⁶ The Federal Government provides state and local agencies with information and other assistance, such as federal criteria for designing municipal solid waste landfills and other solid waste disposal facilities,

³⁹ Industry representative, e-mail response to USITC staff, Dec. 16, 2003.

⁴⁰ EPA, OSW, *The National Biennial RCRA Hazardous Waste Report (Based on 1999 Data)*, Executive Summary.

⁴¹ Katherine N. Probst and Thomas C. Beierle, *The Evolution of Hazardous Waste Programs: Lessons from Eight Countries* (Washington, DC: Resources for the Future, June 1999), p. 67.

⁴² EPA, OSW, *The National Biennial RCRA Hazardous Waste Report (Based on 1999 Data)*.

⁴³ Texas (22 percent), Louisiana (16 percent), Florida (11 percent), Kansas (9 percent), and Ohio (6 percent).

⁴⁴ Stericycle, Inc., annual report on Form 10-K.

⁴⁵ Ibid.

⁴⁶ EPA, "Section 1: Introduction to the Resource Conservation and Recovery Act," found at Internet address <http://www.epa.gov/epaoswer/general/orientat/rom1.pdf>, retrieved May 8, 2003.

which many states adopt through state legislation. For authority over hazardous waste management, federal laws and regulations set basic requirements for the states to implement, although states may enact more stringent criteria. New or more rigorous environmental regulation and enforcement are regarded as drivers of environmental services demand, and major catalysts for defining new markets. Federal waste management legislation had its genesis in the 1960s, but the evolution of the current U.S. waste services industry resulted from the enactment of the RCRA⁴⁷ in 1976. The RCRA established three interrelated programs: Subtitle C, the hazardous waste program, established a system to control such waste from generation until final disposal;⁴⁸ Subtitle D, the solid waste program, encouraged states to institute comprehensive plans to manage nonhazardous industrial and municipal solid waste, established criteria for municipal solid waste landfills and other solid waste disposal facilities, and prohibited unregulated dumping of solid waste; and Subtitle I, the underground storage tank program, regulated tanks that store hazardous and petroleum products.⁴⁹ The RCRA has been amended several times: in 1984, to establish the reduction or elimination of hazardous waste as a priority and to expand the scope and requirements of the RCRA;⁵⁰ in 1992, to strengthen EPA's authority to enforce the RCRA at federally owned facilities; and in 1996, to provide regulatory flexibility for land disposal of certain wastes.

Numerous other federal laws—including transportation security laws, clean air and clean water legislation, occupational safety and health legislation, and waste-specific laws and regulations other than the RCRA—have an impact on the waste services industry, especially in the hazardous waste services segment. For example, under the CERCLA,⁵¹ also known as Superfund,⁵² generators and transporters of hazardous substances, including waste, along with past and present owners and operators of sites where a release of such substances has occurred, are made strictly, jointly, and severally liable for cleanup costs resulting from releases or threatened releases of CERCLA-regulated hazardous substances. Mixed waste that has both hazardous and radioactive components are jointly regulated by EPA, the Department of Energy, and the Nuclear Regulatory Commission, in accordance with the RCRA and the Atomic

⁴⁷ 42 U.S.C. 6901 et seq.

⁴⁸ The RCRA identified and defined four classes of hazardous waste based on the ignitability, reactivity, corrosiveness, and toxicity of certain substances, and lists of hazardous wastes have been published and continue to be revised under the legislation. RCRA allows only EPA-permitted facilities to accept designated wastes for authorized treatment, storage, or disposal. Under the RCRA, EPA reviews state hazardous waste programs and grants authority to states to implement their own programs in lieu of the federal program, provided that these state programs are at least as stringent as the federal program. In practice, states may impose more stringent requirements than are provided for in federal legislation and regulations. EPA, OSW, *Introduction to the Resource Conservation and Recovery Act*.

⁴⁹ EPA, OSW, *Introduction to the Resource Conservation and Recovery Act*.

⁵⁰ More specifically, the 1984 amendments instructed EPA to develop certain regulations, providing for automatic implementation if EPA had not yet issued subject regulations in accordance with specified timetables. These amendments were adopted in response to concerns over the safety of existing methods of hazardous waste disposal.

⁵¹ 42 U.S.C. 9601 et seq.

⁵² EPA, *CERCLA Overview*, found at Internet address <http://www.epa.gov/superfund/action/law/cercla.htm/>, retrieved May 8, 2003.

Energy Act.⁵³ Moreover, low-level radioactive waste has additional limitations with respect to the movement of such waste.⁵⁴ The Pollution Prevention Act (PPA) of 1990,⁵⁵ while not exclusively devoted to waste services, is a federal law establishing a national policy hierarchy that puts top priority on pollution prevention at the source where feasible, followed by recycling, treatment, and safe disposal. The PPA tasked the EPA with several responsibilities meant to encourage the development of pollution prevention technologies and programs. However, industry sources report that in recent years, regulation relating to solid and hazardous waste management has reportedly eased rather than strengthened.⁵⁶

Trade and Investment

The U.S. Government does not publish discrete data on trade in waste management services.⁵⁷ However, industry trade data -- which reflect both cross-border trade and repatriated earnings from affiliate operations -- estimate that U.S. exports of solid waste management services totaled \$503 million in 2002, while U.S. imports of such services totaled \$1.3 billion.⁵⁸ The estimated \$827-million trade deficit in solid waste services was, in part, a result of the increasing amount of U.S. waste shipped abroad, and the substantial U.S. market presence of foreign-owned firms. During 1994-2002, U.S. exports of solid waste services decreased by 6 percent per year, on average, while imports increased at an average annual rate of 16 percent.⁵⁹ Industry sources estimate that U.S. imports of hazardous waste management services totaled \$220 million in 2002, while exports of such services amounted to \$95 million, resulting in a \$125-million deficit. During 1994-2002, U.S. exports of hazardous waste services decreased at a 9-percent average annual rate, although imports increased at the rate of 10 percent per year.⁶⁰

Official U.S. Government data on U.S. foreign direct investment (FDI) abroad indicate that five foreign-based waste management and remediation affiliates of U.S. firms held \$3 billion in assets and reported \$1.1 billion in sales in 2000.⁶¹ These affiliates chiefly supply solid and hazardous waste management services in North America and Puerto Rico. Leading U.S. participants in foreign markets include

⁵³ EPA, "Frequently Asked Questions on Mixed Waste," Feb. 1, 1997, found at Internet address <http://yosemite.epa.gov/osw/rcra.nsf/>, retrieved Oct. 10, 2003.

⁵⁴ EBI, *The U.S. Environmental Industry & Global Market*, p. 11-34.

⁵⁵ 42 U.S.C. 13101 and 13102, et seq. (P.L. 101-505, Title VI, Subtitle F, Sections 6601-6610).

⁵⁶ Industry representatives, e-mail response to USITC staff, Dec. 16, 2003, and interviews by USITC staff, Washington, DC, Sept. 9 and Nov. 12, 2003.

⁵⁷ Moreover, no statutory authority under the RCRA provides for notice and consent of municipal solid waste imports and exports. EPA, OSW, correspondence to the Honorable Debbie Stabenow, U.S. Senate, Aug. 26, 2003.

⁵⁸ EBI, e-mail sent to USITC staff, Jan. 22, 2004.

⁵⁹ Calculated by USITC staff based on various EBI sources.

⁶⁰ *Ibid.*

⁶¹ U.S. Department of Commerce (USDOC), Bureau of Economic Analysis (BEA), *U.S. Direct Investment Abroad*, table III.A2, "Selected Data for Foreign Affiliates and U.S. Parents in All Industries," preliminary 2000. These data are the first U.S. outbound FDI estimates to be reported separately for waste management and remediation services.

WMI, Clean Harbors,⁶² and Stericycle.⁶³ In addition to its leading position in terms of revenues in the U.S. solid waste management services market, WMI is the leading solid waste management firm operating in Canada. Until recently, WMI provided waste management services in several European markets, but the company sold these operations reportedly for financial and strategic reasons.⁶⁴ Casella Waste Systems, Inc. (U.S.) also provides solid waste management services in parts of Canada. In general, U.S. firms providing services related to, but not classified as, waste management services are more active participants in foreign markets than are U.S. waste management firms. Examples include environmental consulting and engineering firms, such as Bechtel, URS, Washington Group, and CH2M Hill.⁶⁵ U.S. firms that have reduced operations in foreign markets, or exited these markets entirely, indicate that the slow adoption of environmental regulations and the failure of certain regulatory entities in foreign countries to implement and enforce existing environmental measures raised risks of liability and other financial considerations to unacceptable levels.⁶⁶

Key foreign participants in the U.S. market include French-owned affiliates Onyx (a subsidiary of Veolia Environnement) and Teris (a subsidiary of Suez). Onyx is the largest foreign-owned firm providing solid waste services in the U.S. market, with U.S. revenues totaling less than \$500 million in 2001. Teris operates treatment, storage, and disposal facilities in Arkansas and California, and provides on-site project management services and transportation services for hazardous and special wastes throughout the United States.⁶⁷ Official U.S. Government data indicate that a total of six U.S.-based waste management and remediation affiliates of foreign-owned firms held \$4.8 billion in assets and reported \$1.8 billion in sales in 2000.⁶⁸ This represents a substantial decrease from 1998, when nine affiliates held \$6.3 billion in assets and reported \$3.5 billion in sales.⁶⁹

There are no known measures that are imposed specifically on foreign providers of waste management services in the United States or on foreign investment in the U.S. waste services industry. Certain professionals that provide services incidental to waste management, such as engineers, are subject to licensing provisions that vary by state, such as requirements for citizenship or residency. Moreover, Michigan requires contractors that provide construction and related services—another service

⁶² Clean Harbors derived about 91 percent of total revenue from customers in the United States and Puerto Rico, and 9 percent from customers in Canada in 2002. The firm owns incineration facilities in Quebec and Ontario designed primarily for the destruction of liquid organic waste, and operates two commercial hazardous waste landfills in Canada. Additionally, the firm operates in Mexico. Clean Harbors, Inc., annual report on Form 10-K.

⁶³ Stericycle serves customers through collection and treatment facilities in the United States, Puerto Rico, Canada, and Mexico. In addition, the firm has license agreements and joint ventures to market its technology and expertise in Asia, Africa, and South America. Stericycle, Inc., annual report on Form 10-K.

⁶⁴ Industry representative, e-mail response to USITC staff, Dec. 16, 2003.

⁶⁵ Corporate annual reports.

⁶⁶ Industry representatives, interviews with USITC staff, Washington, DC, Sept. 9 and Nov. 12, 2003.

⁶⁷ Industry representative, interview by USITC staff, Paris, France, Nov. 3, 2003.

⁶⁸ USDOC, BEA, *Foreign Direct Investment in the United States*, table A-1, “Selected Financial and Operating Data of Affiliates, by Industry of Affiliate,” revised 2000.

⁶⁹ USDOC, BEA, *Foreign Direct Investment in the United States*, table A-1, “Selected Financial and Operating Data of Affiliates, by Industry of Affiliate,” revised 1998 and 1999.

that is frequently provided in conjunction with waste management– to maintain an office in the state.

The United States trades only a minimal amount of waste with foreign countries; however, Michigan is an exception, engaging in a substantial amount of such trade. Canada was the state's largest export market for solid waste management services in 2002, surpassing exports to other U.S. states for the first time. Canadian solid waste as a share of total solid waste disposed of in Michigan landfills increased from 5 percent in 1999 to 12 percent in 2002, as the amount of waste sent to Michigan landfills from Canada increased by 282 percent during 1999-2002.⁷⁰ Although shipments of solid waste into Michigan for disposal may have been considered manageable in the short term, state environmental regulators have expressed concern that continued significant increases in waste shipments from Canada⁷¹ could adversely affect state budget allocations for source reduction and recycling programs.⁷² To date, U.S. courts have ruled that laws enacted in Michigan and other states that impose restrictions on imports of wastes from other countries and states are unconstitutional, absent the U.S. Congress enacting legislation specifically granting the authority to restrict such trade.⁷³ As regards hazardous waste, Michigan is a net exporter of such waste transported to Canada, and thus may be a net importer of hazardous waste management services.⁷⁴ U.S. shipments of hazardous wastes to Ontario and Quebec reportedly have increased significantly in recent years, reportedly due to relatively less stringent regulatory standards in effect in the provinces at that time and expanding provincial disposal capacity.⁷⁵ The United States and Canada generally permit hazardous waste shipments across each other's borders for appropriate treatment, recycling, and disposal. However, hazardous waste containing certain substances above legally permissible thresholds are exceptions. For example, owing to the potential adverse health effects of exposure to

⁷⁰ State of Michigan, Department of Environmental Quality, Waste and Hazardous Materials Division, "Report of Solid Waste Landfilled in Michigan: October 1, 2001 - September 30, 2002," Feb. 28, 2003, found at Internet address <http://www.michigan.gov/deq/>, retrieved Sept. 17, 2003.

⁷¹ In January 2003, the City of Toronto began exporting all solid waste earmarked for a landfill, up from approximately 60 percent in the previous year, to a commercial landfill in Michigan, costing Toronto about \$26 million per year. E & E Publishing LLC, "Interstate Waste: Michigan Lawmakers to Consider Cap on Imported Trash," Greenwire, Dec. 3, 2003, found at Internet address <http://www.eenews.net/greenwire/>, retrieved Dec. 3, 2003.

⁷² State of Michigan, Department of Environmental Quality, Waste Management Division, "Report of the Michigan Solid Waste Importation Task Force to Governor John Engler and Department of Environmental Quality Director Russell J. Harding," Nov. 22, 2000, found at Internet address <http://www.michigan.gov/deq/>.

⁷³ Environmental Industry Association, facsimile to the Commission, Sept. 9, 2003; and State of Michigan, Department of Environmental Quality, "Report of the Michigan Solid Waste Importation Task Force," Nov. 22, 2000.

⁷⁴ State of Michigan, Department of Environmental Quality, "2002 Michigan DEQ Environmental Quality Report," found at Internet address <http://www.michigan.gov/deq/>, retrieved Sept. 17, 2003.

⁷⁵ Texas Center for Policy Studies, "The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990-2000," May 2001, p. 64.

polychlorinated biphenyls (PCBs),⁷⁶ the process to obtain the U.S. EPA's approval to transport wastes containing PCBs into the United States⁷⁷ within authorized concentrations may take several years and only the U.S. Department of Defense has been approved for such shipments.⁷⁸

U.S. trade in hazardous waste with Mexico is believed to be more limited than with Canada,⁷⁹ as Mexican law bans imports of such waste for final disposal.⁸⁰ In addition, under the La Paz Agreement and Mexican environmental legislation, maquiladora plants that use substantially U.S. inputs must return hazardous wastes generated in Mexico to the United States, although the extent of compliance reportedly is subject to question.⁸¹ However, hazardous waste shipped to Mexico⁸² from the United States for the purpose of recycling is believed to have increased significantly since NAFTA entered into force.⁸³ Factors contributing to the increase in U.S. shipments to Mexico include likely cost advantages in using Mexican recycling firms⁸⁴ and a lack of capacity in the United States to treat certain hazardous waste.⁸⁵

The United States has major international agreements with Canada⁸⁶ and Mexico⁸⁷-- its principal trading partners for waste services-- regarding transboundary shipments of waste. In addition, the United States abides by the Organization for Economic Cooperation and Development (OECD) decision concerning the control of transboundary movements of wastes destined for recovery between OECD members.⁸⁸ However, the United States is not a party to the United Nations' Basel

⁷⁶ EPA, "Polychlorinated Biphenyls (PCBs)," found at Internet address <http://www.epa.gov/oppt/pcb/effects.html>, retrieved Mar. 12, 2004.

⁷⁷ Authority is granted under the Toxic Substances Control Act of 1976.

⁷⁸ Environmental Technology Council, Washington, DC, comments submitted to the USITC regarding Investigation No. 332-455, Nov. 5, 2003.

⁷⁹ USITC Dataweb. For example, U.S. trade under heading 3825 of the *Harmonized Tariff Schedule of the United States (2003)* includes substantially more trade with Canada than with Mexico with respect to clinical waste as a residual product of the chemical or allied industries during January 2002 through September 2003.

⁸⁰ Texas Center for Policy Studies, p. 3.

⁸¹ Texas Center for Policy Studies, p. 61.

⁸² Shipments are principally electric arc dust containing zinc and other metals from steelmaking.

⁸³ Texas Center for Policy Studies, p. 59.

⁸⁴ Certain environmental controls for high temperature recovery units are lower in Mexico, as are liability costs and financial assurance requirements as regard operating recycling plants, according to the Texas Center for Policy Studies.

⁸⁵ Texas Center for Policy Studies, p. 20. As Texas reportedly lacks the capacity to manage zinc recovery, most of this waste is sent to Mexico for recycling.

⁸⁶ Agreement Between the Government of the United States of America and the Government of Canada Concerning the Transboundary Movement of Hazardous Waste, Oct. 28, 1986, as amended in 1992. By an exchange of letters, the amendment in 1992 extended the agreement to include solid waste.

⁸⁷ Annex III to the Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area: Agreement of Cooperation Between the United States of America and the United Mexican States Regarding the Transboundary Shipments of Hazardous Wastes and Hazardous Substances ("La Paz Agreement"), Nov. 12, 1986.

⁸⁸ Revision in May 2002 of OECD Decision C(92)/39/final.

Future Prospects

As the number of U.S. landfills continues to decline, demand for additional transfer stations is likely to continue to increase,⁹⁰ which could provide additional sources of revenue for firms operating such facilities. Remaining landfills are likely to prolong their life spans through the increased use of bioreactor processing technologies, which accelerate waste decomposition.⁹¹ As the capital expense to establish and operate waste-to-energy plants is prohibitive in many areas, the EPA and most states will likely emphasize source reduction as the centerpiece of solid waste management plans. To illustrate, in July 2003, the EPA announced nine new projects that will evaluate various approaches to waste minimization and energy recovery. These projects would build on programs seeking to encourage production and consumption of products that are easy to recycle and that contain recyclables.⁹² Such projects are likely to stimulate additional market opportunities for environmental engineers, consultants, technology companies, and large multidimensional waste management firms providing services related to source reduction.

Large industrial generators of hazardous waste appear to be seeking more waste management services from fewer suppliers.⁹³ Accordingly, demand will likely increase for suppliers with broader breadth of expertise and geographic coverage. For example, leading hazardous waste management firms are increasingly providing clients with choices of bundled services that span client waste management operations from generation to final disposition of waste. The availability of such services would further enable clients of waste management firms to contract for these services in lieu of dedicating in-house resources. Additional outsourcing of waste management functions to services firms is likely, as part of an accelerating trend across industries toward outsourcing many facets of administrative, sales, and marketing expenses.

In the absence of major new domestic environmental regulations, further market exit and consolidation of waste management firms among smaller and regional firms are considered likely.⁹⁴ Additional acquisitions of domestic waste management firms by foreign parent firms are considered by industry sources to be more likely than increases in U.S. firms' acquisitions or operations in foreign markets.⁹⁵

⁸⁹ Parties to the Basel convention agree not to trade in hazardous wastes with nonparties, without an agreement pursuant to Article 11 of Basel which does not derogate from environmentally sound management provisions specified in the convention. EPA, OSW, correspondence to a U.S. importer, June 17, 1996.

⁹⁰ EBI, *The U.S. Environmental Industry and Global Market*, p. 9-4.

⁹¹ Industry representatives, interviews by USITC staff, Rockville and Dickerson, MD, Sept. 11 and 25, 2003.

⁹² EPA, "EPA Funds Nine Projects to Test New Approaches to Waste Reduction, Recycling, and Land Revitalization," press release, July 10, 2003.

⁹³ EBI, *The U.S. Environmental Industry and Global Market*, p. 11-8.

⁹⁴ *Ibid.*, p. 9-33.

⁹⁵ Industry representative, e-mail response to USITC staff, Dec. 16, 2003.

Opportunities regarding services trade and investment abroad for U.S. waste management and related services firms are likely greatest in hazardous waste management services in Latin American and Asian markets, conditioned on adequate funding necessary to increase infrastructure and establish enforcement capacity.⁹⁶ However, the movement of waste across U.S. borders is likely to decrease,⁹⁷ in part as source reduction programs accelerate.

⁹⁶ Industry representative, interview by USITC staff, Washington, DC, Nov. 12, 2003.

⁹⁷ Industry representative, e-mail response to USITC staff, Dec. 16, 2003.

CHAPTER 4

CANADA AND MEXICO

Introduction

The Canadian market for waste management services is approaching maturity yet open to new service suppliers. Canada is likely a net importer of waste management services, and leading U.S. and other non-Canadian firms operate in both solid and hazardous waste management segments in Canada. The Mexican market for waste management services is in the early stage of development, is undercapitalized, and with respect to solid waste services is dominated by the public sector. Market participants in Mexico are chiefly Mexican-owned firms, with only moderate involvement from U.S. or other foreign-owned firms. The North American Free Trade Agreement (NAFTA) has augmented cooperative efforts and stimulated the development of trade and capacity building in waste management services.

This chapter presents an overview of the regional market and the Canadian and Mexican markets individually with regard to size, key suppliers and consumers, principal technologies, and regulatory circumstances; addresses the nature and extent of trade and investment in this industry in both markets; and discusses the future outlook for the Canadian and Mexican markets for waste management services.

Regional Market Overview

Since its inception, the NAFTA is thought to have stimulated economic development, especially in the border areas, and accelerated trade and investment opportunities across all industry sectors, including waste management services. Noting the increased opportunities and accompanying challenges of such growth, the NAFTA partners incorporated an environmental side agreement into the NAFTA that mandated, among other provisions, new cooperative efforts¹ and regulatory harmonization, where feasible, on a range of environmental issues, including waste management. At the same time, the NAFTA created one of the most open markets for solid and hazardous waste services in the world, and provided mechanisms for the settlement of disputes when trade or environmental laws are thought to be violated. Although Canada and Mexico are at different stages in the development of regulatory regimes and capacity for the management and reduction of waste streams,

¹ The North American Commission for Environmental Cooperation, mandated under the NAFTA, facilitates a trinational work program that addresses cross-border environmental issues. In addition, working groups of officials from the three countries address areas such as implementation of compatibility among national standards for transporting hazardous materials, including hazardous waste. These groups continue cooperative efforts first begun on a bilateral basis predating the NAFTA to deal with transboundary environmental issues, including waste management.

both countries have committed to improving solid and hazardous waste services through greater market liberalization and transparency.

Canada

Market Overview

The Canadian market for solid and hazardous waste services is larger than markets in certain other developed countries, such as Australia and New Zealand, but significantly smaller than the solid and hazardous waste markets in the United States and Japan. Revenues generated by the solid waste services industry in Canada were estimated at \$2.3 billion in 2000, while the revenues generated by the hazardous waste services industry were estimated at \$400 million.² The collection and transportation segments³ of the solid and hazardous waste industry together account for the majority of revenues (66 percent).⁴ Within the collection and transportation segment, industrial, commercial, and institutional clients account for 77 percent of revenues, whereas residential clients account for only 18 percent, and 5 percent come from other sources. Ontario and Quebec are Canada's largest provincial markets for solid and hazardous waste services, accounting for 45 percent and 21 percent of industry revenues, respectively. In 2001, the Canadian solid and hazardous waste services industry employed almost 31,000 workers.⁵ Of these, private-sector firms employed 24,197 workers and the public sector employed 6,783 workers. During 1998-2000, private-sector employment rose by 18 percent, while public-sector employment declined by 6 percent, reflecting an ongoing shift in the provision of solid and hazardous waste services from government to private companies.

Canadian Waste Services, a wholly owned subsidiary of the U.S.-based Waste Management Inc., is Canada's top provider of solid waste services. The firm employs 3,600 workers and provides collection, transportation, disposal, and recycling services to customers throughout the country.⁶ Casella Waste Systems, Inc. (U.S.) also provides solid waste services in Canada. Key hazardous waste service providers in the Canadian market include PSC (Philip Services)(U.S.), Clean Harbors (U.S.), Onyx (France), and Safety-Kleen (U.S.). A large number of small- and medium-sized firms also comprise a significant portion of the Canadian hazardous waste services market. Although competition is high⁷ in the hazardous waste management market, particularly among medium-sized firms that focus on the

² Environmental Business International (EBI), *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

³ Includes collection and transportation of waste for disposal and recycling.

⁴ Statistics Canada. "Waste Management Industry Survey 2000," found at Internet address <http://www.statcan.ca/english/freepub/16F0023XIE/16F0022XIE00001.pdf/>, retrieved Aug. 6, 2003.

⁵ Statistics Canada, "Waste Management Industry Survey 2000."

⁶ Waste Management Inc., corporate information on Canadian affiliate found at Internet address <http://www.wm.com/canada/index.asp/>, retrieved Aug. 1, 2003.

⁷ Industry representative, telephone interviews by USITC staff, Aug. 11, 2003.

provision of certain niche services, specialization prevents direct competition among large firms for certain revenue streams.

Canada generated 31.4 million metric tons of nonhazardous solid waste and approximately 6 million metric tons of hazardous waste in 2000 (table 4-1).⁸ Fifty-one percent of nonhazardous solid waste is generated by the industrial/commercial sector. Residential solid waste comprises 36 percent of the waste stream, and construction waste accounts for the remaining 12 percent. The majority (62 percent) of the solid and hazardous waste stream is generated in Ontario and Quebec.

In 2000, 73 percent of Canada's solid waste stream was disposed of in Canadian landfills and incinerators, while approximately 24 percent was diverted and recycled.⁹ The most common materials recycled include mixed paper and newsprint (32 percent of recycled materials, by weight) and ferrous metals such as iron and steel (25 percent). Recent efforts to increase composting rates led to a 45-percent increase in the amount of materials composted during 1998-2000. As a result, by 2000, organic waste accounted for 13 percent of all materials recycled in Canada. In 2000, almost 900,000 metric tons (net) of Canada's solid waste, or 3 percent of the waste stream, was exported to foreign facilities, primarily in the United States.¹⁰ Recyclable material accounted for about one-third of these Canadian waste exports.

The majority of regulations governing solid and hazardous waste management in Canada are prescribed at the provincial and municipal levels. These regulations are currently undergoing harmonization, primarily through discussions in the Canadian Council of Ministers of the Environment (CCME), an intergovernmental forum comprised of environmental ministers from the federal, provincial, and territorial governments. In 1998, all Canadian provinces, with the exception of Quebec, signed The Canada-Wide Accord on Environmental Harmonization, which allows provincial governments to retain their existing authorities, but commits them to using this authority in a coordinated manner to achieve harmonized environmental regulations. Already, CCME has produced a number of model regulations and standards that have yielded some harmonization. According to Environment Canada, remaining discrepancies among provinces regarding solid and hazardous waste services are minor and not of commercial significance.¹¹

The jurisdiction of the Federal Government is limited to federal facilities and lands, aboriginal lands, transboundary movement of hazardous waste (both interprovincial and international), and implementation of international commitments, including the recently signed Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, and binational agreements such as the Agreement Between the United

⁸ Statistics Canada, "Waste Management Industry Survey 2000."

⁹ Ibid.

¹⁰ Ibid.

¹¹ Environment Canada representative, telephone interview by USITC staff, Aug. 13, 2003.

**Table 4-1
Selected characteristics of the Canadian solid and hazardous waste services market**

Item	Solid waste	Hazardous waste
Waste generation/treatment	Canada generated 31.4 million metric tons of solid waste in 2000, a substantial proportion of which is believed to be managed. ¹	Canada generated approximately 6 million metric tons of hazardous waste in 2000, virtually all of which is managed. ¹
Market size (2000)	\$2.3 billion; ² 1,737 firms. ¹	\$400 million ²
Employment (2000)	The solid and hazardous waste industry employs 30,980 workers, of whom 24,197 were employed by the private sector. ¹	
Trade (2000)	Available data reflect the volume of Canadian waste that was transported abroad (1 million tons) and the volume of foreign waste that was transported to Canada (97,000 tons) for treatment and disposal. Based on these data, Canada was likely a net importer of solid waste management services. ¹	Available data reflect the volume of Canadian waste that was transported abroad (324,000 tons) and the volume of foreign waste that was transported to Canada (560,000 tons) for treatment and disposal. Based on these data, Canada was likely a net exporter of hazardous waste management services. ¹
Nature of industry	Competitive, but not highly concentrated. ³ The market is experiencing a shift from government provision of waste management services to contractual provision of services by private firms, which has led to increases in the number of firms in the market in recent years. ^{1,3}	Competitive; likely to consolidate, owing to overcapacity in disposal technologies. ³
Key market participants (and location of parent)	Canadian Waste Services (U.S.). ⁴	Clean Harbors (U.S.); Onyx (France); Philip Services (U.S.). ⁴
Principal methods of waste treatment and disposal	Landfills and incinerators disposed of 23 million tons (73 percent of generated solid waste) in 2000, and 7.5 million tons (24 percent) was recycled. ¹	1.1 million tons was treated and disposed of in 2000. ¹
Key legislation	Canadian Environmental Protection Act of 1999 (CEPA) ⁵	Canadian Environmental Protection Act of 1999 (CEPA), ⁵ Transportation of Dangerous Goods Act of 1992. ⁶
Regulatory authorities	Environment Canada; provincial and territorial legislatures and ministries of environment. ⁵	

See footnotes at end of table.

Table 4-1—continued
Selected characteristics of the Canadian solid and hazardous waste services market

Item	Solid waste	Hazardous waste
GATS commitments	Canadian commitments grant full market access and national treatment for the provision of refuse disposal services through cross-border supply (mode 1), consumption abroad (mode 2), and commercial presence (mode 3). ⁷	
Other measures affecting trade and investment	(8)	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; ⁹ Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal; ¹⁰ Canada-U.S. Agreement Concerning the Transboundary Movement of Hazardous Waste; ¹¹ North American Agreement on Environmental Cooperation. ¹²

¹ Statistics Canada, *Waste Management Industry Survey, Business and Government Sectors 2000*, catalogue No. 16F0023XIE, Mar. 2003.

² Environmental Business International Inc. (EBI), *Environmental Business Journal*, vol. xvi, No. 5/6, 2003, p. 5; EBI data, e-mailed to Commission staff.

³ Industry representatives, telephone interviews by Commission staff, Aug. 2003.

⁴ Corporate annual 10-K reports.

⁵ For information on environmental laws, regulations, and regulatory authorities in Canada, see Government of Canada, Environment Canada, found at Internet address <http://www.ec.gc.ca/EnviroRegs/ENG/Default.cfm>.

⁶ Enacted in 1992, this act is administered by Transport Canada with assistance from Environment Canada. For information, see Internet address <http://www.laws.justice.gc.ca/en/T-19.01/text.html>.

⁷ General Agreement on Trade in Services (GATS), *Canada: Schedule of Specific Commitments*, GATS/SC/16, Apr. 15, 1994.

⁸ Not available.

⁹ In August 2002, Canada published final regulations in the *Canada Gazette* concerning implementation of the Rotterdam Convention in Canada. For more information, see Environment Canada, found at Internet address <http://www.ec.gc.ca/dpr/2003/en/c4a.htm>.

¹⁰ In August 1992, Canada ratified the Basel Convention, which entered into force in Canada on Nov. 26, 1992. For more information on the Basel Convention, see Environment Canada, found at Internet address http://www.ec.gc.ca/international/multilat/tmhw_e.htm.

¹¹ Agreement Between the Government of the United States of America and the Government of Canada Concerning the Transboundary Movement of Hazardous Waste, Oct. 28, 1986, as amended in 1992. By an exchange of letters, the amendment in 1992 extended the agreement to include solid waste.

¹² This agreement which is the environmental side agreement to the NAFTA, entered into force on Jan. 1, 1994. For more information, see Internet address http://www.naaec.gc.ca/eng/index_e.htm.

States and Canada Concerning the Transboundary Movement of Hazardous Waste.¹² However, the federal government is able to exert some control over local regulations by requiring federal authorization of hazardous waste movements. The primary federal regulatory agency governing solid and hazardous waste services is

¹² The agreement was signed and entered into force in 1986. An amendment in 1992 extended coverage in the agreement to also include “other waste,” defined as municipal solid waste sent for final disposal or for incineration with energy recovery.

Environment Canada, which receives its authority from the Canadian Environmental Protection Act of 1999 (CEPA). First enacted in 1988, the legislation was significantly revised in 1999 to expand coverage and shift the focus to upstream methods of pollution and waste reduction. CEPA 1999 provides the mandate for revision of existing federal regulations governing the transboundary movement of hazardous waste and provides new authority for the development of regulations governing the transboundary movement of nonhazardous waste. Representatives from Environment Canada estimate that new regulations governing nonhazardous waste will be completed by 2004.¹³ Canada's federal regulatory process allows for significant input by industry and stakeholders, and industry sources indicate that this process yields fair and balanced regulations.¹⁴

Recent regulatory and technological developments have had an impact on the size and nature of the Canadian market for solid and hazardous waste services. For example, according to industry sources, as regulations in Canada increasingly focus on waste reduction technologies, the market for hazardous waste services has been shrinking. Thus, many in the industry believe that the industry has reached, and possibly exceeded, capacity. Additionally, recent advances in sorting technology favor a market structure in which one stream of consolidated waste feeds into the system and many streams of separated waste and recyclables flow out.¹⁵ These advances are creating a competitive advantage for a number of firms, especially in the recycling market.

Trade and Investment

Data specific to trade and investment in the Canadian solid and hazardous waste services industry are not available. However, related data and anecdotal information suggest that Canada's international transactions in this sector are significant, particularly with the United States. Anecdotal evidence suggests that Canada is a net importer of solid waste management services, as U.S. waste management firms earn substantial revenues from Canada by disposing of large quantities of waste transported into the United States from certain Canadian localities. For example, since January 2003, all solid waste generated in the city of Toronto,¹⁶ which is estimated at 1.25 million metric tons per year, has been exported to Michigan landfills, due to the closing of Toronto's only landfill site.¹⁷

¹³ New regulations have been drafted and taken through the mandatory consultation process.

¹⁴ Canadian industry representative, telephone interview by USITC staff, Aug. 11 and 18, 2003.

¹⁵ Canadian industry representative, telephone interview by USITC staff, Aug. 18, 2003.

¹⁶ Ontario's Waste Diversion Act of 2002 may eventually alleviate some of the requirements for landfilling by distributing the fees collected from waste generating industries to municipalities for use in new waste management programs and equipment, and allocating funds to waste diversion programs including expansion of recycling programs, all of which are likely to create further opportunities for private investment in waste management services.

¹⁷ U.S. Department of State and U.S. Department of Commerce, U.S. Foreign & Commercial Service, "Canada: Municipal Solid Waste Equipment," Industry Sector Analysis, May 30, 2003, found at Internet address <http://www.stat-usa.gov/>, retrieved Oct. 9, 2003.

Data on the cross-border trade of wastes provides some estimate of the magnitude of trade in hazardous waste management services, as the export of waste may indicate the import of a waste management service. Such data indicate that Canada is likely a net exporter of hazardous waste services, although its surplus may have decreased in recent years. Historically, Canadian imports of hazardous waste have significantly outstripped exports, as Canadian hazardous waste regulations were less strict than those in the United States. However, in 2000, Ontario tightened regulations by requiring pretreatment of hazardous waste before landfilling.¹⁸ These new regulations are more in line with U.S. standards, and, thus, the cost advantage of exporting such waste to Canada has been reduced. As a result, Canada's imports of hazardous waste have decreased significantly in recent years, from almost 663,000 metric tons in 1999 to approximately 423,000 metric tons in 2002.¹⁹ During 1999-2000, Canada's hazardous waste exports increased from 268,000 metric tons to 324,000 metric tons.²⁰ The United States dominates Canadian trade in hazardous waste, having accounted for more than 97 percent of imports and 96 percent of exports in 2000. More than 99 percent of all waste imported for disposal in Canada was destined for Ontario and Quebec.

Anecdotal information suggests that Canada purchases a significant amount of solid and hazardous waste services from Canadian-based affiliates of foreign-owned firms, particularly U.S. firms. As stated previously, Canadian affiliates of U.S. firms such as Waste Management Inc. and Laidlaw are top providers of solid waste services in Canada, while Canadian affiliates of U.S. firms such as Safety-Kleen, Philip Services, and Clean Harbors are top hazardous waste services providers. For example, Waste Management Inc.'s affiliate, Canadian Waste Services, provides solid waste services to 4 million residential and 150,000 commercial and industrial customers in Canada; Clean Harbors conducts hazardous waste operations in six Canadian provinces, including at two commercial landfills and two incineration plants.²¹ The French firm Onyx also provides solid and hazardous waste services through Canadian affiliates. In 2003, a Canadian solid waste services company, Capital Environmental Resources Inc., acquired collection, landfill, and transfer station properties in Arizona.

There are no significant barriers to investment in the Canadian waste management market. Canada has made specific and full commitments on solid and hazardous waste services under the GATS. However, transboundary movement of solid and hazardous waste has historically been a controversial and litigious issue for Canada. In 2002, a NAFTA dispute settlement tribunal awarded \$6 million plus interest to S. D. Myers Inc. (U.S.) in a suit filed by the firm in 1998 against Canada for banning the exportation of PCB waste from Canada to the firm's U.S. facility for treatment or destruction.²² The case has stimulated discussion as to ramifications for future

¹⁸ Industry representative, telephone interview by USITC staff, Aug. 2003.

¹⁹ Statistics Canada; and "15 Percent Decline in Imports of Hazardous Wastes and Hazardous Recyclable Materials in 2002," Canada News Wire, Aug. 20, 2002, found at Internet address <http://www.newswire.ca/>, retrieved Aug. 22, 2003.

²⁰ Statistics Canada, "Waste Management Industry Survey 2000."

²¹ Clean Harbors, Inc., annual report on Form 10-K, year ended Dec. 31, 2002.

²² The Canadian Government has asked Canada's Federal Court to set aside the tribunal's decision on grounds that in certain respects the tribunal exceeded its authority and disregarded Canada's public policy. Government of Canada, Department of Foreign Affairs and

disputes in which the NAFTA's commercial and environmental provisions come into conflict.²³

Mexico

Market Overview

In 2000, Mexico generated at least 31 million metric tons of solid waste, of which households accounted for about 84 percent (table 4-2).²⁴ By weight, organic material was the principal component of the solid waste stream (52 percent), followed by paper and paperboard (14 percent), plastics and glass (10 percent), textiles and other waste (20 percent), and metals (3 percent). Most private-sector sources estimate that between 6 and 11 million metric tons of hazardous waste are produced each year in Mexico,²⁵ while the Mexican Government estimated that hazardous waste generation was close to 8 million metric tons in 1997.²⁶ There are likely over 100,000 manufacturing companies and millions of other entities, including households, that generate hazardous waste in Mexico.²⁷

Discrete data on the size of the Mexican solid and hazardous waste services market are not available. It is estimated that in 2001, the combined market for solid waste equipment and services totaled \$505 million dollars, while the market for hazardous waste equipment and services totaled \$210 million.²⁸ It is estimated that \$1.7 billion of new investment is needed annually to develop and construct the infrastructure

International Trade, "Dispute Settlement: NAFTA - Chapter 11 - Investment: Cases Filed Against the Government of Canada," found at Internet address <http://www.dfait-maeci.gc.ca/tna-nac/SDM-en.asp/>, retrieved Aug. 8, 2003.

²³ Brian Trevor Hodges, "Where the Grass is Always Greener: Foreign Investor Actions Against Environmental Regulations Under NAFTA's Chapter 11, S.D. Myers, Inc. v. Canada," *Georgetown International Environmental Law Review*, winter 2001, LexisNexis Academic, found at Internet address <http://80-web.lexis-nexis.com/>, retrieved Aug. 8, 2003.

²⁴ Organization for Economic Cooperation and Development (OECD), Environmental Directorate, *OECD Environmental Data: Compendium 2002*, found at Internet address <http://www.oecd.org/>, retrieved Aug. 7, 2003.

²⁵ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

²⁶ In an effort to better control hazardous waste, Mexico's National Institute of Ecology (INE) has undertaken an effort to register all companies generating hazardous waste. Registered firms must report their production of hazardous waste and demonstrate their compliance with proper disposal techniques. As of May 2000, INE registered 27,820 companies as hazardous waste generators. These companies reported generating just over 4 million tons of hazardous waste per year. INE estimates that this represents about 40 percent of the total market.

²⁷ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

²⁸ *Ibid.*

Table 4-2
Selected characteristics of the Mexican solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Waste generation/treatment	Mexico generated at least 31 million metric tons of solid waste in 2000, ¹ most of which was reportedly managed. ²	Mexico generated 6 to 11 million metric tons of hazardous waste in 2000, about one-quarter of which was professionally managed. ³
Market size (2001)	The combined market for solid waste equipment and services totaled \$505 million. ³	The combined market for hazardous waste equipment and services totaled \$210 million ³ and comprised 873 firms. ⁴
Trade (2000)	(⁵)	Available data reflect the volume of Mexican waste that is transferred to foreign markets for treatment and disposal (exports) and the volume of foreign waste that is sent to Mexico for treatment and disposal (imports): exports- 97,000 tons; imports- 276,000 tons. ¹
Nature of industry	Highly fragmented; collection and disposal services are predominantly provided free of charge by municipal governments, with limited private participation. ³	Rapid expansion in numbers of firms authorized to provide services, especially treatment services. ⁶ Bio-hazardous waste treatment segment is more developed than other segments of hazardous waste management. ³ Imports of hazardous wastes into Mexico are permitted only for recycling. ²
Key market participants (and location of parent)	Mexican-owned firms. ²	Mexican-owned firms, primarily. ² Cement manufacturers are leading providers of hazardous waste management services. ⁷ Foreign participation to date has been largely technical assistance, with attempts at operation or ownership of industry infrastructure having been largely unsuccessful, ³ except in the medical waste services segment, where Stericycle (U.S.) has established a presence. ⁸

See footnotes at end of table.

Table 4-2—continued
Selected characteristics of the Mexican solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Principal methods of waste treatment and disposal	Landfills; waste recycling is very limited, and waste-to-energy in pilot stage. ²	One-fifth of total capacity to manage hazardous waste is provided through burning waste in cement kilns. ⁷ Incineration has grown rapidly in recent years, and recycling has also increased. For medical waste treatment, sterilization predominates. ^{3,8} Confinement and treatment infrastructure for hazardous waste management is sparse. ³
Key legislation	General Law of Ecological Balance and Environmental Protection. ⁹	
Regulatory authorities	SEMARNAT ¹⁰	
GATS commitments	Mexico has scheduled no commitments on refuse disposal services.	
Other measures affecting trade and investment	North American Agreement on Environmental Cooperation; ¹¹ La Paz Agreement; ¹² Basel Convention. ¹³	

¹ Organization for Economic Cooperation and Development (OECD), Environmental Directorate, OECD Environmental Data: Compendium 2002, found at Internet address <http://www.oecd.org/>.

² Interviews by Commission staff with U.S. and Mexican Government and Mexican industry representatives, Mexico City, Mexico, June 9-10, 2003.

³ U.S. Department of Commerce, International Trade Administration, *Mexico Environmental Technologies Export Market Plan*, Dec. 2001.

⁴ Carlos Muñoz Villarreal, "Mexico: Identifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services," paper prepared for the North American Commission on Environmental Cooperation and the OECD Joint Working Party on Trade and Environment, July 2003.

⁵ Not available.

⁶ Texas Center for Policy Studies, *The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990-2000*, May 2001.

⁷ Marisa Jacott, Cyrus Reed, Amy Taylor, and Mark Winfield, "Energy Use in the Cement Industry in North America: Emissions, Waste Generation and Pollution Control, 1990-2001," paper for the Commission for Environmental Cooperation, Second North American Symposium on Assessing the Environmental Effects on Trade, May 30, 2003, found at Internet address <http://www.texascenter.org/>.

⁸ Stericycle, Inc., annual 10-K reports.

⁹ Mexico's basic environmental law, published in the Federal Official Gazette on Jan. 28, 1988, may be found, in English, at Internet address http://www.semarnat.gob.mx/dgeia/web_ingles/.

¹⁰ Secretariat of Environment and Natural Resources. For information, see Internet address http://www.semarnat.gob.mx/dgeia/web_ingles/what_is_semarnat.shtml.

¹¹ This agreement, which is the environmental side agreement to the NAFTA, entered into force on Jan. 1, 1994. For information, see Internet address http://www.naaec.gc.ca/eng/index_e.htm.

¹² Annex III to the Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area: Agreement of Cooperation Between the United States of America and the United Mexican States Regarding the Transboundary Shipments of Hazardous Wastes and Hazardous Substances ("La Paz Agreement"), Nov. 12, 1986.

¹³ In February 1991, Mexico ratified the Basel Convention. For more information, see Internet address <http://www.basel.int/ratif/ratif.html#basel>.

Note: Data on market size in Mexico reflect estimates for equipment and waste management services combined.

opted for private participation in waste management.²⁹ The Mexican market for solid waste services is also characterized by significant informal sector participation.

It is estimated that 84 percent of the population in Mexico is served by municipal waste services.³⁰ The rate of collection surpasses 90 percent in metropolitan areas, but is estimated at 70 percent or less in small cities, towns, and rural areas. The share of solid waste that is professionally disposed of is estimated at more than 80 percent in metropolitan areas but falls below 50 percent elsewhere, especially outside of medium-sized cities. In 2000, about 98 percent of the managed solid waste stream was disposed of in landfills and the remainder was recycled.³¹ Currently, landfill capacity is inadequate to handle the solid waste generated in Mexico, and most existing landfills are open-air facilities that do not incorporate the latest technologies.³² Landfills are nearing capacity, especially in large cities. Market observers state that possible future closure of these facilities and the contracting of new sites, if realized, could promote greater consumer consciousness regarding recycling and reuse.³³ The city of Monterrey is in the process of tendering a landfill project that would include a gas-to-energy component. If successful, this project may be replicated in other large cities, including Guadalajara and Mexico City.³⁴ Managed incineration and waste-to-energy technology are used to manage only a negligible amount of solid waste in Mexico. Currently, solid waste in Mexico is used to produce about 11 megawatts of electrical capacity and hybrid fuel-oil/agricultural waste is used to produce about 400 megawatts of energy.³⁵ Minimal use of solid waste and agricultural waste as alternative fuels for electricity production is expected to continue indefinitely.

In 2002, 873 companies were authorized to provide hazardous waste services in Mexico.³⁶ Of these, 411 companies are authorized for collection and transportation. Additional authorized suppliers of hazardous waste services provide recycling services (167 firms), temporary storage (124 firms), treatment (114 firms), incineration³⁷ (44 firms), reuse (9 firms), and confinement (1 firm).³⁸ The number of

²⁹ U.S. Department of Commerce, "Mexico Environmental Technologies Export Market Plan," p. 30. Cities listed as of December 2001 are Aqua Prieta, Cancun, Leon, Los Cabos, Los Mochis, Merida, Monterrey, Nuevo Laredo, Piedras Negras, Puebla, Queretaro, Reynosa, Tijuana, Tlalnepantla, and Torreón.

³⁰ OECD, Environmental Directorate, *OECD Environmental Data: Compendium 2002*.

³¹ In 2000, about 8 percent of solid waste collected in large Mexican cities was recycled. Most households and businesses in Mexico reportedly do not separate wastes for recycling. U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

³² U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

³³ *Ibid.*

³⁴ *Ibid.*

³⁵ U.S. Department of State, "Alternative Energy Use in Mexico," message reference No. 05989, prepared by U.S. Embassy, Mexico City, July 21, 2003.

³⁶ Carlos Muñoz Villarreal, "Mexico: Identifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services," July 2003.

³⁷ Includes industrial waste used as alternative fuel, and biologic-infectious waste.

³⁸ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

companies authorized to provide such services increased by 32 percent during 2000-2002,³⁹ with particularly rapid growth in the number of firms providing treatment services.

Approximately 26 percent of the hazardous waste stream in Mexico receives professionally managed handling, treatment, disposal, or confinement. Hazardous waste management is limited primarily owing to a lack of dedicated modern facilities.⁴⁰ Most hazardous waste is incinerated or treated, although hazardous waste recycling capacity, including the ability to convert waste to energy, has increased greatly, from approximately 500,000 metric tons in 1995 to 2.5 million metric tons in 2000. Mexico's cement industry burns hazardous and other industrial wastes in cement kilns as an inexpensive, alternate fuel source, and earns revenue as a waste manager when burning waste supplied by external sources.⁴¹ Such cement kilns represent about one-half of the total capacity to recycle⁴² hazardous wastes and about one-fifth of total capacity to manage hazardous waste in Mexico. The biohazardous waste treatment segment is more highly developed than other hazardous waste services segments in Mexico, and capacity outstrips demand in most parts of the country.⁴³ The main reason for this excess capacity is significant overestimation of the need for these services. Collected biohazardous waste is treated through sterilization (39 percent), incineration (27 percent), the use of radio waves (25 percent), and chemical treatment processes (9 percent).⁴⁴

When the Fox administration took office in 2000, one of its first actions was the reorganization of the regulatory structure governing environmental services. Under this new structure, the Secretariat of the Environment and Natural Resources

³⁹ USITC staff calculation based on data reported in U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001 and Carlos Muñoz Villarreal, "Mexico: Identifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services," July 2003.

⁴⁰ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

⁴¹ Marisa Jacott, Cyrus Reed, Amy Taylor, and Mark Winfield, "Energy Use in the Cement Industry in North America: Emissions, Waste Generation and Pollution Control, 1990-2001," paper for the Commission for Environmental Cooperation, Second North American Symposium on Assessing the Environmental Effects of Trade, May 30, 2003, found at Internet address <http://www.texascenter.org/>, retrieved Dec. 4, 2003.

⁴² According to the Mexican definition classifying waste management methods, the burning of waste in cement kilns is considered recycling rather than incineration with energy recovery.

⁴³ Biohazardous waste disposal facilities in Central Mexico are working below capacity, and some have closed or moved.

⁴⁴ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

(SEMARNAT) is the lead agency for nearly all environmental services,⁴⁵ including solid and hazardous waste services. The General Law of Ecological Balance and Environmental Protection is the primary piece of legislation governing solid and hazardous waste services in Mexico. This legislation, first enacted in 1988 and revised in 1996, provides a general framework for biodiversity protection, assessment of environmental risks and impacts, stewardship of natural resources, and prevention and control of pollution. Regulations are derived from the authority provided by this act and codified as either mandatory regulations or voluntary regulations. The pace of issuing federal regulations on waste management has increased substantially in recent years. As of early 2003, 25 hazardous waste regulations had been enacted or drafted, up from 8 such regulations in 2000.⁴⁶ Mexico's environmental law is similar in some respects to the RCRA in the United States, as both provide for a "cradle-to-grave" approach to regulating hazardous waste, although the two countries' laws differ somewhat as to the constituent elements of hazardous waste, and Mexico has only begun to implement its hazardous waste management requirements.⁴⁷ The federal government plays a limited role in regulating the provision of solid waste management services in Mexico, as such authority almost exclusively resides at the state and municipal government level.⁴⁸ Primarily, federal environmental authorities provide technical support and capacity-building assistance to municipalities, and coordinate with local governments seeking regional solutions where feasible.⁴⁹

The Government of Mexico has established goals to decentralize authority over hazardous waste regulation. However, federal regulations continue to predominate and evolve with regard to hazardous waste services. For example, new hazardous waste regulations require analysis of the hazardous properties of specific wastes. Recent amendments to the main Mexican environmental law include creation of a mandatory pollution release and transfer registry similar to the toxic release inventory required in the United States.⁵⁰ The amendments are likely to improve public access to important information concerning the impact of current and prospective waste management operations. Additionally, in December 2002, the Federal Government approved and published a new standard establishing maximum permissible emissions

⁴⁵ This restructuring shifted the regulatory and governance responsibilities of the Instituto Nacional de Ecología (INE, National Institute of Ecology), to SEMARNAT, and recast INE as a research center under SEMARNAT's jurisdiction. PROFEPA was also brought under the umbrella of SEMARNAT, and now focuses exclusively on inspections.

⁴⁶ Current list of regulations available at www.hazmat.dot.gov/nomslst.htm/.

⁴⁷ Leon Trakman, Nick Ranieri, and Lic. Marlon Omar Lopez Zapata, ed., *Doing Business in Mexico*, vol. 2 (New York: Transnational Publishers, Inc., 2002). pp. 1-15 and 1-16.

⁴⁸ An important exception is federal regulation NOM-083-ECOL-1996, which outlines the requirements for locations where final disposal facilities may be built. The regulation sets rules governing characteristics of the soil and minimum distances of the proposed facility from underground aquifers and populated areas.

⁴⁹ Mexican Government representative, interview by USITC staff, Mexico City, Mexico, June 9, 2003.

⁵⁰ Under the amendment, waste management facilities and manufacturing firms must report toxic releases, air emission, hazardous waste generation, and wastewater discharges to a publicly available database, unlike the prior system that relied on voluntary reporting and was deemed incomplete. Marisa Jacott, et. al., "Energy Use in the Cement Industry in North America: Emissions, Waste Generation and Pollution Control, 1990-2001."

for the cement industry, including those firms that burn hazardous waste.⁵¹ Nevertheless, industry representatives have noted concerns regarding omissions and inconsistencies in hazardous waste legislation and regulations, such as inadequate definitions of hazardous waste.⁵²

Although environmental awareness is gradually developing in Mexico, several factors continue to hamper Mexican demand for waste services. For example, Mexico's weak economic performance in the last few years and high interest rates on bank loans⁵³ are believed to have significantly discouraged investment.⁵⁴ Waste collection and disposal services have historically been provided at no cost to citizens, so municipalities are reluctant to institute a fee, and citizens are frequently unwilling to pay, for these services, presenting a significant impediment to financing the provision of high-quality waste services.⁵⁵ Municipalities often are unable to finance environmental feasibility studies, which undermines progress toward developing waste management projects. Additionally, the high turnover of technical experts administering environmental regulatory affairs at the municipal level makes long-term planning and project flow difficult.⁵⁶

By contrast, demand for waste management services has been encouraged by the availability of financing from the U.S. Export-Import Bank and international development banks. For example, in 2002, the U.S. Export-Import Bank announced a \$100-million line of credit to Mexican public works bank BANOBRAS, which identified 80 potential municipal projects, including some in solid waste studies. Additional resources are available through the North American Development Bank (NADBank), created under the NAFTA, which provides loans and loan guarantees to public and private sector environmental projects, the Inter-American Development Bank, the World Bank, and other sources.⁵⁷

Trade and Investment

Data specific to trade and investment in the Mexican solid and hazardous waste services industry are not available. Nevertheless, related data and anecdotal observations suggest that such services trade, which takes place almost exclusively with the United States, is increasing. The Mexican Government estimated that

⁵¹ The new Mexican emission standards are regarded as comparable to those established by EPA in the United States for portland cement plants, although proposed EU standards are considered more stringent. Marisa Jacott, et. al., "Energy Use in the Cement Industry in North America: Emissions, Waste Generation and Pollution Control, 1990-2001."

⁵² Industry association representative, interview by USITC staff, Mexico City, Mexico, June 10, 2003; and Carlos Muñoz Villarreal, "Mexico: Identifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services," July 2003.

⁵³ Loan rates offered by the North American Development Bank (NADB) are as high as commercial rates.

⁵⁴ Industry representative, interview by USITC staff, Mexico City, Mexico, June 10, 2003.

⁵⁵ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

⁵⁶ High-level environmental experts are replaced whenever a new mayor enters office. Mayoral elections are held every 3 years.

⁵⁷ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

approximately 276,000 metric tons of hazardous waste were imported by Mexico in 2000, while about 97,000 metric tons were exported.⁵⁸ The majority of Mexico's hazardous waste imports were reportedly for the recycling of electric arc dust containing zinc and other metals.⁵⁹ Hazardous waste exports from Mexico reflected maquiladora plants in Mexico returning wastes generated at the plants to the country of origin, and non-maquiladora entities exporting hazardous waste that could not be managed in Mexico to the United States, in part owing to insufficient waste management capacity.⁶⁰

The volume of hazardous waste being transported between the United States and Mexico, and thus U.S.-Mexican trade in hazardous waste services, is likely affected by special NAFTA and non-NAFTA regulations, which apply in the border region of the two countries. For example, maquiladora plants operated by or for a U.S. firm, and producing goods with predominantly U.S. content, are obligated to export hazardous waste to the United States for treatment or disposal. Since NAFTA was signed, enforcement of these regulations on both sides of the border has been strengthened significantly, especially through HAZTRAKS, a consultative mechanism to facilitate information exchanges and the monitoring of hazardous waste within a 100-kilometer radius of the U.S.-Mexican border.

Available information in the absence of official statistics suggests that few U.S. solid waste management firms, with the exception of Waste Management Inc., operate in the Mexican solid waste services market. Several U.S. firms, including Clean Harbors and Stericycle, operate in the Mexican hazardous waste services market. Aside from a few Mexican firms involved in transporting waste to the United States for management, Mexican waste management firms are not known to operate in the U.S. market. It is likely that Mexican firms would be positioned to participate in the development of waste management capacity in other Latin American markets, as envisioned by Mexican Government environmental officials, drawing on expertise and experience gained in transboundary waste management circumstances between the United States and Mexico.

Mexico made no specific commitments on environmental services under the GATS. Moreover, inconsistency and insufficient transparency in the federal, state, and municipal regulation of hazardous waste management have heightened the perception of potential risk among foreign investors.⁶¹ For example, the U.S.-based firm Metalclad made a multimillion-dollar investment to build a hazardous waste landfill in Mexico, obtaining all required federal licences and permits.⁶² However, after the plant was completed, the state government invoked its authority to designate the plant site as an ecological preserve and the local government refused to grant a land use

⁵⁸ OECD, *OECD Environmental Data: Compendium 2002*.

⁵⁹ Marisa Jacott, Cyrus Reed, and Mark Winfield, "The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990-2000," Texas Center for Policy Studies, report, May 2001, found at Internet address <http://www.texascenter.org/>.

⁶⁰ Ibid.

⁶¹ U.S. Department of Commerce, International Trade Administration, "Mexico Environmental Technologies Export Market Plan," Dec. 2001.

⁶² Jan Gilbreath and Janine Ferretti, "Mixing Environment and Trade Policies under NAFTA," unpublished paper.

permit, preventing the plant from opening.⁶³ Arguing successfully before an arbitration panel that the Mexican state's action amounted to expropriation, Metalclad was awarded the right to compensation under the investor-protection measures found in Chapter 11 of the NAFTA. Additionally, Chemical Waste Management (U.S.) built a \$32- million incineration facility in Tijuana, but the facility was closed following the Mexican federal government's decision not to allow any hazardous waste incineration in Tijuana.

Future Prospects

The Commission for Environmental Cooperation (CEC), the environmental forum created under the NAFTA, is facilitating efforts among NAFTA partners to move toward greater harmonization of environmental regulations across North America and to increase information exchanges and capacity-building interaction in the environmental markets. The CEC is in the process of creating a simpler system to track the transfer of hazardous waste across borders and ensure timely permitting. Industry sources have indicated that early efforts have significantly improved the process.

In Canada, a focus on implementation of the Kyoto Protocol will likely subsume most federal environmental legislation in the near future, including legislation regarding solid and hazardous waste services. In addition, Canadian waste legislation likely will be affected by efforts to create a separate regulatory structure for the recycling industry, autonomous from the current solid and hazardous waste regulations.⁶⁴ Although representatives from the Canadian Association of Recycling Industries (CARI) predict that this process may take 7 to 10 years, CCME has issued separate definitions for the recycling and waste industries, thus laying the groundwork for eventual separation.⁶⁵

The development of Mexico's waste management services market will likely be affected by a number of factors. Waste streams, especially for hazardous waste, appear to be increasing and are likely much more extensive than publicly reported.⁶⁶ Such growth places urgency on the adoption of upgraded waste management technologies, on changes in public attitudes and behavior toward waste management, and on tapping unprecedented levels of new funding to build capacity in waste management expertise and infrastructure.⁶⁷ Industry sources indicate that opportunities for public-private partnerships in the development of new waste management projects will likely increase, with the newly created Commission for

⁶³ "Hazardous Waste Incineration and Combustion: A Tabasco Case Study," Texas Center for Policy Studies, English summary document, Oct. 2002, found at Internet address <http://www.texascenter.org/>, retrieved Aug. 7, 2003.

⁶⁴ Industry representative, telephone interview by USITC staff, Aug. 18, 2003.

⁶⁵ Ibid.

⁶⁶ Mexican industry and government officials, interviews by USITC staff, Mexico City, Mexico, June 9-10, 2003.

⁶⁷ Carlos Muñoz Villarreal, "Mexico: Identifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services," July 2003.

Environmental Infrastructure⁶⁸ engaged in collaborative efforts. Large multinational firms in Mexico are in the process of developing controls on waste generation in an effort to reduce operating costs, although the trend has yet to engage small and mid-size firms. Significant growth in the hazardous waste management market is likely, depending on the pace of regulatory developments and the creation of effective enforcement capabilities.

⁶⁸ This consultative body includes representatives from the private, public, and social sectors in Mexico.

CHAPTER 5

EUROPE

Introduction

Europe is home to several of the largest solid and hazardous waste service companies in the world. Non-European firms currently are not active in the market, most notably because the largest U.S. firms have withdrawn from the European market in recent years.¹ European companies, however, continue to operate worldwide, competing with, and at times, operating jointly with other European companies. The European Union (EU) is the largest market within Europe, and one of the world's largest markets for solid and hazardous waste services. The EU is also the world's largest exporter of environmental services, with most of those exports destined for the United States.

Broadly speaking, the European market for solid and hazardous waste services can be divided between EU countries and non-EU countries. EU countries reportedly have more rigorous environmental standards and devote more resources to enforcing those standards.² EU environmental priorities³ include taking measures to reduce waste generation associated with economic activity, so that increased prosperity will not lead to increased waste. Many of the non-EU countries are currently in the process of acceding to the EU, which requires them to acclimate their environmental policies and legislation to that of the EU. This has served to create opportunities for many EU waste services firms,⁴ as technology and resources are often limited in non-EU countries.⁵

This chapter includes a brief overview of the European market for waste management services, and presents specific information on the solid and hazardous waste markets

¹ For more information regarding the participation and withdrawal of U.S. waste management firms in foreign markets, see chapter 3.

² Government officials and industry representatives, interviews by USITC staff, Prague, Czech Republic, Brussels, Belgium, and Paris, France, Oct. 24 - Nov. 4, 2003.

³ EU-wide waste treatment strategies are proportioned as follows: land filling, 57 percent; incineration, 16 percent; recycling, 13 percent. In most EU member states, the average land filling costs for nonhazardous wastes are below the costs of incineration. Consequently, in practice, market mechanisms do not conform to the EC's optimal waste management strategy. European Environmental Agency (EEA), *Environmental Signals 2002*, found at Internet address <http://eea.eu.int/>, retrieved Dec. 9, 2003.

⁴ Industry representatives, interviews by USITC staff, Prague, Czech Republic, Oct. 24 and 27, 2003.

⁵ EU-acceding countries have replaced South East Asia as the second largest export market for European environmental services firms. *The EU Eco-Industry's Export Potential*, final report to Director General XI of the European Commission, Sept. 1999, found at Internet address http://www.europa.eu.int/comm/environment/enveco/industry_employment/eco.pdf, retrieved Dec. 9, 2003.

of the EU and the Czech Republic, an aspirant to the European Union⁶ and one of the more-developed solid and hazardous waste markets in Eastern Europe.

Regional Market Overview

The European market for solid and hazardous waste services is the second largest in the world, having accounted for \$41.2 billion, or 31.0 percent of the global market for such services in 2000. The vast majority of the European waste services market is concentrated in Western Europe (\$39.3 billion). Western Europe accounted for 29 percent of the global market for solid waste management services in 2000, and for 34 percent of the global market for hazardous waste management services.⁷ By comparison, Eastern Europe accounted for approximately 1 percent and 2 percent of the global solid and hazardous waste management markets, respectively.

Public sentiment among European countries generally favors increased environmental protection.⁸ As a result, the pace of national environmental initiatives and public and private environmental spending is increasing, although enforcement reportedly varies among countries.⁹ Individual EU Member states develop their own environmental initiatives, but the EU authorities in Brussels set overall environmental policy through EU-wide directives, standards, norms, and goals. However, implementation of the EU rules is the responsibility of individual member states, so processes and procedures may vary from one country to another.¹⁰ Most of the countries of Central and Eastern Europe (CEE) have reportedly enacted less extensive environmental protection measures, although this is likely due to a lack of capital or appropriate technology.¹¹ However, some of these countries have made efforts to conform to EU directives on the environment in preparation for accession to the Community. The Czech Republic, for example, has adopted several laws specifically for the purpose of conforming with EU environmental directives and requirements.

⁶ Countries who are working towards membership in the EU include Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Malta, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. The EU is scheduled to expand from 15 to 25 member states in May 2004.

⁷ Environmental Business International Inc. (EBI), *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

⁸ Government officials, interviews by USITC staff, Brussels, Belgium, Oct. 30-31, 2003.

⁹ Industry representative, interview by USITC staff, Brussels, Belgium, Oct. 31, 2003.

¹⁰ Government official, interview by USITC staff, Paris, France, Nov. 3, 2003.

¹¹ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003. Hisashi Ogawa, *Sustainable Solid Waste Management in Developing Countries*, presentation at the 7th International Solid Waste Association (ISWA) International Congress and Exhibition, Oct. 1996.

European Union¹²

Market Overview

As a group, the 15 Member countries of the EU¹³ generated approximately 1.4 billion metric tons of solid and hazardous waste annually during the late 1990s (table 5-1).¹⁴ Current estimates of annual waste generation range as high as 3 billion metric tons. Within the EU, the largest producers of waste are Germany, the United Kingdom, France, Italy, Spain, and the Netherlands.¹⁵ Along sectoral lines, agriculture, manufacturing, construction, and mining accounted for the bulk of waste generation. OECD/Eurostat data indicate that overall waste generation in the EU increased by 10 percent per year during the late 1990s,¹⁶ despite efforts to minimize such generation.¹⁷ The increase may be explained by a direct relationship between economic growth and waste generation, but also by increased activity in other environmental sectors, such as wastewater purification and flue gas cleaning, that generate additional solid wastes.

Landfilling is the most prominent disposal method, especially in southern EU Member states, usually owing to its relatively low cost.¹⁸ Incineration, including waste-to-energy activities, is also a common method of waste disposal in the EU, despite slow public acceptance. Stronger emission controls are being employed on

¹² In terms of data collection and analysis, the EU should be considered as 15 markets with unique characteristics, rather than as a single, homogeneous regional market. Aggregate information on the European environmental services industry is also difficult to compile as countries generally do not share common definitions, terminology, or classifications. Reporting systems and formats are not harmonized among countries, and at times, even within countries. Solid waste market information, for instance, originates most often at the local level, where management policies are defined and implemented, leading to differences from region to region. Hazardous waste statistics, trade data, and market information all face similarly inherent limitations. For example, countries and regions with data for both 1990 and 1995 show an apparent increase (on average more than 60 percent) in hazardous waste quantities, but this is mainly due to changed definitions and new legislation. Also, there are considerable unexplained differences between hazardous waste generation and treatment figures. Consequently, data available at the country level are difficult to compare and data at the EU-level should be viewed as estimates.

¹³ The Member states of the EU are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

¹⁴ The data presented in table 5-1 are an approximation of EU total waste generation, as the available data are not based on a single common year. The data represent the latest year for which country statistics are available, and as a result, the EU total is inherently imprecise. EEA, *Environmental Signals 2002*.

¹⁵ MEA, *Environmental Signals 2002*.

¹⁶ European Commission, *EU Focus on Waste Management*, Luxembourg: 1999.

¹⁷ The EC's goal of stabilizing municipal waste generation in the EU at 1985 levels by 2000 was not met, and was significantly exceeded in almost all countries. European Environmental Agency (EEA), *Environmental Assessment Report 2003*.

¹⁸ Landfilling is generally the least expensive disposal option, even after the introduction of landfill taxes in some European countries. EEA, *Europe's Environment - the Second Assessment*, Office for Official Publications of the European Communities, 2001.

Table 5-1
Selected characteristics of the European Union (EU) market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	Approximately 2.2 billion metric tons per year in Western Europe during 1998-2001, the majority of which was treated. ¹	47 million metric tons per year in Western Europe during 1997-2001, virtually all of which was managed. ¹
Market size (2000)	\$33.4 billion (total for all Western European countries). ²	\$5.9 billion (total for all Western European countries). ²
Trade (2000)	Net exporter in waste services. ³	Net exporter in waste services. ³
Nature of industry	Competitive, provided more by private sector, with public sector declining in market share. ³	Competitive, provided by private sector to a greater degree, relative to solid waste. ³
Key market participants (and location of parent)	Veolia Environment (Onyx-France), Suez (SITA-France), Rethmann Entsorgung (Germany), RWE Entsorgung AG (Germany), Noell Gonlbk (Germany). ³	Veolia Environment (Onyx-France), Suez (SITA-France, Teris, France). ³
Principal methods of waste treatment and disposal	Land filling is the dominant waste disposal method. Minority shares are split between incineration and recovery (recycling). ^{1, 3}	Land filling, physico/chemical and biological treatment (stabilization), and incineration. ¹
Key European Community legislation	Council Directive 91/156/EEC on Solid Waste; Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC); Council Directive 99/31/EC on Landfill of Waste; Directive 94/62/EC on Packaging Waste. ⁴	Council Directive 91/689/EEC on Hazardous Waste; Council Directive 94/67/EC on Hazardous Waste Incineration. ¹
Regulatory authorities	European Commission; national and subnational authorities. ⁴	

See footnotes at end of table.

Table 5-1—continued

Selected characteristics of the European Union (EU) market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
GATS commitments	The European Union has scheduled full commitments on the provision of refuse disposal services through consumption abroad (mode 2) and commercial presence (mode 3). No commitments have been undertaken in the provision of such services through cross-border supply (mode 1), due to technical infeasibility. ⁵	
Other measures affecting trade and investment	(6)	Basel Convention; ⁷ Rotterdam Convention. ⁸

¹ European Commission/Eurostat, *Waste Generated and Treated in Europe*, Office for Official Publications of the European Communities, Luxembourg, 2003, pp. 6, 26, 29-31, and 39.

² Environmental Business International, Inc., data e-mailed to the Commission.

³ Industry and government representatives, interviews by USITC staff, Brussels, Belgium, Oct. 30-31, 2003, and Paris, France, Nov. 3-4, 2003.

⁴ Found at Internet address <http://europa.eu.int/comm/environment>.

⁵ General Agreement on Trade in Services (GATS), *European Union: Schedule of Specific Commitments*, GATS/SC/31, Apr. 1994.

⁶ Not available.

⁷ European Commission/Eurostat, *Waste Generated and Treated in Europe*, Office for Official Publications of the European Communities, Luxembourg, 2003, p. 41. For more information see Internet address <http://www.basel.int>.

⁸ The EC approved the convention on Dec. 20, 2002. For information, see Internet address <http://www.pic.int>.

incinerators, such as in France where nonconforming incinerators will be taken out of service within the next year.¹⁹ However, composting, recycling, and waste minimization are the preferred modes of management for solid waste, especially in most northern EU Member countries, which have implemented specific regulations in an effort to encourage the use of these waste management techniques.²⁰ The use of recycling incentives (such as waste taxes) is increasing in Member states, but is not yet fully integrated into waste management strategies. Recycling issues are likely to become increasingly prominent in Europe with the introduction of policies for life cycle management of certain products (e.g., tires, batteries, and certain chemicals), which will make manufacturers responsible for the ultimate disposition of the products that they produce.²¹

¹⁹ Government representative, interview by USITC staff, Paris, France, Nov. 3, 2003.

²⁰ Government official, interview by USITC staff, Brussels, Belgium, Oct. 30, 2003.

²¹ Government official, telephone interview with USITC staff, Washington, DC, Oct. 1, 2003.

Eurostat estimates that the EU generated approximately 27 million metric tons of hazardous waste annually in the mid-1990s.²² Although hazardous waste generally accounts for less than 5 percent of all waste generated in Europe, the sector garners special attention owing to the significant risks that such wastes pose to the environment and human health. Principal management methods for hazardous waste include landfilling²³ (which often includes stabilization prior to disposal) and incineration. In addition, several EU Member states report hazardous waste recovery²⁴ rates in excess of 40 percent.²⁵

EU firms rank among the world's leading providers of solid and hazardous waste services and face virtually no competition from non-EU firms within their own market. The leading companies currently active in the EU waste management market include the waste divisions of the French companies Veolia Environment and Suez Lyonnaise des Eaux (Sita and Teris), and German firms RWE and Rethmann. Veolia Environment (formerly Vivendi Environment) is a recognized world leader in water and waste management.²⁶ Onyx, an affiliate of Veolia, is a market leader in waste management in Europe with diversified operations in all sectors of waste management, including waste collection, sorting, treatment, and landfill. In recent years, the European waste management industry has been consolidating through mergers and acquisitions. Germany is the only EU Member state in which one provider- RWE- dominates the country's entire waste management system.²⁷

The EU is a world leader in the development and implementation of laws, policies, and regulations regarding environmental protection, as the EU's high population density and limited land mass have led to a heightened recognition of the need for more effective solutions to the problems of waste treatment and disposal. The Community's 150-plus environmental statutes include some of the world's most stringent environmental standards and regulations.²⁸ Key EU directives affecting the provision of solid and hazardous waste services include the Waste Framework

²² Eurostat, *EU Generating 27 Million Tonnes of Hazardous Waste*, news release, No. 83/99, Aug. 19, 1999. In all of Western Europe, an estimated 47 million metric tons of hazardous waste was generated annually between 1997 and 2001. European Commission / Eurostat, *Waste Generated and Treated in Europe*, Luxembourg: Office for Official Publications of the European Communities, 2003, p. 26.

²³ Landfilling is decreasing in some EU member countries, while increasing significantly in others, making it difficult to generalize about the overall region. European Commission / Eurostat, *Waste Generated and Treated in Europe*, Office for Official Publications of the European Communities, Luxembourg: 2003, p. 30.

²⁴ Hazardous waste recovery methods include separate collection and use as production inputs.

²⁵ Outside the EU, the situation is less clear, but several countries report low management of hazardous waste, as measured by EU standards.

²⁶ EIU Viewswire, "Vivendi exits Vizzavi," Sept. 11, 2002, found at Internet address http://www.viewswire.com/index.asp?layout=display_print&doc_id=208367/, retrieved Oct. 17, 2003.

²⁷ EIU Viewswire, "Recycling firm fined," Feb. 3, 2003, found at Internet address http://www.viewswire.com/index.asp?layout=display_print&doc_id=143092/, retrieved Oct. 17, 2003.

²⁸ EEA, *Europe's Environment: The Third Assessment*, (Luxembourg: Office for Official Publications of the European Communities, 2003).

Directive, as amended,²⁹ the Directive on Hazardous Waste,³⁰ the EU Landfill Directive,³¹ the Directive on Incineration of Waste,³² and the Directive on Packaging Waste.³³ To improve monitoring and compliance, the Council Regulation on Waste Management Statistics, adopted by the EU in November 2002, requires Member states to provide Eurostat with national statistics on the generation, recovery, and disposal of waste beginning in 2004. Numerous EU policies also focus on environmental matters. For example, the Community Waste Management Strategy strives to establish an integrated waste management policy.³⁴ Also, the sixth Environment Action Programme (EAP), which was approved by the Council in July 2002, includes a waste management program that gives priority to waste prevention,³⁵ followed by recycling, waste recovery and incineration, and landfilling. The EAP's target is to achieve a 20-percent reduction in the quantity of waste destined for disposal facilities (based on 2000 levels) by 2010, and a 50-percent reduction by 2050.³⁶

²⁹ Council Directive 75/442/EEC requires Member states to establish an integrated and adequate network of disposal facilities that enables the Community as a whole to become self-sufficient in waste disposal. Further, the network must have capacity such that certain wastes, particularly hazardous waste, may not be generated in one country in quantities that warrant the establishment of a dedicated disposal facility in that country. European Commission, Environment Policies, Waste Disposal, found at Internet address <http://europa.eu.int/scadplus/leg/en/lvb/l21197.htm/>, retrieved Nov. 5, 2003.

³⁰ Council Directive 91/689/EEC covers the management, recovery, and correct disposal of hazardous waste. European Commission, Environment Policies, *Controlled management of hazardous waste*, found at Internet address <http://europa.eu.int/scadplus/leg/en/lvb/l21199.htm/>, retrieved Nov. 5, 2003.

³¹ In the EU Member states and accession countries, compliance with this directive is likely to reduce the potential for environmental pollution from landfills. The directive imposes stringent operational and technical requirements on land filling and requires a reduction in the quantity of various waste streams entering landfills, as well as treatment of waste prior to landfill. Council Directive 1999/31/EC entered into force on July 16, 1999. The deadline for implementation by the Member states was July 16, 2001. European Commission, Environment Policies, *Landfill of Waste*, found at Internet address http://europa.eu.int/comm/environment/waste/landfill_index.html/, retrieved Nov. 5, 2003.

³² Council Directive 2000/76/EC entered into force on Dec. 29, 2000. From Dec. 28, 2002 onward, new incinerators must comply with the provisions of the Directive, while the deadline for existing plants is Dec. 28, 2005. European Commission, Environment Policies, *Waste incineration*, found at Internet address <http://europa.eu.int/comm/environment/wasteinc/index.htm/>, retrieved Nov. 5, 2003.

³³ Numerous directives focus on specialized topics including waste oils, titanium dioxide, batteries, disposal of PCBs and PCTs, end-of-life vehicles, and waste in electric and electronic products.

³⁴ As part of the Commissions overall waste management strategy, several high-priority waste streams have been identified, including packaging, vehicles, batteries, electronic waste, and hazardous household waste. European Commission, *EU Focus on Waste Management*, Luxembourg: 1999.

³⁵ One example of a waste prevention program is the promotion of intelligent product design that reduces the environmental impacts of products from their manufacture to the end of their useful life.

³⁶ European Commission, *Environment 2010: Our Future, Our Choice*, 6th EU Environment Action Programme, 2001-2010, 2001, p. 8.

Trade and Investment

Anecdotal information suggests that the EU is a net exporter of both solid and hazardous waste services. While the home market is likely to remain the primary focus of EU waste management firms, some of the most promising growth opportunities for such firms are in newly industrializing nations. Some overseas expansion by European environmental services firms takes place through “tied-aid”³⁷ provided by the European Community and Member states. Tied-aid may account for as much as 40 percent of the EU’s environmental exports, and is most often applied to aid projects in Southeast Asia, India, Africa, and South America.³⁸ However, the majority of EU environmental exports go to markets where EU tied-aid is not a factor (e.g., the United States), indicating that EU suppliers are competitive in open market conditions. Owing to geographic proximity, EU suppliers are in a particularly good position to capitalize on the expected increase in demand for solid and hazardous waste disposal services in Central and Eastern Europe, as many of these countries prepare for EU accession.³⁹ French companies Onyx, Sita, and Teris, German companies RWE and Rethmann, and smaller firms based in Austria and Germany -- including Asa, Becker, Lobbe, Saubermacher, and Rumpold -- are particularly active in Central and Eastern Europe.

One significant market development was the withdrawal of the U.S. multinationals BFI (now Allied Waste)⁴⁰ and Waste Management, Inc. (WMI) from the EU market and Central Europe. WMI had operations in most major European countries, but by the end of March 2002 had sold all of its European subsidiaries to former rivals. In 1999, WMI announced a shift in its strategic plan and refocused on the North American solid waste management services market.⁴¹ Industry representatives also report that European competitors of the U.S. firms likely gain some measure of competitive advantage from their proximity to clients, as well as from their long-standing business relationships with clients in the region.⁴² Opportunities for U.S.

³⁷ “Tied-aid” is project financing or other assistance to which certain conditions are attached. Recipients of tied-aid are often required to procure goods and services from firms based in the country that provides the aid.

³⁸ *The EU Eco-Industry’s Export Potential*, final report to Director General XI of the European Commission, Sept. 1999, found at Internet address http://www.europa.eu.int/comm/environment/enveco/industry_employment/eco.pdf, retrieved Dec. 9, 2003.

³⁹ For example, prior to accession, a number of European waste management firms are already established in the Czech Republic. Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁴⁰ After the acquisition of BFI by Allied Waste in 1999, the new company continued the divestment program begun by BFI before the merger. BFI sold most of its non-North American operations to Sita in 1998, and in 1999, Allied Waste sold its Sita holdings to Suez Lyonnaise.

⁴¹ Beginning in 1999 and continuing throughout 2000, WMI sold the majority of its international operations. Securities and Exchange Commission (SEC) Form 10_K, Waste Management, Inc., Fiscal Year Ended Dec 31, 2000, found at Internet address <http://www.sec.gov/Archives/edgar/data/823768/000095012901001398/h84376e10-k.txt>, retrieved Oct. 22, 2003.

⁴² Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 27, 2003.

and other firms exist in specialized niches of the European waste management market, such as medical waste services.⁴³

EU member countries seem to maintain few, if any, measures that specifically apply to the foreign provision of solid and hazardous waste services. Further, EU commitments under the General Agreement on Trade in Services (GATS) grant full market access and national treatment for the provision of refuse disposal services through modes 2 and 3.⁴⁴ However, some waste-related provisions may have a particularly significant impact on non-EU waste management firms. For example, EU policy dictates that, within Europe, waste disposal should occur as close as possible to the site of waste generation. EU legislation also prohibits the transport of all waste destined for disposal, as well as hazardous waste destined for recovery, to non-OECD countries.⁴⁵

Czech Republic

Market Overview

Compared to the other acceding countries, the Czech Republic generates a relatively large amount of solid and hazardous waste, especially in the mining, manufacturing, and power industries, and a relatively large share of the waste produced in the country is hazardous. The Czech Republic generated 28.2 million metric tons of waste in 2002, including 1.3 million metric tons of hazardous waste (table 5-2).⁴⁶ The vast majority of generated waste is managed, and expenditures on waste management have increased in recent years.⁴⁷ Landfilling is the most prevalent method of waste disposal, accounting for 70 percent of the annual total, although since August 1, 1996, landfilling has only been permissible in landfills that provide adequate technical measures to prevent environmental pollution. In response to a government policy that aims to discourage the use of hazardous waste landfills through increased landfill disposal fees, Czech industry is minimizing hazardous waste by treating it and converting it to nonhazardous waste, which is cheaper to manage.⁴⁸ Recycling of both solid and hazardous waste is increasing, and financial incentives to encourage the purchase of recycled products are under development.⁴⁹ However, currently, waste is not widely used as a source of secondary inputs or for

⁴³ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 27, 2003.

⁴⁴ General Agreement on Trade in Services (GATS), *European Communities and their Member States: Schedule of Specific Commitments*, GATS/SC/31, Apr. 15, 1994.

⁴⁵ European Commission, *EU Focus on Waste Management*, Luxembourg: 1999.

⁴⁶ New definitions covering some areas of waste and waste services were introduced in 2001, making time series analysis impossible. Czech Statistical Office, 2003.

⁴⁷ In 2002, approximately 57 percent of the hazardous waste generated in the Czech Republic was managed within the country. Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁴⁸ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁴⁹ Government official, interview by USITC staff, Prague, Czech Republic, Oct. 27, 2003.

Table 5-2
Selected characteristics of the Czech Republic market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	26.9 million metric tons (2002). ¹ Major components of waste: industrial (23%), energy production (20%), agricultural (16%), and municipal solid waste (11%).	1.3 million metric tons (2002). ¹
Trade Republic	Available data reflect the amounts of Czech Republic waste transferred to foreign markets for treatment and disposal (exports) in 2002: 317,000 tons. ¹ Data for imports are not available.	Available data reflect the amounts of Czech Republic waste transferred to foreign markets for treatment and disposal (exports) and sent to the Czech Republic for treatment and disposal (imports) in 2001: Exports, 11,000 tons; imports, 69,000 tons. ²
Nature of industry	Competitive, consolidating; private providers in major cities, mixture of public and private providers elsewhere. Foreign-owned firms are the major participants; Czech-owned firms are declining in market share. ³	Competitive; one Czech-owned and several foreign-owned firms are market leaders. ³
Key market participants (and location of parent)	Peterson (France); Asa (France); Sita (France); RWE (Germany). ³	Sita (France); Asa (France); Dekonta (Czech Republic). ³
Principal methods of waste treatment and disposal	Municipal waste, which accounts for about 10 percent of total Czech Republic waste, is managed chiefly through landfilling (70 percent). Composting and recycling are areas for current and future emphasis. Incineration in Czech Republic is low by comparison with EU, may become increasingly important as a method of complying with EU directives on landfills. ³	Available data indicate that physico/chemical treatment is the most widely used method of hazardous waste management. Land filling and recycling are also used. Major effort is underway to introduce clean production technologies in order to reduce waste production. ³
Key legislation	Czech Waste Management Act No.185/2001; ¹ Waste Management Plan of the Czech Republic (Government Regulation No. 1971, 2003).	
Regulatory authorities	Ministry of Environment of the Czech Republic. ⁴	
GATS commitments	The Czech Republic has scheduled full commitments on the provision of refuse disposal services through consumption abroad (mode 2) and commercial presence (mode 3). No commitments have been undertaken in the provision of such services through cross-border supply (mode 1). ⁵	

See footnotes at end of table.

Table 5-2—continued

Selected characteristics of the Czech Republic market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Other measures affecting trade and investment ⁽⁶⁾		Basel Convention; ⁷ Rotterdam Convention (ratified). ⁸

¹ Czech Statistical Office, *Production, Treatment, Utilization and Disposal of Waste in 2002*, found at Internet address <http://www.czso.cz/eng/edicniplan.nsf/p/2001-03>, retrieved Oct. 23, 2003.

² Ministry of the Environment of the Czech Republic, Czech Statistical Office, *Statistical Environmental Yearbook of the Czech Republic, 2002*, p. 95. The Czech Republic has reported more categories of wastes as hazardous than is the case with hazardous wastes reported under the Basel Convention.

³ Czech Republic industry representatives, interviews by USITC staff, Prague, Czech Republic, Oct. 24 and 27, 2003.

⁴ For information, see Internet address <http://www.env.cz/>.

⁵ General Agreement on Trade in Services (GATS), *Czech Republic: Schedule of Specific Commitments*, GATS/SC/26, Apr. 1994.

⁶ Not available.

⁷ For information, see Internet address <http://www.basel.int>.

⁸ For information, see Internet address <http://www.pic.int>.

energy generation. Incineration of waste is also on the rise, although considerably below levels in the EU, as the Czech Republic has insufficient capacity for waste utilization or energy recovery from waste.⁵⁰

Private firms account for a large majority of revenues in the Czech waste management markets (both solid and hazardous). Municipalities commonly keep at least a minority interest in ownership of local waste treatment companies, often subcontracting specialized services to private individuals and firms. Most large cities have commissioned large turnkey contracts for waste management. The City of Prague has its own incineration plant, which is operated by private firm Asa (the second-largest solid waste management firm in the Czech Republic) under a service contract.⁵¹

The European Agreement concluded between the Czech Republic and the European Union, which came into force on February 1, 1995, obligates the Czech Republic to harmonize existing and new legal provisions, technical standards, and relevant procedures with those of the EU, including those which relate to environmental protection.⁵² The Ministry of Environment of the Czech Republic (MZP) is the state administrator for environmental policy and legislation, and is also responsible for harmonizing the environmental legislation of the Czech Republic with those of the European Union. An agency of the MZP oversees the State Environmental Fund and also manages structural funds made available by the EU to acceding countries.⁵³ A

⁵⁰ Czech Republic, Ministry of the Environment, State Environmental Policy, January 2001, found at Internet address <http://www.env.cz>, retrieved Dec. 2, 2003.

⁵¹ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁵² Czech Republic, Ministry of the Environment, State Environmental Policy.

⁵³ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

Czech Parliament committee is responsible for regional environmental policy and protection, while the oversight of waste management is to be transferred to the regional authorities.⁵⁴

Recent progress has been achieved in the form of the development of a State administration of waste management. Legal and institutional processes have been created for keeping records of waste generation, waste management, and waste disposal; and the first wave of closures and reclamation of inadequate landfills has been completed.⁵⁵

Trade and Investment

The Czech Republic is a competitive market for European firms,⁵⁶ however, development funds from the EU usually are tied-aid that awards projects to EU firms.⁵⁷ As such, many of the major waste management firms in the Czech Republic were formerly Czech-owned, but subsequently were acquired by EU-owned firms, including Peterson (part of Veolia group, France; \$56 million⁵⁸ in revenues), Asa (owned by electricity firm EDP, France; \$45 million), Sita (part of Suez group, France; \$37 million),⁵⁹ and RWE (Germany).⁶⁰ The import and export of wastes for recovery or disposal are permitted under current legal regulations in the Czech Republic, as are the associated waste management services.⁶¹

Future Prospects

The future prospects of the European solid and hazardous waste services markets will likely be most heavily influenced by the accession of several Eastern European countries to the EU in May 2004, the trend toward regulatory incentives for waste reduction and recovery within the EU, and the continuing privatization of public waste services across Europe. The increase in the size of the European market will undoubtedly create new opportunities for commerce, and accession is likely to contribute to conditions that would support investment in technology and infrastructure in the newer Member states. With anticipated higher levels of economic growth in the new Member states following accession, a significant

⁵⁴ Czech Republic, Ministry of the Environment, State Environmental Policy.

⁵⁵ Czech Republic, Ministry of the Environment, State Environmental Policy.

⁵⁶ Waste Management Inc. (U.S.) used to be in the Czech market, but has since withdrawn.

⁵⁷ Government and industry representatives, interviews by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁵⁸ Dollar values generated by USITC calculation.

⁵⁹ Sita serves about 600,000 residential customers (less than 10 percent of the market) and 12,000 commercial customers. The firm ranks third in the Czech Republic in solid waste, and first in hazardous waste and remediation.

⁶⁰ Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 24, 2003.

⁶¹ For example, waste tires are only imported for recycling; none are exported. Imports of refrigerators from Asia for recycling is another government priority program being put into effect. Industry representative, interview by USITC staff, Prague, Czech Republic, Oct. 27, 2003.

increase in waste generation can be expected. According to European Environment Agency (EEA) estimates, if quantities of solid and hazardous waste in the new Member states reach the average amount per capita for the EU, the total amount of municipal waste in these countries will increase by 50 percent by 2010. In addition, acceding countries will be required to implement some 140 environmental directives that may have an impact on the solid and hazardous waste services industry. It has been estimated by the European Court of Auditors that it will cost the accession countries up to \$90 billion⁶² over the next decade to conform to the environmental regulations of the European Union.

⁶² Dollar value generated by USITC calculation.

CHAPTER 6

ASIA AND THE PACIFIC

Introduction

Solid and hazardous waste services markets in Asia and the Pacific are highly varied, reflecting the diverse economic landscape of the region. Waste generation rates and the ability to finance waste management efforts differ among low-, middle-, and upper-income countries. As per capita GDP rises in many Asian nations so, too, do consumption, waste generation, and thus, demand for solid and hazardous waste management services. While trade in waste management services seems to be in its infancy throughout the region, foreign investment in the construction of treatment facilities and related infrastructure is growing rapidly. It is likely that opportunities for trade and investment will increase as the regulatory environments of Asia-Pacific nations mature, either through adoption of new laws or more consistent enforcement of existing regulations.

This chapter provides an overview of solid and hazardous waste services markets across the Asia-Pacific region, and presents specific information on the Australian, Chinese, Japanese, and Malaysian markets for such services. Australia and Japan were selected for special emphasis owing to the relatively large size and maturity of their solid and hazardous waste services markets, China was selected owing to the rapid growth of its environmental services market, and Malaysia was selected owing to its relatively long experience with environmental regulation.

Regional Market Overview

Waste generation in the Asia-Pacific region is generally increasing as economies grow and individual consumption rises. The Asia-Pacific region as a whole generates an estimated 1.5 million metric tons of solid waste per day, and is expected to increase its rate of solid waste generation to at least 3 million metric tons by 2025.¹ The region as a whole generated an estimated 233 million metric tons of hazardous waste² in 2000, of which China accounted for the greatest share, 56 percent, followed by India and Indonesia with 35 percent and 5 percent, respectively.³ Industrial solid waste accounts for an estimated 87 percent of all nonhazardous solid waste generated in developed countries such as Japan and Australia. By contrast, in developing

¹ *What a Waste: Solid Waste Management in Asia*, World Bank, May 1999. According to the report, official waste generation estimates are believed to be extremely conservative and could be more than double these amounts.

² *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank. Figures for hazardous waste generation are estimates and are considered to be conservative. The most common types of hazardous waste generated in the region include solvents and pesticides.

³ *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

countries such as China, industrial solid waste accounts for an estimated 65 percent or less of solid waste generation.⁴

In 2000, the Asia-Pacific market for solid and hazardous waste management services was valued at approximately \$40.2 billion. Japan accounted for 85 percent of that market, Australia and New Zealand an additional 4 percent, and the rest of Asia accounted for the remaining 11 percent.⁵ Resources spent on solid waste management, accounting for 88 percent of the total market for solid and hazardous waste services, greatly outweighed the 12 percent dedicated to hazardous waste management. Urban areas in Asia together spend about \$25 billion per year on solid waste management, and are expected to double such expenditures by 2025.⁶

In the Asia-Pacific region, solid and hazardous waste management services are supplied by governments, the private sector, and in many cases – especially in low-income countries – the informal sector.⁷ In high-income countries there is typically a high degree of government regulation, but private-sector suppliers usually dominate the market for waste management services. In developing countries where waste management systems are less evolved, governments frequently maintain greater control over the provision of such services or grant monopoly status to certain domestic companies. Throughout the region, governments increasingly are contracting out discrete waste management activities to private companies. For example, in 2000, over 20 percent of municipal solid waste collection services in the Asia-Pacific region were performed by private companies under contract, particularly in Australia, China, Hong Kong, Malaysia, the Republic of Korea, Singapore, and Thailand.⁸

Methods of waste treatment and disposal in the Asia-Pacific region are largely influenced by regulation, land costs, and the evolution of waste management programs. Use of sanitary landfills is prevalent throughout Asia and the Pacific, employed by cities in low-, middle-, and high-income countries. Some countries in the region, such as Japan and Australia, are using landfill gasses to generate electrical power. Japan and Singapore are the only two countries in the region that employ incineration as the predominant means of solid waste disposal (75 and 70 percent, respectively).⁹ Australia, Korea, Indonesia, and Hong Kong also have modern incineration facilities.

⁴ Ibid.

⁵ Environmental Business International, Inc. (EBI), *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003. Of the \$40.2 billion spent in 2000, \$35.4 billion was devoted to solid waste services while \$4.8 billion went toward hazardous waste management.

⁶ *What a Waste: Solid Waste Management in Asia*, World Bank.

⁷ The informal sector comprises individuals who pick through waste at dumpsites for reusable products and then find buyers for the materials.

⁸ *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

⁹ Ibid.

Open dumping, which includes disposal in nonengineered, nonsanitary landfills, is reportedly the most common method of solid waste disposal in low-income countries throughout the region.¹⁰ This is likely due to weak regulation and an inability to finance modern methods of waste management.

Methods of hazardous waste management throughout the region vary according to the type of substance being treated and the sophistication of treatment facilities. Most countries have regulations addressing the storage and treatment of hazardous waste, though the levels of compliance vary widely. Middle- and high-income countries are more likely to incinerate or chemically treat waste. In low-income countries where regulation and treatment options tend to be weaker, an unknown but believed to be significant portion of hazardous waste is released into the environment. However, it is not uncommon for governments in low- and middle-income countries to require that companies store their hazardous waste until suitable methods of treatment become available.¹¹

Throughout the 1990s, the rate of recycling grew significantly in the Asia-Pacific region, from less than 10 percent in 1988 to 30 percent in 1998.¹² Paper and paperboard are the most commonly recycled materials, but glass, metal, and plastics are recovered as well. In middle- and high-income countries, governments and the private sector frequently promote, fund, and/or operate recycling facilities. In the region's low-income countries, recycling is primarily carried out by the informal sector. Many countries in the region are signatories to the Basel Convention and Montreal Protocol, as well as members of the World Trade Organization, all of which shape solid and hazardous waste management markets to some degree. For example, member nations of the Basel Convention¹³ are subject to controls on international trade in hazardous waste. GATS commitments on refuse disposal services vary widely throughout the region, with certain economies such as Australia and Taiwan having scheduled full commitments on refuse disposal services provided through modes 2 and 3, and other economies such as Malaysia and New Zealand having scheduled no commitments on this service sector.

¹⁰ Ibid.

¹¹ Based on interviews by USITC staff with industry and government sources, Beijing, China and Kuala Lumpur, Malaysia, Oct. 2003.

¹² *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

¹³ Signatories to the Basel Convention considered members of the Asia and Pacific region include Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cyprus, India, Indonesia, Iran (Islamic Republic of), Japan, Jordan, Kazakhstan, Kiribati, Kuwait, Kyrgyzstan, Lebanon, Malaysia, Maldives, Marshall Islands, Micronesia (Federated States of), Mongolia, Nauru, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Qatar, Republic of Korea, Samoa, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Thailand, Turkmenistan, United Arab Emirates, Uzbekistan, Viet Nam, and Yemen.

Australia

Market Overview

Australia has the second largest environmental market in the Asia-Pacific region, behind Japan, and the tenth largest market worldwide.¹⁴ Australian environmental services revenues totaled \$7.1 billion in 2000, of which an estimated \$1.3 billion was dedicated to solid waste services and \$260 million to hazardous waste services. Australia generates an estimated 14.4 million metric tons of solid waste per year, 95 percent of which is managed (table 6-1). Approximately 96 percent of Australia's managed solid waste is disposed in landfills.¹⁵ Australia's high rate of landfilling reflects the country's abundance of affordable land and a public distaste for incineration, which was particularly acute during the late 1980s and early 1990s. The unpopularity of incineration has reportedly prompted the country's development of cleaner, more advanced methods of waste disposal,¹⁶ however, these new technologies may be better suited to the hazardous waste management industry. Australia generated an estimated 275,000 metric tons of hazardous waste in 2000,¹⁷ almost all of which was managed.¹⁸

In recent years, the Australian Government has strongly encouraged waste minimization and recycling efforts among citizens and industry. Further, the Government has undertaken an ambitious effort to reduce by 50 percent the amount of all solid waste destined for landfills.¹⁹ Such efforts may provide market opportunities for suppliers of technologically advanced and efficient sorting, recycling, and incineration services.

Treatment of solid and hazardous waste in Australia is primarily regulated through the Environment Protection Act of 1970 and the Environment Protection (Prescribed Waste) Regulations. At the national level, the Environmental Protection Authority establishes waste management guidelines, but each state is responsible for crafting specific regulations that are enforced by local governments. Regional Waste Management Groups were created to develop a more consistent approach to waste management in Australia by coordinating and harmonizing nation- and state-wide waste management regulations.

¹⁴ EBI, data from The Global Environmental Market by Region, 2000 spreadsheet.

¹⁵ EBI, *Report 2000 - Environmental Industry Overview*.

¹⁶ *Survey of Environmental Markets in APEC*, Asia-Pacific Economic Cooperation Committee on Trade and Investment, June 2001.

¹⁷ *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

¹⁸ *Ibid.*

¹⁹ EBI, *Report 2000 - Environmental Industry Overview*.

Table 6-1
Selected characteristics of the Australian market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	Australia produces 14.4 million tons of solid waste per year, almost all of which is managed. ¹	Australia generated 275,000 tons of hazardous waste in 2000, almost all of which was managed. ²
Market size (2000)	\$1.3 billion. ³	\$0.26 billion. ³
Employment (2002-03)	11,350 employed in solid and hazardous waste management industries. ⁴	
Trade	Based on anecdotal information, the country is believed to be a net exporter of services. ⁵ Imports account for 25 percent ⁴ of the domestic solid and hazardous waste management market.	
Nature of Industry	Competitive and moderately concentrated market: top 4 firms account for 57 percent of revenues (includes solid and hazardous waste segments). ⁴	
Key market participants (and location of parent)	Brambles Industries Limited (Australia and United Kingdom) Collex Pty Limited (France) SembSita Australia Pty Limited (France and Singapore) Leighton Holdings Limited (Australia) Waste Recycling and Processing Corporation of New South Wales (Australia) ⁴	
Principal methods of waste treatment and disposal	Landfills account for the largest share of solid waste disposal in Australia (96 percent), ³ followed by composting and waste-to-energy.	Specially engineered landfilling, long-term containment, and recycling. ⁶
Key regulations	Environment Protection Act 1970. ⁶	Environment Protection (Prescribed Waste) Regulations. ⁶
Regulatory authorities	Environmental Protection Authority (EPA); Regional Waste Management Groups (RWMG); local governments. ⁶	
GATS commitments	Australian commitments grant full market access and national treatment for the provision of refuse disposal services through consumption abroad (mode 2) and commercial presence (mode 3). ⁷	
Other measures affecting trade and investment	Prospective foreign investors must obtain investment approval from the Foreign Investment Review Board, which may deny specific foreign investment on the basis of national interest. ⁸	

¹ OECD Environmental Data, 1999 Compendium, Annex 1.

² Asian Development Bank, *State of the Environment in Asia and the Pacific, 2000*, p. 174.

³ EBI, *EBI Report 2000: The U.S. Environmental Industry and Global Market*, Sept. 2001.

⁴ *Waste Disposal Services in Australia*, IBIS World Pty Ltd., Aug. 20, 2003

⁵ A U.S. government representative in Australia indicates that the country is likely a net exporter of solid and hazardous waste management services based on a comparison of the foreign revenues of Australia's leading solid and hazardous waste management firm in 2003 and revenues generated in Australia's domestic waste management market.

⁶ EPA Victoria, "Waste," found at Internet address <http://www.epa.vic.gov.au/waste>, retrieved Dec. 3, 2003.

⁷ General Agreement on Trade in Services (GATS), *Australia: Schedule of Specific Commitments*, GATS/SC/6, Apr. 15, 1994

⁸ U.S. Trade Representative, *2003 National Trade Estimate Report on Foreign Trade Barriers*.

Trade and Investment

Though trade data are not available, Australia is believed to be a net exporter of solid and hazardous waste management services.²⁰ Although the heavy reliance on landfilling reduces opportunities in other market segments, it is believed that Australian imports of waste management services account for 25 percent of the country's solid and hazardous waste services market. The two most prominent foreign companies operating in the sector include Collex Pty Limited, whose largest shareholder is the French company Vivendi (Onyx); and SembSita Australia Pty Limited, which is 60-percent owned by the French company SITA, and 40-percent owned by SembCorp Waste Management of Singapore.²¹ Australian exporters of solid and hazardous waste management services focus largely on the Asia-Pacific and European markets. Most recently, the Melbourne-based Cleanevent Group was awarded an \$80 million cleaning and waste management contract for the 2004 Olympic Games in Athens, Greece.²² Australian GATS commitments grant full market access and national treatment for the provision of refuse disposal services through consumption abroad and commercial presence.²³

China

Market Overview

The environmental goods and services market in China is small, but has been growing at an impressive rate in recent years due in part to China's increased involvement in world markets and the country's accession to the WTO. In 2002, China's market for environmental goods and services totaled \$7.15 million,²⁴ which represents a 117-percent increase over 1995 levels. Solid and hazardous waste management services accounted for an estimated \$890 million and \$180 million, respectively, of China's environmental goods and services industry revenues in 2000 (table 6-2).²⁵ While data on waste generation rates²⁶ tends to be inconsistent, the Chinese Government estimates that in 2002, the country generated 160 million

²⁰ A U.S. government representative in Australia indicates that the country is likely a net exporter of solid and hazardous waste management services based on a comparison of the foreign revenues of Australia's leading solid and hazardous waste management firm in 2003 and revenues generated in Australia's domestic waste management market.

²¹ *Waste Disposal Services in Australia*, IBISWorld Pty Ltd., Aug. 20, 2003.

²² Australian Trade Commission, news release found at Internet address <http://www.austrade.gov.au>, retrieved Nov. 24, 2003.

²³ For explanations of these modes of supply, see Appendix E.

²⁴ EBI, data from The Global Environmental Market by Region, 2000 spreadsheet. Figures include environmental equipment, services, and resources such as water utilities.

²⁵ EBI, *Report 2000 - Environmental Industry Overview*, pp.18-20. While data on the entire environmental market size are available through 2002, data on environmental market by sector are only available through 2000.

²⁶ China has three basic classifications of waste: municipal waste, industrial solid waste, and hazardous waste.

Table 6-2
Selected characteristics of the Chinese market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	160 million tons of municipal solid waste per year; 45-50 percent of which is managed. ¹ 950 million tons of industrial solid waste per year; 85 percent of which is reportedly managed. ¹	10 million tons per year, most of which is reportedly managed. ¹
Market size (2000)	\$0.89 billion. ²	\$0.18 billion. ²
Trade	Based on anecdotal information, the country is believed to be a net importer of services. ³	
Nature of industry	Evolving market is highly fragmented and decentralized; many municipalities regard waste management as a free public service. ¹	Evolving market, not consolidated. Public sector dominates but the government is encouraging private sector initiatives. ¹
Key market participants (and location of parent)	Public sector dominates the provision of services. ¹	Public sector dominates the provision of services. ¹
Principal methods of waste treatment and disposal	For municipal waste: landfilling (45 percent) and open dumping (55 percent). ¹ For industrial waste: recycling (53 percent), storing (32 percent), and landfilling (18 percent). ¹	Incineration, chemical neutralization, solidification, and landfilling. ¹
Key regulations	Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, and Regulations on the Declaration and Registration of Pollution Discharge. ¹	
Regulatory authorities	State Environmental Protection Administration, Division of Solid Wastes and Toxic Chemicals. ¹	
GATS commitments	Foreign suppliers of refuse disposal services may only provide services in China through a joint venture. However, foreigners may hold majority stakes in these joint ventures. China reserves the right to restrict the foreign provision of refuse disposal services, with the exception of environmental consultation services, through cross-border supply. ³	
Other measures affecting trade and investment	Ambiguous licensing guidelines make it difficult for foreign engineering firms to obtain necessary permits except on a project-by-project basis. ⁵ All land is owned by the Government which grants fee-based usage rights for set periods. Compensation for early repossession of land is assured by law in some cases but is inconsistent and standards are unclear. ⁵	

¹ Chinese Government and industry representatives, and U.S. government representatives, interviews by USITC staff, Beijing, China, Oct. 2003.

² EBI, *EBI Report 2000: The U.S. Environmental Industry and Global Market*, Sept. 2001.

³ While trade in waste management services is minimal, some foreign companies are operating in China, primarily in the design, construction, and operation of incinerators. There are no known Chinese companies exporting waste management services. Chinese Government representatives, interview by USITC staff, Beijing, China, Oct. 2003.

⁴ World Trade Organization, *China: Schedule of Specific Commitments*, GATS/SC/135, Feb. 14, 2002.

⁵ U.S. Trade Representative, *2003 National Trade Estimate Report on Foreign Trade Barriers*.

metric tons of municipal solid waste, of which an estimated 45-50 percent was managed; 950 million metric tons of industrial solid waste, 85 percent of which was reportedly managed;²⁷ and 10 million metric tons of hazardous waste, most of which was reportedly treated.²⁸

Until recently, the government was almost solely responsible for collecting and disposing municipal waste, but is now encouraging private participation. At least 90 percent of the municipal solid waste that is managed in China is disposed of in landfills, largely owing to China's abundance of inexpensive land and a shortage of capital with which to invest in more sophisticated technologies. Incineration, while not widely practiced, is becoming more acceptable as municipalities gain experience with that treatment method. However, a lack of capital for the construction of new incineration facilities and the absence of means by which to separate combustible waste from that which cannot be burned may serve as an obstacle to more widespread use of incineration.

The Chinese State Environmental Protection Agency (SEPA) encourages companies to handle their industrial solid and hazardous waste by means of multiple-utilization, that is, by finding alternate uses for waste instead of sending it directly to landfills.²⁹ The Government estimates that 45 percent of industrial solid waste and 50 percent of hazardous waste is successfully reused. Hazardous waste is typically treated by means of chemical neutralization, incineration, or solidification, with much of the waste ultimately ending up in landfills after treatment. However, because of limited technology and funding, and thus limited capacity, companies are frequently unable to treat all of their hazardous waste so they must store it until treatment is possible. In response, the Government has planned to allocate approximately \$1.94 billion for the construction of hazardous waste treatment facilities throughout the country during 2003-2005.³⁰ Funding will come from local, state, and foreign governments, as well as from local and foreign industry.³¹

SEPA drafts and supervises the implementation of China's environmental laws and regulations at the national level, and coordinates with the Ministry of Construction, the Ministry of Health, and the Development and Reform Commission, who are responsible for municipal, medical, and industrial waste, respectively. Provincial and local governments are responsible for the implementation of solid and hazardous waste regulations.³²

²⁷ Of the 950 million metric tons of industrial solid waste generated in 2002, 500 million metric tons were multi-utilized, 170 million metric tons treated, 300 million metric tons put in storage until a suitable means of disposal can be determined, and 26.35 million metric tons released to the environment. Chinese Government representative, interview by USITC staff, Beijing, China, Oct. 15, 2003.

²⁸ Estimates by Chinese government representative, interview by USITC staff, Beijing, China, Oct. 15, 2003.

²⁹ For example, coal dust is often used to make bricks, and steel can be stripped from waste and recycled. Chinese Government representative, interview by USITC staff, Beijing, China, Oct. 15, 2003.

³⁰ Chinese Government representative, interview by USITC staff, Beijing, China, Oct. 15, 2003.

³¹ Ibid.

³² Ibid.

Trade and Investment

Trade in solid and hazardous waste management services is believed to be minimal, although several international companies and donor agencies have designed and built waste treatment facilities in China. However, the Chinese Government is actively encouraging foreign direct investment in the market through joint ventures with Chinese companies. Foreign equity in Chinese waste management operations is limited to 50 percent.³³ China's GATS commitments grant national treatment for the provision of refuse disposal services through modes 1, 2, and 3, and grant market access through mode 2.

Japan

Market Overview

Japan's solid and hazardous waste services market is the largest in the Asia-Pacific region and the second largest worldwide behind the United States.³⁴ Solid and hazardous waste management revenues in Japan respectively totaled \$30.2 billion and \$3.9 billion in 2000 (table 6-3), together accounting for 36 percent of Japan's environmental goods and services market. Japan generates an estimated 52.4 million metric tons of municipal solid waste each year, most of which is managed.³⁵ Municipal governments are responsible for the construction of waste management facilities and the collection, transportation, and disposal of waste, although such activities are routinely contracted out to private companies. The construction of waste management facilities is usually subsidized in part by the central government, while waste management services are funded through waste disposal taxes levied upon citizens. An estimated 75 percent³⁶ of municipal solid waste in Japan is disposed of through incineration, followed by landfilling as the second most favored disposal option.³⁷

Japanese companies generate 406 million metric tons of industrial solid and hazardous waste per year,³⁸ with the responsibility for treatment and disposal resting solely with the individual firms generating the waste. Construction and operation of industrial waste management facilities are funded through private investment and disposal fees paid by waste generating firms. Several large manufacturers have

³³ Chinese Government representative, interview by USITC staff, Beijing, China, Oct. 15, 2003.

³⁴ EBI, data from The Global Environmental Market by Region, 2000 spreadsheet.

³⁵ Japan has two classifications of waste: generic, which includes all municipal solid waste; and industrial, which includes both solid and hazardous waste generated in the process of industrial activity.

³⁶ *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

³⁷ Japanese government representative, interview by USITC staff, Tokyo, Japan, Oct. 6, 2003. Japan has approximately 2000 intermediary waste disposal facilities, mainly incinerators, where waste is reduced before final disposal in one of nearly 2000 landfills.

³⁸ Japanese government representative, interview by USITC staff, Tokyo, Japan, Oct. 3, 2003. Official data on industrial waste includes both solid and hazardous waste. An estimate of the share of solid to hazardous waste contained in this category could not be provided.

Table 6-3
Selected characteristics of the Japanese market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	238.4 million tons per year; most of which is managed. ¹	Estimated 220 million tons in 2000, most of which was managed. ^{1,2}
Market size (2000)	\$30.2 billion. ³	\$3.9 billion. ³
Employment (2001)	(⁴)	(⁴)
Trade	Anecdotal information suggests that the country is an aggressive exporter of environmental services in the Asia-Pacific region. ⁵	
Nature of industry	Japan's solid waste industry is believed to be highly consolidated, with domestic firms dominating Japanese market. ¹	Mature market, highly competitive, with domestic firms dominant. ¹
Key market participants (and location of parent)	Mitsubishi Heavy Industries (Japan); Ebara Corp. (Japan); Kubota (Japan); Mitsui (Japan). ¹	
Principal methods of waste treatment and disposal	Incineration (waste-to-energy) accounts for the largest share of solid waste disposal in Japan (75 percent), followed by landfilling and composting. Figures do not account for recycling which is prevalent in Japan. ⁶	Incineration, chemical treatment, and storage. ¹
Key regulations	Waste Disposal and Public Cleansing Law, Law for Promotion of Effective Utilization of Recyclable Resources. ¹	Law Concerning Special Measure Against PCB Waste. ¹
Regulatory authorities	Ministry of the Environment, Ministry of Health and Welfare, Ministry of Economy, Trade and Industry, and local governments. ¹	
GATS commitments	Japan grants market access and national treatment to foreign suppliers of refuse disposal services through consumption abroad (mode 2) and commercial presence (mode 3), but indicates that the number of licenses conferred to service suppliers of waste oil disposal at sea from vessels may be limited. ⁷	

See footnotes at end of table.

Table 6-3--continued
Characteristics of the Japanese market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Other measures affecting trade and investment	<p>Complicated and expensive licensing procedures for waste management service providers are common throughout Japan.¹</p> <p>Foreign companies are unlikely to enter the market successfully without a joint venture with Japanese firm.¹</p>	

¹ Japanese Government and industry representatives, and U.S. government representatives, interviews by USITC staff, Tokyo, Japan, Oct. 2003.

² An unknown but believed to be large quantity of hazardous waste in Japan is treated in-house by the waste-generating companies, and therefore is not reflected in the market size figures.

³ EBI, *EBI Report 2000: The U.S. Environmental Industry and Global Market*, Sept. 2001.

⁴ Not available.

⁵ While no foreign waste management firms are known to operate in the Japanese market, it is believed that Japanese firms are active throughout the Asia-Pacific region. Government and industry representatives, interviews by USITC staff, Tokyo, Japan; Kuala Lumpur, Malaysia; Beijing, China, Oct. 2003; and *Waste Disposal Services in Australia*, IBIS World Pty Ltd., Aug. 20, 2003.

⁶ Asian Development Bank, *State of the Environment in Asia and Pacific, 2000*, p. 180.

⁷ General Agreement on Trade in Services (GATS), *Japan: Schedule of Specific Commitments*, GATS/DC/46, Apr. 15, 1994.

incineration facilities to treat their own waste, and in some cases have leveraged surplus capacity to enter the broader waste treatment and disposal market. Together, there are roughly 7,000 incinerators, recycling facilities, and chemical treatment plants for industrial waste, and approximately 2,000 industrial waste landfills.³⁹

Japan faces a particular and high-priority challenge in the disposal of polychlorinated biphenyl (PCB)⁴⁰ waste. Following a 1968 cooking oil contamination incident that resulted in widespread illness and, in some cases, death, the government banned all manufacture and use of the substance. Companies using PCB were instructed to collect and store the waste until suitable disposal methods could be identified.⁴¹ As a result, approximately 30,000 companies are currently storing an estimated 20,000 metric tons of PCB waste.⁴² In 2001, the Government of Japan passed the Law of Special Measures Concerning Promotion of Appropriate Disposal of PCB Waste, stipulating that existing waste be properly disposed of by 2016. The Government is planning construction of five chemical disposal sites⁴³ throughout the country and will contract out the assessment of environmental impacts, construction, and operation of the new facilities to private companies. These services will ultimately

³⁹ There is some overlap between the estimated 2000 industrial landfills and the estimated 2000 generic landfills, but the extent of the overlap is unknown.

⁴⁰ Polychlorinated biphenyl acts as a heat transmission material and was used in electronic devices and high pressure-condensers in the manufacture of processed foods.

⁴¹ PCBs used in electronic devices were allowed to remain in such devices.

⁴² The 20,000 metric ton estimate is based on reports from the prefectural governments. The figure may be understated as it is believed that companies under report levels of PCB waste. Furthermore, some of the PCB waste has gone missing and cannot be accounted for.

⁴³ Incineration is a generally acceptable method of PCB disposal but is not acceptable to the Japanese public due to concerns over toxic emissions. Japanese Government representative, interview by USITC staff, Tokyo, Japan, Oct. 6, 2003.

be funded by disposal fees. While the government has not disclosed the estimated cost of the entire project, it reportedly has awarded \$260 million to Mitsubishi Heavy Industries to construct the Tokyo facility.⁴⁴ Japan has no regulations mandating that the facilities be built or operated by domestic firms.⁴⁵ However, all prospective bidders must construct a demonstration plant, at an estimated cost of \$1 million, in order to obtain approval from the Ministry of the Environment to enter a bid.⁴⁶

Recycling in Japan is typically carried out by private companies without the benefit of government subsidies, except on an ad hoc basis. These companies generate earnings through recycling fees and resale of materials. Some Japanese manufacturers are devising innovative applications for recycled materials, such as substituting recycled plastics for coke in blast furnaces in steel mills. This practice yields both economic and environmental benefits as the plastics emit fewer dioxins than coke when burned, recycled plastic is cheaper than coke, and steel companies can receive compensation for removing the “waste” from municipalities.

Japan’s large solid and hazardous waste market is a product of that country’s substantial environmental regulations. Japan’s Basic Law on the Environment (1993) encourages environmental protection and sustainable development through numerous regulations that legislate, inter alia, waste disposal and recycling.⁴⁷ Waste disposal is primarily governed by the Law Concerning Disposal and Cleanup of Disposed Waste, which dictates a standard waste disposal plan. However, it is the responsibility of individual prefectures to tailor the plan to accommodate local needs. Recycling is governed by the Ministry of Economy, Trade and Industry (METI). International treaties affecting waste management to which Japan is a signatory include the Persistent Organic Pollutants Convention (POP Convention) and the Basel Convention.

Trade and Investment

Japanese Government sources report that data reflecting trade in solid and hazardous waste services are not available.⁴⁸ However, anecdotal information suggests that Japan is an aggressive exporter of environmental services in general, and Japanese firms are active in the design and construction of waste management facilities throughout the Asia-Pacific region. It is reported that only domestic companies provide solid and hazardous waste management services in Japan, principally because it is not a highly profitable industry and it is difficult to obtain waste management licenses from local governments due to complex technical

⁴⁴ Two other significant bidders on the project were Tokyo Electric, which teamed with Mitsui, and Kansai Electric, the first and second largest electric companies in Japan, respectively. Electric companies are some of the biggest generators of PCB waste. U.S. Government representative, interview by USITC staff, Tokyo, Japan, Oct. 6, 2003.

⁴⁵ Japanese Government representative, interview by USITC staff, Tokyo, Japan, Oct. 6, 2003.

⁴⁶ U.S. Government representative, interview by USITC staff, Tokyo, Japan, Oct. 6, 2003.

⁴⁷ *Recycle Oriented Society: Toward Sustainable Development*. Clean Japan Center.

⁴⁸ According to a U.S. government official, services trade data is not readily available in Japan because most such business is done via joint venture where a contract is awarded to the Japanese partner and then a private deal is made for payment to the foreign partner.

requirements.⁴⁹ Domestic and foreign contractors are required to register with municipalities in order to be eligible to operate.

Japan's current GATS commitments grant full market access and national treatment for the foreign provision of refuse disposal services, with the exception of some limitations regarding the disposal of waste oil at sea. However, according to a Japanese government official, joint ventures are widely viewed as the only way for foreign companies to enter the market, and there are currently no such business arrangements in Japan's solid and hazardous waste management industry.⁵⁰

Malaysia

Market Overview

The environmental goods and services market in Malaysia – which includes the solid and hazardous waste services segment – has grown rapidly in recent years, totaling \$840 million in 2002, a 40-percent increase over 1995 levels.⁵¹ The Malaysian environmental services market experienced a temporary downturn because of the Asian financial crisis. However, the Malaysian experience was comparatively less severe than that of some of its neighbors, and the environmental market rebounded after a one-year decline in 1998. Malaysia generates an estimated 5.5 million metric tons⁵² of municipal and industrial solid waste per year, of which an estimated 45 percent is managed (table 6-4).⁵³ The country generated 363 thousand metric tons⁵⁴ of hazardous waste in 2002, of which 90-95 percent was reportedly managed.⁵⁵

The Malaysian Government has aggressively pursued privatization of infrastructure in the past decade to include the waste management industry. In 1995, the Government awarded a 15-year exclusive contract for the management of all of peninsular Malaysia's hazardous waste to a single firm, Kualiti Alam. The Malaysian company receives its revenue from waste collection and disposal fees paid directly by the companies that generate waste. Because Malaysian companies are

⁴⁹ Japanese Government representative, interview by Commission staff, Tokyo, Japan, Oct. 7, 2003.

⁵⁰ Ibid.

⁵¹ EBI, data from the Environmental Markets in the Asia-Pacific, 1995-2000 spreadsheet.

⁵² Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁵³ *State of the Environment in Asia and the Pacific 2000*, Economic and Social Division for Asia and the Pacific, Asian Development Bank.

⁵⁴ Malaysia has two classifications of waste: solid waste, which includes municipal and industrial, and scheduled waste, which encompasses 107 types of hazardous waste. Small and medium enterprises are more likely to under-report their waste and/or dispose of it illegally. Malaysian Government representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁵⁵ *Environmental Quality Report 2001*, Malaysian Ministry of the Environment.

Table 6-4
Selected characteristics of the Malaysian market for solid and hazardous waste services

Item	Solid waste	Hazardous waste
Waste generation/treatment	5.5 million tons per year; an estimated 45 percent of which is managed. ¹	363,000 tons in 2002, 90-95 percent of which was reportedly managed. ¹
Market size (2000)	\$0.12 billion. ²	\$24 million. ²
Employment (2001)	(³)	(³)
Trade	Anecdotal evidence suggests that the country is a net importer of services. ⁴	
Nature of industry	Evolving market; 3 companies control 75 percent of market. ¹	A single company has exclusive ¹ rights to all incineration and chemical treatment through 2013.
Key market participants (and location of parent)	Alam Flora (Malaysia) ¹ Southern Waste (Malaysia) Northern Waste (Malaysia)	Kualiti Alam (Malaysia). ¹
Principal methods of waste treatment and disposal	Open dumping (50 percent), landfilling (30 percent). ⁵	Incineration, chemical treatment, and storage. ¹
Key regulations	Environmental Quality Act of 1974 (and subsequent amendments in 1985 and 1996), Environmental Quality Regulations. ¹	
Regulatory authorities	Department of the Environment, and Ministry of Housing and Local Government ¹	
GATS commitments	Malaysia has scheduled no commitments on refuse disposal services. ⁶	
Other measures affecting trade and investment	Foreign investors limited to 30-percent financial stake. ¹ Privatization of solid and hazardous waste management services resulted in exclusive, long-term agreements for Malaysian firms. ¹	

¹ Malaysian and U.S. government and industry representatives, interviews by USITC staff, Kuala Lumpur, Malaysia, Oct. 2003.

² EBI, *EBI Report 2000: The U.S. Environmental Industry and Global Market*, Sept. 2001.

³ Not available.

⁴ Foreign waste management firms are present in niche areas of the Malaysian market, but Malaysian firms are not believed to be exporting such services. Malaysian and U.S. government and industry representatives, interviews by USITC staff, Kuala Lumpur, Malaysia, Oct. 2003.

⁵ Asian Development Bank, *State of the Environment in Asia and the Pacific, 2000*, p. 180.

⁶ General Agreement on Trade in Services (GATS), *Malaysia: Schedule of Specific Commitments*, GATS/SC/52, Apr. 15, 1994.

legally obligated to obtain treatment for their hazardous waste, Kualiti Alam is assured steady revenue until its contract expires in 2013. Kualiti Alam employs multiple hazardous waste treatment techniques, although incineration and chemical treatment are the most prevalent. While other modes of treatment operate at approximately 40-50 percent⁵⁶ of capacity, Kualiti Alam's incinerator is stressed to full capacity and the company is forced to refuse waste, and thus, some companies are storing their waste until Kualiti Alam can accept it.⁵⁷ In response, Kualiti Alam is actively pursuing the addition of plasma technology to its portfolio of treatment options. Kualiti Alam views oil waste, sludge, and other hazardous waste recycling companies as its greatest competition. As a result, Kualiti Alam offers manufacturers competitive pricing to match what they would receive from recyclers or what they would save by implementing waste-reducing technologies.⁵⁸

The management of solid waste is also undergoing privatization, though the process is not yet complete. Treatment of solid waste in Malaysia, which is regulated by the Ministry of Housing and Local Government, is much less sophisticated than that of hazardous waste, with most solid waste destined for open dumps. However, as the privatization of the sector advances, more modern methods of handling and treatment are emerging. In 1994, the Malaysian Government identified four domestic companies, which would each be given 20-year concessions to collect, store, and dispose of solid waste in one of the four geographic areas devised under the plan, but the Government will not sign the concessions until the central government passes a bill, which transfers authority over solid waste management from local governments to the central government.⁵⁹ As such, two of the selected companies never fully began work, while two others – Alam Flora and Southern Waste⁶⁰ – proceeded at their own risk.⁶¹

Alam Flora was awarded the lucrative Pahang and Selang regions that include Kuala Lumpur and account for an estimated 54 percent of generated waste.⁶² Alam Flora currently manages approximately 6,000 metric tons of waste per day, much of which goes into properly engineered landfills. The company is paid by the 24 municipal governments that it serves, a system that the company favors as it is believed that

⁵⁶ Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 13, 2003.

⁵⁷ American Chamber of Commerce member companies contend that Kualiti Alam's services are limited, costs are rising each year, and they sometimes have to store or export waste because Kualiti Alam cannot handle it in a timely manner. Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁵⁸ Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 13, 2003.

⁵⁹ It is believed that the law will be signed in early 2004.

⁶⁰ Southern Waste won the contract that covers Jahor state.

⁶¹ Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁶² Percentage based on estimates of waste generation by Malaysian industry source.

direct billing would not be well received by residents.⁶³ As the company's operations mature, it plans to build incinerators and more economical and environmentally sound landfills. Alam Flora predicts that in the next 20 years all local landfills will be capped and the country will rely on two super-landfills, likely abandoned tin mines, and two high-volume incinerators. These projects are not currently viable due, in part, to the fact that the trash volume generated in Malaysia is not high enough to justify the rail costs.⁶⁴

Few companies provide recycling services in Malaysia as this industry segment is not believed to be lucrative due to a lack of participation by the public. Industry sources believe that more effective and consistent public awareness campaigns are needed to motivate the population to recycle waste products.⁶⁵ Currently there are no recycling laws in Malaysia, though the Government set a 3-percent recycling goal in 2003, which the country has reportedly met.⁶⁶ The Government intends to increase this recycling goal by one percent per annum until it reaches 22 percent in 2023. According to a Malaysian industry source, the country will have difficulty establishing a recycling industry because it is not poor enough to have an effective informal recycling sector, but it is not yet developed enough to have a modern, efficient recycling system.⁶⁷

Trade and Investment

Trade and investment in solid and hazardous waste management services in Malaysia is believed to be minimal owing to the monopolistic structure of both industry segments.⁶⁸ As monopoly contracts are phased out, opportunities may arise for foreign firms to enter the market. However, current regulations state that foreign investment in waste management firms is limited to a 30-percent equity stake. Despite the fairly closed market, a handful of foreign companies have found market opportunities. For example, World Resources Company, which is U.S.-based, is active in reclamation of precious metals from industrial waste. While the company actually exports the waste to the United States before treating and recycling the

⁶³ There is unfavorable public sentiment associated with privatization due to a failed effort with sewage privatization. In that case the company awarded the project began charging sewage fees to the public and then did not follow through with the project.

⁶⁴ Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁶⁵ The Government of Malaysia has instituted and promoted recycling programs, but industry sources believe that efforts to date fall short of what is needed to generate widespread participation. Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁶⁶ Industry representative, interview by USITC staff, Kuala Lumpur, Malaysia, Oct. 10, 2003.

⁶⁷ Ibid.

⁶⁸ Design and construction of waste treatment facilities by foreign firms, especially Japanese, is prevalent, but operation of such facilities by foreign firms is not.

metals, it provides collection and transportation services in Malaysia.⁶⁹ The Government of Malaysia has not made any specific GATS commitments on refuse disposal services.⁷⁰

Future Prospects

As developing countries in the Asia-Pacific region continue to strengthen and enforce environmental regulations, the demand for proven, cost-effective treatment methods is likely to increase. Japanese companies that have already invested in construction of waste management infrastructure, feasibility studies, environmental impact assessments, etc., will likely be in a favorable position to seize upon emerging market opportunities in those countries.

In Japan, demand for environmental services will likely grow, especially as public awareness of environmental issues increases. While there is not currently any notable competition within the domestic waste management market, owing to the propensity toward long-term contracts with established companies, industrial waste management is becoming more competitive as new technologies emerge.⁷¹ Market segments that may experience particularly rapid growth in the future include environmental management consulting and pesticide disposal.

⁶⁹ WRC recovers silver, copper, nickel, and gold from wastewater sludge (N151 – metal hydroxide sludge) from electronics manufacturers. However, it noted that its business is declining as many electronics companies are moving to China and/or becoming more technologically efficient, thereby reducing mineral waste. In 2000, the company exported 2,000 metric tons of sludge, but exported only 300 metric tons during Jan.-Oct. 2003.

⁷⁰ General Agreement on Trade in Services (GATS), *Malaysia: Schedule of Specific Commitments*, GATS/SC/52, Apr. 15, 1994.

⁷¹ Japanese Government representative, interview by USITC staff, Tokyo, Japan, Oct. 7, 2003.

CHAPTER 7

OTHER DEVELOPING-COUNTRY MARKETS

Introduction

Although solid and hazardous waste management is in a very early stage of development in Chile, Egypt, and South Africa, these three countries are among the more advanced within their respective regions in terms of identifying and addressing solid and hazardous waste management problems relative to their current structural and resource constraints. Apparent among these three countries is a growing recognition at the national level that there is a critical link between sustained economic development and an effective and comprehensive environmental program that includes solid and hazardous waste management. Accordingly, each government has recently been making a concerted effort to move its country toward the most efficient solid and hazardous waste management program that can be achieved with available resources. Although these emerging waste management markets are comparatively small, they have the potential of developing into significant trade opportunities in the future as more established country-markets achieve saturation¹ and decline in activity.² This will likely be a long-term endeavor because Chile, Egypt, and South Africa are still in the process of developing regulations and standards relating to the proper management of their waste streams.

This chapter includes a brief overview of solid and hazardous waste services markets in Africa, Latin America, and the Middle East, followed by separate discussions on market conditions, trade, and investment in the solid and hazardous waste services industries of Chile, Egypt, and South Africa.

Regional Market Overview

Solid and hazardous waste services markets in Africa, Latin America, and the Middle East are relatively small, as countries in these regions often have limited financial or regulatory capacity to address environmental concerns. In 2000, solid waste management markets in Latin America, the Middle East, and Africa were valued at \$1.6 billion, \$1.0 billion, and \$442 million, respectively, while hazardous waste

¹ Established markets for solid and hazardous waste become saturated as industries are increasingly able to employ advanced technologies to effectively control the disposal of waste, reduce waste output, and transfer waste into a usable commodity. To some extent, developing waste management markets such as those of Chile, Egypt, and South Africa may benefit from already developed and proven technology used by the more established waste management countries.

² Environmental Business International, Inc. (EBI), *EBI Report 2000, The U.S. Environmental Industry and Global Market*, Sept. 2001, pp. 18-6 to 18-7; and industry representative, interview by USITC staff, Washington, DC, Nov. 12, 2003.

management markets in these regions were valued at \$239 million, \$274 million, and \$32 million, respectively. Together, these three regions account for less than 3 percent of the global market for solid and hazardous waste management services.³ Existing environmental regulations in these regions typically address water and/or air pollution, but do not often address solid or hazardous waste. However, Chile, Egypt, South Africa, and a number of other countries in these regions are parties to the Basel Convention— an international environmental accord concerning the transboundary movement and management of hazardous waste.⁴

Chile

Market Overview

Data on the size of Chile's solid and hazardous waste services market is not available. However, industry sources have estimated that waste generation in Chile totaled over 1.8 billion metric tons in 2001,⁵ 34 percent of which was thought to comprise hazardous waste (table 7-1).⁶ The mining industry⁷ generates the vast majority of waste in Chile, with an estimated 1.8 billion metric tons. Municipal waste was thought to account for 3.3 million metric tons of waste, industrial waste⁸ for 2.5 million metric tons, construction waste for 3.5 million metric tons, and medical waste for 29,000 metric tons. Based on the anecdotal evidence outlined below, it is believed that very little of the solid and hazardous waste generated in Chile is handled and disposed of in a controlled manner.

Controlled municipal waste is collected, transported, and disposed of by both municipalities and private companies. Most controlled municipal waste in Chile is disposed of in landfills, 75 percent of which are operated by private companies.⁹ However, many landfills are reported to be poorly constructed, resulting in environmental contamination. There are three sanitary landfills in Chile: two in the Santiago Metropolitan Region and one in the city of Rancagua, located 50 miles south of Santiago.¹⁰ In the Santiago Metropolitan Region, two companies—Empresa

³ EBI, *The Global Environmental Market by Region, 2000*, attachment to an e-mail message, received July 31, 2003.

⁴ United Nations Environment Programme, Secretariat of the Basel Convention, "List of Parties to the Basel Convention," found at Internet address <http://www.basel.int/ratif/ratif.html>, retrieved Dec. 9, 2003.

⁵ U.S. Department of Commerce (USDOC), U.S. Foreign and Commercial Service (US&FCS), Research Reports, *Chile, Environmental Technologies - Solid Waste*, by Isabel Valenzuela, Oct. 13, 2001, p. 2, found at Internet address <http://www.s...penDocument&sessID=A07A043F2913979/>, retrieved Apr. 29, 2003.

⁶ Ibid.

⁷ Includes copper, iron ore, nitrates, precious metal, and molybdenum mining.

⁸ Includes waste generated by the metal manufacturing, chemicals, paper, and textiles industries.

⁹ Allen Blakey, "The Locals Rule South of the Border," *International Waste*, 1999, p. 78.

¹⁰ USDOC, *Chile - Solid Waste Management - Summary - ISA 990901, 1999*, p. 5.

Table 7-1
Selected characteristics of the Chilean solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Waste generation/treatment	An estimated 1.2 billion metric tons of solid waste is generated per year (disproportionate amount of which is mining waste), of which a small amount is thought to be managed. ¹	An estimated 600 million metric tons of hazardous waste is generated per year (most of which is mining waste), of which a small amount is thought to be managed. ¹
Market size (2000)	An estimated \$1.4 billion for equipment and services most of which is accounted for by the Santiago Metropolitan Region. ²	(³)
Trade (2000)	Solid waste equipment and services: exports- none, imports- \$1.4 billion. ²	Hazardous waste equipment and services: exports- none; imports- data not available, but such imports are thought to be increasing in conjunction with Chile's industrial growth. ²
Nature of industry	The solid waste industry is relatively small and primarily concentrated in the Santiago metropolitan region, with five private waste treatment companies accounting for a majority of the solid waste services market. ⁴	Three of the top five solid waste companies handle hazardous waste. ² These firms maintain facilities only in Santiago. ⁴
Key market participants (and location of parent)	Residential waste- EMERES Ltda. (Chile) and KDM (U.S.); industrial waste- Hidronor (Spain) and Bravo Energy (U.S.). ⁴	Industrial hazardous waste- Hidronor (Spain) and Bravo Energy (U.S.); medical waste- PROCESAN (Chile). ⁴
Principal methods of waste treatment and disposal	Landfills account for most controlled disposition of waste. ⁴	With only two hazardous waste facilities, both in Santiago, much of this waste is thought to be dumped at uncontrolled sites. Medical waste in Santiago is primarily incinerated. ⁴
Key regulations	The Environmental Framework Law, 1994, provides a general legal basis for environmental protection. ⁵ Chile has been working to establish the necessary legislative framework and regulatory infrastructure for waste management, particularly hazardous waste, but these measures are not expected to be enacted until 2008. ⁶	

See footnotes at end of table.

Table 7-1—continued
Selected characteristics of the Chilean solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Regulatory authorities	Chile does not have a centralized government agency with legislative and enforcement authority over environmental issues. Each ministry is responsible for establishing standards in the sector it regulates, and the ministries' regional offices have enforcement responsibility. Environmental coordinating agencies include CONAMA and COREMAs. ⁵	
GATS commitments	Chile has scheduled no GATS commitments on refuse disposal services, but its commitments on environmental engineering design services grant limited market access and national treatment for the foreign provision of such services through cross-border supply and consumption abroad. ⁷	
Other measures affecting trade and investment	Exporters are increasingly required by their foreign customers to achieve ISO 14000 waste management certification. ⁵	

¹ USDOC, US&FCS Research Reports, *Chile Environmental Technologies - Solid Waste*, by Isabel Valenzuela, Oct. 13, 2001, p. 2.

² USDOC, US&FCS Research Reports, *Chile Country Commercial Guide FY 2003 - Leading Sectors for U.S. Exports and Investments*, by Carlos Capurro, Aug. 28, 2002, p. 3.

³ Not available

⁴ USDOC, *Chile - Solid Waste Management - Summary - ISA 990901*, 1999, pp. 1-7.

⁵ USDOC, International Trade Administration (ITA), *Chile - Environmental Technologies Export Market Plan*, May 1998, pp. 6-9, and 23.

⁶ U.K. Trade and Investment, "Environmental Market in Chile," Opportunities Profile - Mining, p. 4.

⁷ General Agreement on Trade in Services (GATS), *Chile: Schedule of Specific Commitments*, GATS/SC/18, Apr. 15, 1994.

Metropolitana de Tratamiento de Residuos Solidos (EMERES) and Kiasa Demarco S.A. (KDM)—dominate the municipal collection and disposal market. EMERES is controlled by the mayors of 19 municipalities in the southern part of the Santiago metropolitan region, and owns and operates the Lepanto sanitary landfill. KDM, a private company with U.S. investors, owns and operates a transfer station and the Santiago Region's other sanitary landfill. KDM reportedly signed a 16-year waste management contract in 1995 with Cerros de Renca, an organization that represents 20 municipalities in the northern half of the Santiago metropolitan region.

In the Santiago Metropolitan Region, two companies—Hidronor (owned by Belgian-based Machiels) and Bravo Energy Chile S.A. (owned by U.S.-based Bravo Energy Trading N.A.)—dominate the industrial waste services market. Each company has one facility to serve the region, both of which are equipped to handle solid and hazardous industrial waste. There are no known facilities for the management of hazardous industrial waste outside the Santiago Metropolitan Region.¹¹

Incineration is the primary method of managing medical waste. Procesos Sanitarios S.A.(PROCESAN) is the only company authorized to dispose of hazardous medical

¹¹ Ibid., p. 9.

waste in Chile. However, the firm's only facility, which is located in the Santiago Metropolitan Region, manages only about five percent of all hazardous medical waste generated in Chile.¹²

Although recycling is not practiced on a large-scale basis, there is some formal and informal recycling of aluminum, cardboard boxes, paper, and glass in Chile. Individuals collect small volumes of recyclable materials from homes and businesses and sell these items to small intermediary companies who, in turn, sell them to companies that recover the materials. Some industries sell recyclable material directly to intermediaries or to paper and glass producing companies that use recovered materials as production inputs. However, recycled material is often more expensive than virgin material,¹³ reducing the demand for recycled material and associated services.

Chile's efforts to manage its solid and hazardous waste stream may be constrained by a lack of national standards and regulations that specifically address the collection, transportation, and disposal of such waste. Chile's environmental regulatory system is shaped primarily by its "Environmental Framework Law," which was enacted in March 1994. This law provides a general legal basis for environmental protection in Chile. Key regulatory elements—which apply to solid and hazardous waste management together with all environmental issues—include a process for establishing environmental standards, economic mechanisms for implementing standards (e.g., tradeable permits, pollution charges, and user fees), and mandatory environmental impact assessments for all major projects or activities.¹⁴

Much of the country's industrial waste is dumped in uncontrolled areas, as many waste generators simply pay a nominal fee to independent garbage collectors to haul it away. Chile's Association of Professionals for the Environment estimated that only 10 percent of the country's construction solid waste and 40 percent of its industrial solid waste are handled in a controlled manner.¹⁵ Only Santiago has established a cradle-to-grave manifest system to track industrial hazardous waste. Although the Government of Chile has been working to establish a legislated standard and regulatory package that specifically addresses the collection, transportation, and disposal of solid waste, medical waste, and industrial hazardous waste at the national level, business concerns and a lack of resources have stalled the effort. The Chilean Government estimates that it could take another five years to establish a national regulatory structure for industrial solid and hazardous waste management.¹⁶ Chile also has not established national regulations regarding the management of solid and hazardous mining waste. However, starting around 1998, government agencies and mining companies drafted proposed regulations and

¹² USDOC, Chile - Solid Waste Management - Summary - ISA 990901, 1999, p. 9.

¹³ *Ibid.*, p. 8.

¹⁴ USDOC, International Trade Administration, *Chile - Environmental Technologies Export Market Plan*, May 1998, p. 6.

¹⁵ USDOC, US&FCS Research Reports, *Chile, Environmental Technologies - Solid Waste*, pp. 2-4.

¹⁶ U.K. Trade and Investment, "Environment Market in Chile," Crown copyright date 2003, found at Internet address <http://www.tradepartners.gov.uk/environment/chile/opportunities.shtml>, retrieved Nov. 20, 2003.

voluntary “good practice” standards for adoption by Chile’s mining industry. These measures, which are designed to safeguard the environment in mining areas, are generally enforced by waste generators themselves.¹⁷

There is no central government agency with legislative and enforcement authority over environmental issues in Chile. Under the auspices of the Environmental Framework Law, the National Environmental Commission (CONAMA) was established to coordinate the country’s environmental policies. CONAMA’s Council of Directors is composed of the General Secretary of the Presidency and the heads of each of the government’s 11 ministries, including the Ministries of Health, Public Works, Mining, and Agriculture. In addition to this national coordinating agency, there are similar agencies for each of Chile’s 12 regions called the Regional Environmental Commissions (COREMA). Each COREMA includes the regional governor and the regional representative of each of the 11 ministries. To ensure coordination of national and regional policies, the director of each COREMA also serves on the executive unit of CONAMA. However, neither CONAMA nor the COREMAs have the authority to enforce environmental regulations. Instead, CONAMA can suggest that a ministry take a particular course of action to correct a problem within its specific jurisdiction. Likewise, the COREMAs rely on the regional ministries to handle the enforcement of regulations.¹⁸

In addition to the regulatory environment, factors affecting the demand for solid waste management services in Chile include economic growth, increased industrial production, and rising consumption in the 1990s. Taken together, these factors resulted in a rapid increase in the generation of solid and hazardous waste. Other factors that have produced some measure of demand for solid and hazardous waste management services include the implementation of environmental education programs that have raised environmental consciousness, particularly among the university population,¹⁹ and the development of international trade relationships. The latter is particularly important, as businesses interested in exporting are increasingly required by potential international trade partners to adopt and become certified in international environmental management standards such as the International Standardization Organization’s (ISO’s) 14000 series.²⁰ Such requirements may increase demand for environmental services—including solid and hazardous waste services—among Chilean exporters.²¹

¹⁷ U.K. Trade and Investment, “Environment Market in Chile.”

¹⁸ USDOC, International Trade Administration, *Chile - environmental Technologies Export Market Plan*, pp. 6-9.

¹⁹ USDOC, US&FCS Research Reports, *Solid Waste Management*, by Isabel Valenzuela, Oct. 1, 2002, p. 2, found at Internet address <http://www.s...penDocument&sessID=90BB044D2903021/>, retrieved Apr. 29, 2003.

²⁰ The ISO series was developed to provide businesses with a structure for managing environmental impacts, and confers a “stamp of approval” on a company’s environmental practices.

²¹ USDOC, International Trade Administration, *Chile - Environmental Technologies Export Market Plan*, p. 24.

Trade and Investment

Although data on trade and investment in the Chilean waste management market do not exist, it is likely that Chile imports some solid and hazardous waste services through the foreign-owned waste management affiliates that have established a presence in the Chilean market. Foreign investment in Chilean waste management facilities includes Belgium-based Hidronor's \$25 million industrial and hazardous waste plant,²² and a similar facility owned by U.S.-based Bravo Energy Trading. Japan established a channel for its companies to actively pursue opportunities in the Chilean market by helping to finance a preliminary study on industrial solid waste in the late 1990s.

Chile has made no commitments on refuse disposal services under GATS, and its commitments on environmental engineering design services grant limited market access and national treatment for the foreign provision of such services through cross-border supply and consumption abroad.²³ In addition, Chile's GATS schedule indicates that authorization of foreign investment in service industries may be contingent on such factors as employment generation and the use of local inputs. Much like the GATS, the U.S.-Chile Free Trade Agreement (FTA) covers both cross-border supply of services and the right to invest and establish a local presence in a wide range of service sectors including environmental services, construction, and engineering. The U.S.-Chile FTA will protect all forms of investment and would remove certain restrictions on U.S. investors, such as requirements to buy Chilean inputs.²⁴

Egypt

Market Overview

Industry sources estimate that Egypt's market for municipal and industrial waste management (goods and services) totaled \$40 million in 1998, with the hazardous waste management segment accounting for an estimated \$30 million of the total.²⁵ It was estimated that 20-30 million metric tons of municipal and industrial solid waste and 100,000-300,000 metric tons of hazardous waste were generated in 2000 (table 7-2).²⁶ Egypt's primary solid and hazardous waste generating industries include

²² Ibid., pp. 20-23.

²³ General Agreement on Trade in Services (GATS), *Chile: Schedule of Specific Commitments*, GATS/SC/18, Apr. 15, 1994.

²⁴ U.S. Trade Representative, *2003 National Trade Estimate Report on Foreign Trade Barriers*, pp. 43-45.

²⁵ USDOC, International Trade Administration, *Egypt - Environmental Technologies Export Market Plan*, Feb. 1999, pp. 21-22.

²⁶ USDOC, US&FCS Market Research Reports, *Egypt - Environmental Equipment and Services*, by Heba Abdel Aziz, June 8, 2003, pp. 4-5, found at Internet address http://www.stat-usa.gov/mrd.nsf/vwISA_Country/016F8FEED4C3B/, retrieved Aug. 26, 2003.

Table 7-2
Selected characteristics of the Egyptian solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Waste generation/treatment	An estimated 20-30 million metric tons of solid waste was generated in 2000, little of which is believed to be managed. ¹	Approximately 100,000 to 300,000 metric tons of hazardous industrial waste and about 20,000 metric tons of hazardous medical waste are generated per year; little of either type of waste is thought to be managed. ¹
Market size (1998)	Approximately \$10 million (goods and services). ²	Approximately \$30 million (goods and services). ²
Trade	Egypt is likely a net importer of solid waste services. ²	Egypt is likely a net importer of hazardous waste services. ²
Nature of industry	The overall environmental services industry is small and relatively new due to the recent establishment of the Egyptian Environmental Affairs Agency (EEAA) in 1994, ² followed by the establishment of the Ministry of State for Environmental Affairs in 1997. ¹	
Key market participants (and location of parent)	Municipal authorities tend to dominate the managed waste market, although they plan to transfer operations to the private sector. ² French-based Onyx does provide landfill services at one facility near Alexandria. ³	The controlled waste market is not fully developed and a dominant participant has not emerged. ⁴
Principal methods of waste treatment and disposal	Municipal waste is disposed of in unlined open dumps; waste also may be open-air burned to reduce the volume. ²	There are no disposal facilities for hazardous industrial waste in Egypt, and such waste is typically managed in the same manner as nonhazardous industrial waste. Health waste is generally open-air burned or disposed of in unlined dumps. ²
Key regulations	Environmental Conservation Law 4/1994 ²	
Regulatory authorities	Egyptian Environmental Affairs Agency. ²	Egyptian Environmental Affairs Agency. Line ministries issue hazardous waste licenses for relevant industry (i.e., Ministry of Industry, Agriculture, etc.). ²

See footnotes at end of table.

Table 7-2—continued
Selected characteristics of the Egyptian solid and hazardous waste services market

Item	Solid waste	Hazardous waste
GATS commitments	Egypt scheduled no GATS commitments on refuse disposal services. Egypt's GATS schedule lists restrictions on other service sectors that may affect the foreign provision of refuse disposal services, including limits on commercial presence (allows only joint ventures) and limits on foreign equity. ⁵	
Other measures affecting trade and investment	Exporting firms are increasingly required by their foreign customers to achieve ISO 14000 waste management certification. ²	

¹ Calculated by Commission staff from USDOC, US&FCS Market Research Reports, *Egypt - Environmental Equipment and Services*, by Heba Abdel Aziz, June 8, 2003, pp. 3-5.

² USDOC, International Trade Administration, *Egypt - Environmental Technologies Export Market Plan*, Feb. 1999, pp. 5-8, 21-22, and 24-25.

³ Cam McGrath, "Raising a Sink," *Egypt Today*, Aug. 2003.

⁴ Research has uncovered no evidence regarding the activities of specific firms in Egypt's hazardous waste services sector.

⁵ General Agreement on Trade in Services (GATS), Egypt: Schedule of Specific Commitments, GATS/SC/30, Apr. 15, 1994.

metal foundries, chemicals and petrochemicals, electroplating, and textiles.²⁷ Anecdotal evidence suggests that very little of the solid and hazardous waste generated in Egypt is treated or disposed of in a controlled environment.²⁸

Municipal waste collection primarily has been a public sector responsibility, with the reliability of service varying from location to location depending on economic conditions. Large-capacity trucks are used in relatively affluent areas that can afford this service, while small vehicles such as pickup trucks and pull carts are typically used in poor urban neighborhoods and rural areas. There are few if any engineered sanitary landfills in Egypt, and many operators of unlined open dumps burn waste to reduce the volume.²⁹ Although prohibited by law, waste is often burned in open spaces.

²⁷ U.S. Central Intelligence Agency, *The World Factbook - Egypt*, Aug. 2003, p. 9, found at Internet address <http://www.cia.gov/publications/factbook/geos/eg.html>, retrieved Nov. 3, 2003.

²⁸ Ministry of State for Environmental Affairs, Egyptian Environmental Affairs Agency, "Achievements and Planned Activities-- Solid Waste Management," found at Internet address <http://www.eeaa.gov.eg/English/main/accomp4.asp/>, retrieved Dec. 4, 2003; and Support for Environmental Assessment and Management (SEAM) Organization, "Solid Waste Management Strategy for Dakahleya Governorate," case study dated 1999, found at Internet address www.seamegypt.com/Manuals/DakahSolidWaste/content/html/, retrieved Dec. 4, 2003.

²⁹ USDOC, International Trade Administration, *Egypt - Environmental Technologies Export Market Plan*, p. 21.

Industrial and hazardous waste collection and disposal are arranged by waste-generating firms. Owing to a lack of hazardous waste management facilities, such waste is generally mixed with industrial solid waste and disposed of in open dumps.³⁰ Open burning and dumping are the prevailing methods for disposing of medical waste. Estimates suggest that a \$350-million investment would be needed to properly manage hazardous waste produced by Egyptian medical facilities, reduce waste-borne diseases and ailments, and establish a database on the quantity and composition of hazardous medical waste generated in Egypt.³¹

Despite the relatively small size of Egypt's waste management market, there is a growing push to control its solid and hazardous waste generation as evidenced in recent regulatory developments. Egypt's current regulatory framework for solid and hazardous waste management is based on the "Law for the Environment" (Law 4 enacted in 1994). This legislation provides for the development of standards, monitoring systems, environmental impact assessments, and enforcement mechanisms with respect to both air pollution and solid and hazardous waste. The legislation also prohibits the dumping, treating, or burning of solid waste in unauthorized locations, and established the Egyptian Environmental Affairs Agency (EEAA) as the national implementing authority. However, EEAA shares its waste management responsibilities with as many as 15 sectoral ministries—including the Ministry of Health, Ministry of Industry and Mineral Resources, and Ministry of Housing, Utilities, and New Communities—which has reportedly made it difficult to develop and implement a national, integrated solid and hazardous waste management plan.

Factors that may affect the provision of solid and hazardous waste services in Egypt include municipal government plans to transfer management operations to private enterprises in an effort to improve efficiency,³² and Federal Government plans to develop waste control programs in cooperation with businesses, nongovernment organizations, and consumer groups.³³ One incentive spurring demand for solid and hazardous waste management services in Egypt is the growing pressure on exporting businesses to adopt and become certified in established environment management standards such as ISO 14000 series.³⁴ In addition, a number of development agencies have made funds available for the clean-up and protection of Egypt's environment, including the International Bank for Reconstruction and Development (IBRD), the Danish International Development Agency (DANIDA), and the Finnish International Development Agency (FINNIDA). For example, FINNIDA funded a waste management system and a licensed landfill in Alexandria for the collection, treatment, and disposal of certain types of industrial hazardous waste. IBRD supports pollution abatement investments in Cairo, Alexandria, Suez, and Ismailia.³⁵ Moreover, DANIDA completed a feasibility study for an industrial hazardous waste

³⁰ Ibid., p. 22.

³¹ USDOC, US&FCS Market Research Reports, *Egypt - Environmental Equipment and Services*, p. 5.

³² Ibid., P. 24.

³³ Ibid., p. 5.

³⁴ USDOC, International Trade Administration, *Egypt - Environmental Technologies Export Market Plan*, p. 25.

³⁵ Ibid., pp. 22-23.

management project in Cairo and FINNIDA is funding an ongoing project for the integrated management of dump sites.³⁶

Trade and Investment

Although data on the extent of foreign trade and investment in Egypt are not readily available, there is evidence that several foreign-owned companies provide solid and hazardous waste management services in the market. As of 2001, Onyx SA, a subsidiary of French-based Veolia Environment, provided waste collection services and landfill management in Egypt.³⁷ During 1999-2002, Finland-based Plancenter Ltd. reportedly provided consulting services for developing the FINNIDA hazardous waste management project in Alexandria, Egypt, discussed above; this project is pending approval by appropriate government authorities.³⁸ Also, U.S.-based SCS Engineers helped the governorate of Alexandria, Egypt to develop a privatization program for its solid waste management and public cleaning system. This project consisted of developing a solid waste management and monitoring system, preparing tender evaluation criteria, developing scenarios for the unbundling of services, preparing the contract and a framework for implementing the project, establishing a financial model for determining the least cost and present value of each component of the solid waste and public cleaning system, and developing a contract monitoring plan.³⁹

Although Egypt was an active participant in the Uruguay Round negotiations on services, it made no commitments on refuse disposal services under the General Agreement on Trade in Services (GATS). Egypt's GATS schedule lists restrictions on other service sectors that may affect the foreign provision of refuse disposal services, including limits on commercial presence (allows only joint-venture companies) and limits on foreign equity.⁴⁰

³⁶ USDOC, US&FCS Market Research Reports, *Egypt - Environmental Equipment and Services*, p. 4.

³⁷ Cam McGrath, "Raising a Sink," *Egypt Today*, Aug. 2003, found at Internet address <http://www.egypttoday.com/issues/0308/>, retrieved Dec. 10, 2003.

³⁸ Finland Ministry of Foreign Affairs, Projects in Egypt 1999, found at <http://global.finland.fi/english/projects/countries/egypt.htm/>, retrieved Dec. 12, 2003; and International Consulting Services of the Finnish Environment Institute (SYKE), List of All Projects, found at Internet address <http://www.vyh.fi/eng/intcoop/projects/consult/allproje.html/>, retrieved Dec. 17, 2003.

³⁹ SCS Engineers, "Phase I: Solid Waste Privatization Assistance-- Alexandria, Egypt, 2002," found at Internet address http://www.scsengineers.com/InternationalProjects_SWP_PIEgypt.html/, retrieved Dec. 4, 2003.

⁴⁰ General Agreement on Trade in Services (GATS), *Egypt: Schedule of Specific Commitments*, GATS/SC/30, Apr. 15, 1994.

South Africa

Market Overview

Although data reflecting the size of South Africa's solid and hazardous waste services market are not available, industry sources estimate that the country generated approximately 560-600 million metric tons of solid and hazardous waste in 2001 (table 7-3). The mining sector⁴¹ alone is thought to account for 450-500 million metric tons, or 80 percent, of South African waste generation.⁴² Manufacturing industries that generate a significant amount of waste in South Africa include metalworking, machinery, iron and steel, and chemicals.⁴³ Anecdotal evidence suggests that very little of the solid and hazardous waste stream in South Africa is treated or disposed of in a controlled manner.⁴⁴

Over half of South Africa's communities do not have access to waste collection services, and municipal waste collection, where it exists, is reportedly irregular. Most collected waste is reportedly disposed of in landfills. There are about 540 known landfill operations in South Africa, 61 percent of which operate under permits. However, industry sources estimate that there could be as many as 15,000 landfill sites in the country. A number of small communities burn waste in incinerators. The siting, construction, and operation of these small-scale incinerators was accomplished to serve an urgent need with little apparent regard for environmental impact.⁴⁵

There is very little information concerning the management of industrial solid and hazardous waste in South Africa. One hazardous waste landfill at Holfontein reportedly serves the Gauteng, Mpumalanga, Free State, Northwest, and Northern provinces. Hazardous waste facilities reportedly also exist in Western Cape, Kwa Zulu-Natal, and Eastern Cape.⁴⁶ Solid waste from mining generally is deposited on tailing heaps or is used to backfill mines and rehabilitate sites.⁴⁷ With regard to medical waste, on-site incineration by hospitals is the prevailing method of disposal. For example, in the Province of Gauteng, there are 54 small-scale incinerators in

⁴¹ Includes gold, platinum, and chromium mining.

⁴² USDOC, US&FCS Market Research Reports, *South Africa - Waste Management*, by Averil Millard, Oct. 1, 2002, pp. 3-4, found at Internet address <http://www.s...penDocument&sessID=8017042029832F9/>, retrieved Apr. 29, 2003.

⁴³ U.S. Central Intelligence Agency, *The World Factbook - South Africa*, Aug. 2003, p. 7, found at Internet address <http://www.cia.gov/publications/factbook/geos/eg.html/>, retrieved Nov. 3, 2003.

⁴⁴ U.K. Trade and Investment, "Environment Market in South Africa," Crown copyright 2003, found at Internet address http://www.tradepartners.gov.uk/environment/south_africa/profile/overview.shtml/, retrieved Nov. 20, 2003.

⁴⁵ USDOC, US&FCS Market Research Reports, *South Africa - Waste Management*, pp. 2-3.

⁴⁶ *Ibid.*, p. 5.

⁴⁷ USDOC, International Trade Administration, *South Africa - Environmental Technologies Export Market Plan*, Oct. 1998, p. 17.

Table 7-3
Selected characteristics of the South African solid and hazardous waste services market

Item	Solid waste	Hazardous waste
Waste generation/treatment	South Africa produced an estimated 560-600 million metric tons of solid waste in 2001, some of which was disposed of at controlled sites. ¹	(2)
Trade (2000)	South Africa may be a net importer of solid waste services. ³	South Africa may be a net importer of hazardous waste services. ³
Nature of industry	A very small industry in its first stages of development, responding to pressing needs on a reactionary basis. Despite the availability of equipment, South Africa does not have a waste management system and thus lacks an organized waste disposition service. ¹	South Africa's hazardous waste services industry is likely very small or nonexistent. ⁴
Key market participants (and location of parent)	Municipal authorities tend to dominate controlled waste management through landfill ownership. ⁵ French-based Onyx has recently established a subsidiary in South Africa which manages solid waste. ⁶	French-based Onyx has recently established a subsidiary in South Africa which may have the capacity to manage hazardous waste. ⁶
Principal methods of waste treatment and disposal	Landfills account for the largest share of controlled waste disposition, followed by some recycling conducted by private companies that generate the waste, and a minor amount of composting by private entrepreneurs. Mining waste is disposed on-site at tailing dams and mine dumps. ¹	Controlled health waste is disposed through incineration. Other hazardous waste tends to be disposed of in landfills or unregulated dumps. ¹
Key regulations	Environmental Conservation Act ⁷ and the White Paper on Integrated Pollution and Waste Management. However, neither of these statutes have been implemented by formal proclamation. ¹	There is no legislation that directly applies to hazardous waste management. ⁷
Regulatory authorities	Department of Environmental Affairs and Tourism, Department of Water Affairs and Forestry, and Department of Health. ⁷	

See footnotes at end of table.

Table 7-3–continued

Selected characteristics of the South African solid and hazardous waste services market

Item	Solid waste	Hazardous waste
GATS commitments	GATS commitments grant full market access and national treatment to foreign providers of refuse disposal services through cross-border supply (mode 1), consumption abroad (mode 2), and commercial presence (mode 3). South Africa's GATS schedule lists restrictions in other services that may affect the foreign provision of refuse disposal services, including technical limitations on market access and national treatment through cross-border supply for general construction work for civil engineering and limitations on the size of building plans for market access through cross-border supply and consumption abroad. ⁸	
Other measures affecting trade and investment	Exporting businesses are increasingly required by their foreign customers to achieve ISO 14000 waste management certification. ⁷	

¹ USDOC, US&FCS Market Research Reports, *South Africa - Waste Management*, by Averil Millard, Oct. 1, 2002, p. 1-15.

² Not available.

³ Anecdotal evidence indicated that at least one foreign owned firm is providing waste management services in South Africa. Research has uncovered no evidence of South African firms providing waste management services in foreign markets. Onyx South Africa Waste Management Services website, home page, found at Internet address <http://www.onyxsa.com>, retrieved Nov. 21, 2003.

⁴ Research has uncovered evidence of one firm that may provide hazardous waste services in South Africa. Onyx South Africa Waste Management Services website, home page, found at Internet address <http://www.onyxsa.com>, retrieved Nov. 21, 2003.

⁵ The World Bank, Urban Development Division, Waste Management Anchor Team, *Observations of Solid Waste Landfills in Developing Countries: Africa, Asia, and Latin America*, by Lars Mikkel Johannessen with Gabriel Boyer, June 1999, p. 11.

⁶ Onyx South Africa Waste Management Services website, home page, found at Internet address <http://www.onyxsa.com>, retrieved Nov. 21, 2003.

⁷ USDOC, International Trade Administration, *South Africa - Environmental Technologies Export Market Plan*, Oct. 1998, p. 4, 7, and 9.

⁸ General Agreement on Trade in Services (GATS), *South Africa: Schedule of Specific Commitments*, GATS/S/78, Apr. 15, 1994.

operation. Non-burn technologies reportedly are being introduced as an alternative to the existing incinerators, possibly as a result of public pressure to address air pollution concerns.⁴⁸

There is very little recycling activity in South Africa because the cost of recovered materials is frequently higher than that of new materials. However, some recycling initiatives that were developed on an adhoc basis with private sector funding have met with some success. Paper and fiber recycling is fairly well-developed and is controlled by SAPPI, Mondi, and Nampak, South Africa's three largest paper companies. Steel and aluminum cans are recycled by a company called Collect-a-Can, which has a detinning facility in Gauteng Province. Owing to the availability of recyclable materials at landfills, informal salvaging is widespread. Informal recycling is particularly common in undeveloped areas, where some waste is

⁴⁸ USDOC, US&FCS Market Research Reports, *South Africa - Waste Management*, pp. 7-8.

converted into useable household items such as bags, mats, and toys. Composting is also conducted on an informal basis by private entrepreneurs.⁴⁹

South Africa does not have a central government agency with regulatory and enforcement authority over environmental issues. Since the dismantling of apartheid in 1994, the Government of South Africa has made some preliminary efforts to improve the legal and regulatory framework for environmental management. For example, the new constitution emphasizes the importance of environmental health and welfare, pollution control, nature conservation, and sustainable social and economic development. Also, the Department of Environmental Affairs and Tourism published the *White Paper on Environmental Management Policy for South Africa* in May 1998 and a draft *National Environmental Management Bill* in June 1998, currently pending approval.⁵⁰ In the meantime, the Government of South Africa is using pre-1994 environmental regulations in order to meet immediate needs. South Africa has a large body of environmental protection legislation on the books, including the country's major environmental law, the Environment Conservation Act, and more than 30 statutes covering land-based pollution. However, these have never been effectively implemented.⁵¹

Other factors that limit demand for solid and hazardous waste services in South Africa include pressing social and economic issues such as the high unemployment rate and growing HIV/AIDS infection rates. In addition, substantial economic problems remain from the apartheid era, most notably the high level of poverty (an estimated 33 percent of households) and the lack of economic empowerment among disadvantaged groups.⁵² As long as these issues remain top government priorities, efforts to address environmental problems may not garner a substantial amount of scarce public resources.⁵³ Nevertheless, domestic businesses' interest in exporting may stimulate the demand for solid and hazardous waste management services in South Africa, as trade partners are increasingly pressing exporters to adopt and become certified in established environment management standards such as the ISO 14000 series.

Trade and Investment

Evidence suggests that foreign participation in the South African solid and hazardous waste management market is limited. French-based Veolia Environment has recently established a solid and hazardous waste subsidiary in South Africa called Onyx South Africa Waste Management Services.⁵⁴ Weston Solutions, Inc., a U.S.-based waste management company, in partnership with Peacock Bay Environmental Services, a South African-based waste management company, recently concluded a two-year business development program in South Africa. However, the waste management

⁴⁹ Ibid., pp. 5-7.

⁵⁰ USDOC, International Trade Administration, *South Africa - Environmental Technologies Export Market Plan*, p. 9.

⁵¹ Ibid.

⁵² U.S. Central Intelligence Agency, *The World Factbook - South Africa*, p. 6.

⁵³ Industry representative, interview by USITC staff, Washington, DC, Nov. 12, 2003.

⁵⁴ Onyx South Africa Waste Management Services web site, home page, found at Internet address <http://www.onyxsa.com/>, retrieved Nov. 21, 2003.

proposal put forward by Weston and Peacock at the end of this program was not accepted, likely due to South Africa's resource constraints. In retrospect, the high-technology program offered in Weston's original proposal may have been out-of-reach for the newly emerging South African waste management market. One industry representative observed that South Africa's leadership is in the difficult situation of deciding which critical public needs to fund with very scarce public resources in order to achieve the greatest public benefit in the least amount of time.⁵⁵

South Africa's commitments on refuse disposal services under the GATS grant full market access and national treatment for the foreign provision of such services through cross-border supply, consumption abroad, and commercial presence. South Africa's GATS schedule lists restrictions in other services that may affect the foreign provision of refuse disposal services, including technical limitations on market access and national treatment through cross-border supply for general construction work for civil engineering, as well as limitations on the size of building plans for market access through cross-border supply and consumption abroad.⁵⁶

Future Prospects

Solid and hazardous waste services markets in Africa, Latin America, and the Middle East are modest in both relative and absolute terms. Chile, Egypt, and South Africa, which are considered regional leaders, are just beginning the process of assessing the full economic burdens associated with a lack of effective environmental legislation, regulation, and enforcement. As regulations and enforcement become more robust, the growth of industrial activity with its attendant solid and hazardous waste management issues will likely expand at a rate slightly greater than the growth of domestic waste management capacity. During this developmental phase, these countries will likely be net importers of services, equipment, and capital to implement solutions toward achieving adequate standards of solid and hazardous waste management.

Chilean efforts to address the treatment and disposal of solid and hazardous waste are expected to result in the construction of additional certified sanitary landfills to meet growing demand for waste disposal capacity. This increase in demand is driven by the pending approval of regulations pertaining to the management of industrial and hazardous waste, the country's goal to dispose of 80 percent of all solid waste in certified sanitary landfills, and the adoption of ISO standards and certification protocols by Chilean exporters.⁵⁷

Egyptian Decree 338/1995 requires the licensing of hazardous waste generation, collection, storage, transport, treatment, and disposal operations. This action establishes a framework for the foreign provision of hazardous waste management

⁵⁵ Pre-hearing written submission, Michael T. Werner, Esq., Client Services Manager, Weston Solutions, Inc., Oct. 6, 2003; and industry representative, interview by USITC staff, Washington, DC, Nov. 12, 2003.

⁵⁶ General Agreement on Trade in Services (GATS), *South Africa: Schedule of Specific Commitments*, GATS/SC/78, Apr. 15, 1994.

⁵⁷ U.K. Trade and Investment, "Environment Market in Chile."

services.⁵⁸ Further, the establishment and maturing of regional branch offices of the Egyptian Environmental Affairs Agency, as well as increasing standardization in planning cycles, work plans, budgets, operating procedures, and staff skill levels, should enhance opportunities in the Egyptian waste management market.⁵⁹ Lastly, the completion of a \$1.3 million USAID-funded project to develop guidelines for the classification and safe handling of hazardous wastes and a system to license entities that generate, handle, or dispose of such waste will likely provide a common structure for managing hazardous wastes and create commercial opportunities for waste management firms.⁶⁰

It appears that near-term trade opportunities in South Africa's solid and hazardous waste management market are somewhat limited owing to a variety of resource constraints. However, there may be selected opportunities for developing niche waste management markets. For example, the World Bank has initiated a pilot project to harness methane gas emissions from three landfills in Durban to use in the generation of electricity. Development of the project is anticipated to start sometime in 2004, following an environmental impact assessment.⁶¹ The recycling of tires, which is reportedly required by the Department of Environmental Affairs and Tourism, is also expected to provide additional market opportunities in the solid and hazardous waste services sector.⁶²

⁵⁸ USDOC, International Trade Administration, *Egypt - Environmental Technologies Export Market Plan*, p. 6.

⁵⁹ Egyptian Environmental Policy Program, found at Internet address <http://www.greencom.org/greencom/papers.asp?type=country&letter=E/>, retrieved Dec. 4, 2003.

⁶⁰ U.S. Embassy in Cairo, "U.S., Egypt Put Hazardous Waste Management into Action," press release, July 13, 2003, found at Internet address <http://cairo.usembassy.gov/usis/pr071303.html/>, retrieved Dec. 4, 2003.

⁶¹ Vernon Mchunu, "World Bank Project Will Draw Power From Trash," *The Mercury*, Jun. 27, 2003, found at Internet address http://www.iol.co.za/index.php?click_id=13&art_id=vn2003062703..., retrieved Dec. 4, 2003.

⁶² John Sutter, "Fixing a Tyred Environment," Apr. 6, 2003, found at Internet address http://www.news24.com/News24/South_Africa/News/0,,2-7-1442..., retrieved Dec. 4, 2003.

CHAPTER 8

SUMMARY

A cross-country comparison of the information presented throughout this report suggests that there is a significant relationship between income and the characteristics of national solid and hazardous waste services markets. Among the countries discussed in this report, high-income economies typically generate more solid waste than middle-income economies. High-income countries manage a greater share of their waste, are more likely to employ modern waste management techniques, and are more likely to maintain and enforce strict waste management regulations than developing economies. Trade and investment in the solid and hazardous waste services sector is also more prevalent among developed economies than developing countries. However, some market characteristics, including hazardous waste generation and private participation in hazardous waste management markets, may be unrelated to per capita income levels.

This chapter provides an overview of the country-specific information presented in the preceding chapters, and compares this information in an effort to identify trends in the global markets for solid and hazardous waste services and in the provision of such services across national borders.

Market Conditions

Solid Waste Management

An analysis of the information presented in this investigation suggests that high-income countries tend to generate more solid waste than developing countries (table 8-1). A direct comparison of per capita municipal solid waste¹ generation rates and per capita income levels across the subject countries indicates that there is a positive relationship between waste generation and income: waste generation tends to grow as per capita income increases (figure 8-1). Thus, for example, middle-income economies such as China, Chile, the Czech Republic, and Mexico are observed as generating less waste per capita than high-income countries.² The stringency and enforcement of solid waste management regulations also seem to be closely related to per capita income levels.

¹ Municipal solid waste generation rates are used in this comparison, as the definition of municipal solid waste tends to be more comparable across countries than definitions of other waste streams.

² The World Bank Group defines lower-middle income countries (China, Egypt, and South Africa) as those with per capita GDP of \$736– \$2,935, upper-middle income countries (Chile, Czech Republic, Malaysia, and Mexico) \$2,936– \$9,075, and high income (Australia, Canada, European Union, Japan, and United States) \$9,076 or more. Municipal waste generation data were not available for Australia, Canada, Egypt, Malaysia, or South Africa.

Table 8-1
Characteristics of selected solid waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
Australia	14.4 million metric tons per year, 95 percent of which is managed.	Mostly landfilling and recycling.	Private sector dominates.	Competitive and moderately concentrated market: top 4 firms account for 57 percent of revenues (includes solid and hazardous waste segments).	Highly regulated, enforcement is decentralized but believed to be strong.
Canada	31.4 million metric tons in 2000; most of which was managed.	Landfilling and incineration (73 percent, combined); recycling (24 percent).	Private sector dominates.	Mature market but not highly concentrated; number of firms has grown in recent years as public-sector provision of services has decreased.	Recent, more rigorous regulations enacted or under development in numerous provinces following national legislation enacted in 1999; enforcement is strong.
Chile	9.3 million metric tons of municipal and industrial solid waste per year, over half of which is managed. 1.2 billion metric tons of mining waste per year, little of which is managed.	Mostly landfilling and open dumping.	Public sector dominates the overall market; private companies dominate collection in Santiago Metropolitan Region and sanitary landfilling.	Evolving market, very competitive with low overall market concentration, though sanitary landfill market concentrated among 4-5 companies.	Municipal solid waste treatment laws exist though enforcement is believed to be low.
China	160 million metric tons of municipal solid waste per year; 45-50 percent of which is managed. 950 million metric tons of industrial solid waste per year; 85 percent of which is reportedly managed.	For municipal waste: landfilling (45 percent) and open dumping (55 percent). For industrial waste: recycling (53 percent), storing (32 percent), and landfilling (18 percent).	Public sector dominates.	Evolving market is highly fragmented and decentralized; many municipalities regard waste management as a free public service.	Solid waste treatment laws exist though enforcement is believed to be low.

Table 8-1—continued
Characteristics of selected solid waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
Czech Republic	26.9 million metric tons in 2002; most of which was managed.	Landfilling (21 percent), and recycling (20 percent).	Private sector dominates; municipalities generally keep a minority interest in service providers, while larger cities commission turnkey contractors.	Evolving, competitive market.	Comprehensive waste treatment laws; enforcement moderate and improving in preparation for EU accession.
Egypt	20-30 million metric tons per year; a small portion of which is believed to be managed.	Mostly open dumping.	Public sector dominates, but government plans to transfer operations to private sector.	Few private companies primarily because Egypt has limited resources for waste management.	Solid waste treatment laws exist, though enforcement is believed to be low.
European Union	Approximately 2.2 billion metric tons per year in Western Europe during 1998-2001; most of which was believed to be managed.	Mostly landfilling; some incineration, recycling, and composting.	Public sector dominates, though the private sector will likely account for a larger market share in the future.	Mature market, highly competitive.	National environmental regulations becoming stronger and more comprehensive.
Japan	238.4 million metric tons per year; most of which is managed.	Incineration (75 percent).	Private sector dominates.	Mature market, highly competitive.	Highly regulated and strongly enforced.
Malaysia	5.5 million metric tons per year; an estimated 45 percent of which is managed.	Open dumping (50 percent), landfilling (30 percent).	Private sector will dominate upon completion of privatization in 2004.	Evolving market; 3 companies control 75 percent of market.	Regulation is pending and expected to be passed in 2004.

Table 8-1—continued
Characteristics of selected solid waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
Mexico	At least 31 metric million tons per year, an estimated majority of which is managed.	Mostly landfilling.	Public sector dominates; limited private participation by Mexican-owned firms.	Evolving market is highly fragmented and decentralized; many municipalities regard waste management as a free public service.	Few Federal regulations cover nonhazardous waste; Federal Government provides technical support, capacity building aid to sub-Federal authorities, is trying to decentralize. Evolution of State and municipal regulation of solid waste management is limited.
South Africa	Estimated 560-600 million metric tons per year, little of which is believed to be managed.	Mostly landfilling.	Most landfills are publicly owned but privately operated.	Evolving market with few companies operating, primarily because South Africa has limited resources for waste management.	Solid waste treatment laws exist, though enforcement is believed to be low.

Table 8-1—continued
Characteristics of selected solid waste markets

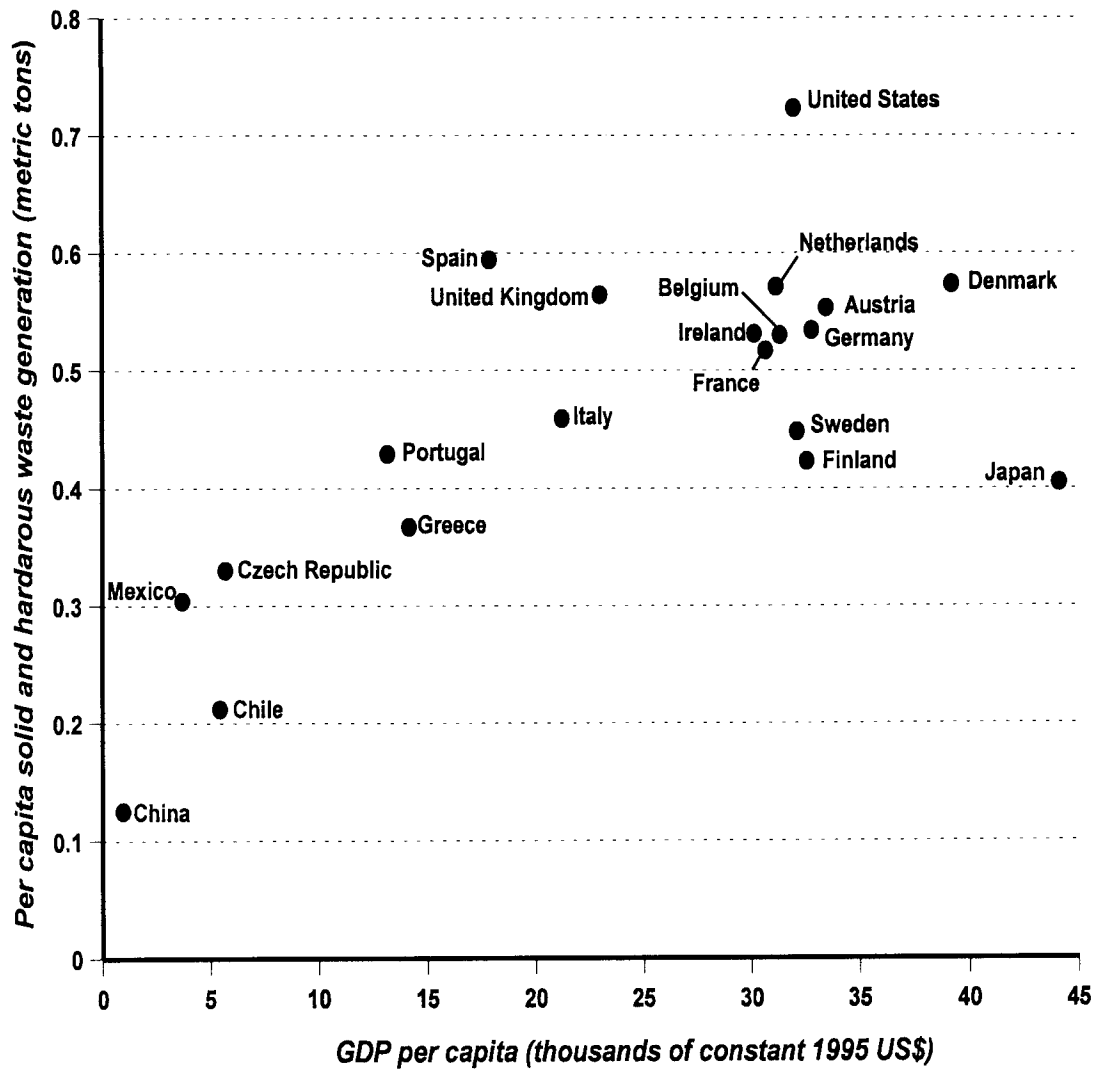
Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
United States	208 million metric tons ¹ in 2001; 100 percent of which was managed (total excludes construction and demolition waste, believed to account for an additional 34-69 million tons).	Landfilling (55 percent), recycling (30 percent), waste-to-energy (15 percent).	Private sector dominates (69 percent of sector revenues) .	Mature market, highly consolidated; 3 largest firms serving the market accounted for 47 percent of revenues in 2001, though 2002 data indicate that 11,200 firms provided services in this market.	Highly regulated and strictly enforced.

¹ Total does not include municipal sludges; industrial nonhazardous wastes; construction and demolition debris; and agricultural, oil and gas, and mining wastes. Industry estimates for solid waste generation, which include data for certain municipal solid waste as well as solid waste excluded from EPA data, exceeded 363 million metric tons in 2001. These industry estimates were generated using methodologies that are substantially different from the one developed by EPA.

U-8

Source: Compiled by the U.S. International Trade Commission from various primary and secondary sources. For more specific information and citations see the country-specific tables presented in chapters 3-7.

Figure 8-1
 GDP and municipal solid waste per capita, by country, 2002



Source: OECD and the World Bank.

High-income countries typically manage a larger share of their solid waste streams than developing countries. Solid waste management tends to begin with open dumping and/or burning, before shifting to controlled disposal technologies such as landfilling, incineration, and recycling. Middle-income countries usually employ some combination of these methods with a greater propensity toward open dumping and landfilling, though recycling of industrial solid waste to recover precious metals or other valuable materials is common. High-income countries typically employ sanitary landfilling, incineration, and recycling, with the former being the most prevalent waste treatment option. The composition often varies according to resource restrictions and/or cultural biases. For example, because Australia has ample land and a public aversion to incineration, most of its waste is landfilled or recycled. Conversely, in Japan land is very expensive and in short supply, so most waste is incinerated. Recycling rates tend to increase with waste generation rates, particularly in high-income countries. Recycling is typically undertaken by the private sector as such efforts must be undertaken on a large scale in order to be profitable. Municipalities do not always have, or are unwilling to expend, the resources to maintain such operations and often contract out recycling activities to private firms, or rely upon market forces to prompt private firms to take initiative.

In high-income countries, the solid waste management industry tends to be dominated by private firms, even though the responsibility for proper waste disposal may ultimately fall upon public agencies. In many middle-income countries, waste removal is still considered a free public service that state and local governments undertake themselves. A lack of privatization laws and public unwillingness or inability to pay for more efficient trash collection and disposal have made it difficult for some developing countries to introduce private sector participation into the waste management sector. In Japan, the United States, Canada, and many European Union countries, solid waste markets are mature and highly concentrated, thereby making market entry more challenging. Countries like Mexico, China, and the Czech Republic may ultimately provide more market opportunities owing to high levels of unmet demand, though new ventures may be exposed to higher risk levels.

Hazardous Waste Management

It is not possible to formulate definitive conclusions based on cross-economy comparisons of hazardous waste generation rates, as the definition of hazardous waste often differs substantially from country to country. However, the information presented in table 8-2 suggests that total hazardous waste generation in a given country may not be closely related to a country's level of development. Both high-income countries and middle-income countries rank among the largest (Chile and Japan) and smallest (Australia, Egypt, and Malaysia) generators of hazardous waste. By contrast, the management of such waste does seem to be related to income levels, as high-income countries tend to manage a larger share of their hazardous waste streams than developing countries. One notable exception to this trend is Malaysia, which reportedly treats 90 to 95 percent of its hazardous waste. Most of the sample economies employ advanced hazardous waste treatment and disposal methods. Specially engineered landfilling, incineration, and chemical treatment are the most common treatment methods used in high-income countries, and are employed to some extent by middle-income countries as well. It is reported that some of the

Table 8-2
Characteristics of selected hazardous waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
Australia	275,000 metric tons in 2000, virtually all of which was managed.	Specially engineered landfilling, chemical treatment, and recycling.	Private sector dominates.	Competitive and moderately consolidated market, top 4 firms account for 57 percent of revenues (includes solid and hazardous segments).	Highly regulated; enforcement is decentralized but believed to be strong.
Canada	6 million metric tons in 2000, virtually all of which was managed.	Landfilling is believed to predominate. Half of hazardous waste imported in 2001 was recycled, 21 percent landfilled, 15 percent incinerated, and 13 percent physically or chemically treated.	Private sector dominates.	Competitive market, consolidation is likely to increase due to overcapacity in disposal technologies.	Canadian standards for landfilling of hazardous waste are less stringent than U.S. regulations, especially with regard to pretreatment requirements, but more stringent regulations have recently been introduced in some provinces. Enforcement is strong.
Chile	Estimated 600 million metric tons per year, little of which is believed to be managed.	Landfilling, incineration, and open dumping.	Private sector dominates.	Evolving market, with two companies currently dominating the Santiago market.	Regulations are currently being developed.
China	10 million metric tons per year, most of which is reportedly managed.	Incineration, chemical neutralization, solidification, and landfilling.	Public sector dominates but the government is encouraging private sector initiatives.	Evolving market, not consolidated.	Highly regulated; enforcement is believed to be moderate.
Czech Republic	1.3 million metric tons in 2002, 57 percent of which was managed.	Recycling (27 percent), physical chemical treatment (14 percent), and landfilling (10 percent).	Private sector dominates.	Evolving, competitive market.	Comprehensive waste treatment laws; enforcement is moderate and improving in preparation for EU accession.

Table 8-2—continued
Characteristics of selected hazardous waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
Egypt	Estimated 100,000-300,000 metric tons per year, little of which is believed to be managed.	Open dumping and burning.	Public sector dominates, but government is planning to transfer operations to the private sector.	Market is in early stages of development.	No government regulations currently exist.
European Union	Estimated 4.7 million metric tons per year in Western Europe during 1997-2001, most of which was believed to be managed.	Landfilling, recycling, and incineration.	Private sector dominates.	Mature, consolidated market, though opportunities exist in accession country and niche markets (e.g., medical waste treatment).	Highly regulated and strongly enforced.
Japan	Estimated 220 million metric tons in 2000, most of which was managed.	Incineration, chemical treatment, and landfilling of treated waste.	Private sector dominates.	Mature market, highly competitive.	Highly regulated and strongly enforced.
Malaysia	363,000 metric tons in 2002, 90-95 percent of which was reportedly managed.	Incineration, chemical treatment, and storage.	Private sector dominates.	A single company has exclusive rights to all incineration and chemical treatment through 2013.	Highly regulated; enforcement is believed to be moderate.
Mexico	Estimated 6 to 11 million metric tons per year, 25 percent of which is believed to be managed.	Incineration (waste-to-energy) predominates; sterilization for medical waste.	Mexican-owned private firms are believed to dominate.	Evolving, fragmented market consisting of approximately 873 firms.	Regulation is evolving; enforcement is believed to be most stringent near the U.S.-Mexican border, and inconsistent in other areas of Mexico.
South Africa	No data available.	Open dumping and landfilling.	Private sector dominates.	Although market is in early stages of development, a few private companies are operating.	No regulations currently exist.

Table 8-2—continued
Characteristics of selected hazardous waste markets

Country	Waste generation and share managed	Principal treatment methods	Extent of private participation	Market competitiveness	Regulatory environment
United States	36 million metric tons generated by large-quantity generators in 1999, which, according to industry sources, account for approximately 60 percent of hazardous waste generation; 100 percent of which was managed.	Land disposal, mainly deep-well or underground injection (69 percent), thermal treatment (11 percent), and recovery (8 percent).	Private sector dominates.	Mature market with approximately 1,200 firms operating. Clean Harbors holds the largest share of the hazardous waste market (12 percent), while Stericycle holds the largest share (25 percent) of the medical waste market.	Highly regulated and strongly enforced; extensive liability laws related to cleanup of contaminated sites provide strong incentive for effective waste management.

Source: Compiled by the U.S. International Trade Commission from various primary and secondary sources. For more specific information and citations see the country-specific tables presented in chapters 3-7.

developing economies also engage in open dumping and uncontrolled landfilling and burning of hazardous waste. However, as is the case with solid waste, many of those countries also take measures to recover potentially useful materials from the waste stream prior to disposal. The hazardous waste management industry is dominated by the private sector in almost all of the sample countries, regardless of income level. In most cases, state and local governments require industry to bear the burden of treating its hazardous waste.

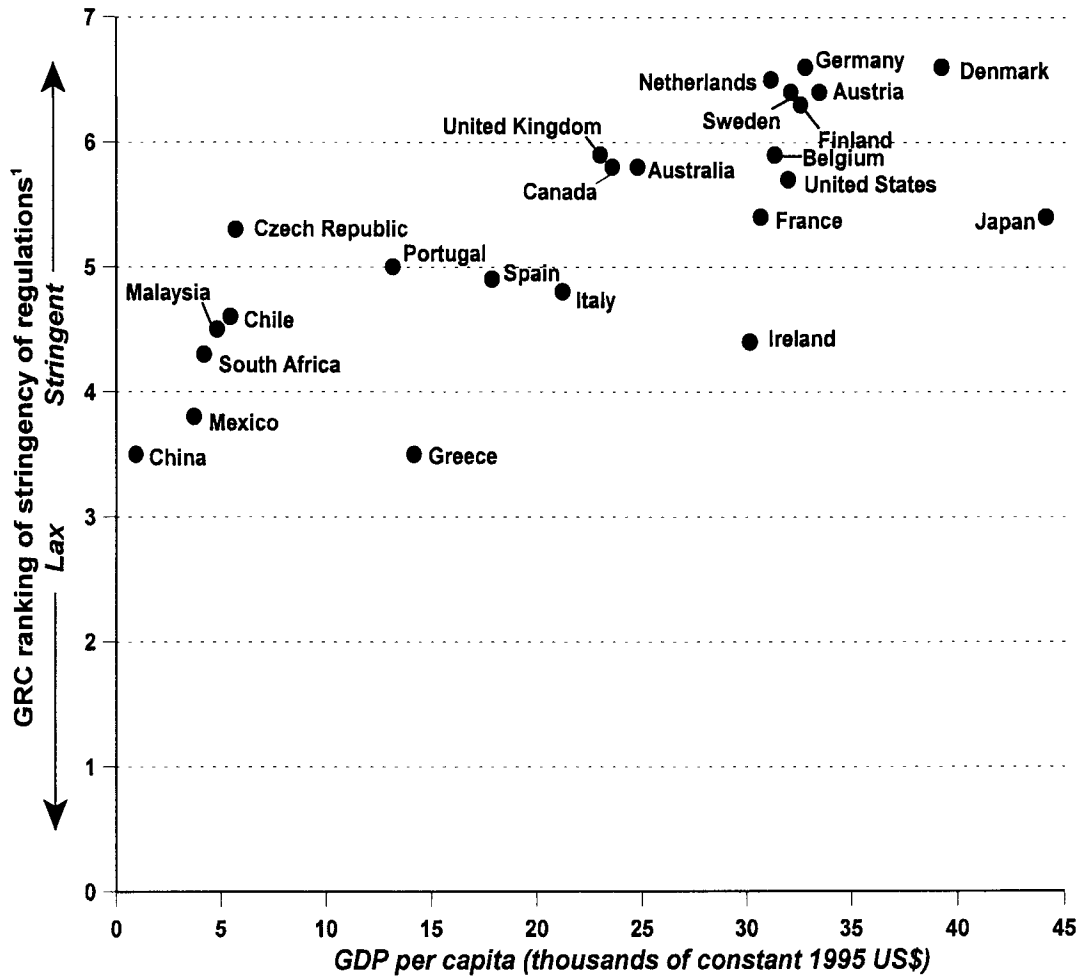
The stringency of hazardous waste regulations and the ability of governments to monitor and enforce those laws differ widely among the sample economies. Hazardous waste regulation and enforcement is typically more stringent in high-income economies than that in developing economies. A comparison of per capita income levels and industry perceptions regarding the stringency of national toxic waste regulations reinforces the positive relationship between the stringency of regulations and per capita income (figure 8-2): toxic waste regulations are generally considered to be more stringent in high-income countries and less stringent in countries with lower per capita income levels. In developing countries such as China, Mexico, Chile, and South Africa, toxic waste disposal regulations may exist but are perceived as weak, and therefore noncompliance and illegal disposal may be more common than in high-income countries. Alternately, in some instances, developing countries may be able to enforce the laws but lack adequate treatment capacity, thus requiring companies to store hazardous waste until treatment options become available.

Trade and Investment

The extent of cross-border trade and investment in solid and hazardous waste management services differs dramatically among the countries examined in this study (table 8-3). Such activity is most common among high-income countries where stringent regulation and consistent enforcement create steady demand for waste management services and encourage the development of waste management capacity. In the European Union, Japan, and the United States, markets for waste management services are mature and highly competitive. Thus, many firms in these economies seek new market opportunities abroad. Although trade accounts for a substantial portion of Canadian waste management activities, there are also substantial opportunities within that country's domestic market as the industry is only moderately concentrated and new regulations have recently emerged. Australia is currently believed to be a net exporter of waste management services, though import levels may rise as the country attempts to lessen its reliance on landfilling. Among the selected middle-income countries, trade can be sporadic reflecting immediate, short-term needs rather than long-term service solutions. In Chile, China, and Malaysia, imports of equipment and technology are more common than services, as those countries work toward establishing waste management infrastructure. As the regulatory environment and the technology in those countries continue to evolve, opportunities for trade will likely increase.

Few of the countries selected for discussion in this report have explicit restrictions on trade in solid and hazardous waste management services. However, regulations

Figure 8-2
 GDP per capita and industry perceptions of toxic waste regulations, by country, 2002



¹ Data on toxic waste regulations were derived from the World Economic Forum's *The Global Competitiveness Report 2002-2003*, in which executives of international firms were polled on the stringency of toxic waste disposal regulations in selected countries. On a scale of 1-7, a rating of 1 denotes lax regulations compared with most other countries, while a rating of 7 indicates that regulations are among the world's most stringent. Toxic waste was not defined in the World Economic Forum's report.

Source: GDP data obtained from the World Bank.

Table 8-3

Extent of solid and hazardous waste services trade by certain countries, and measures affecting such trade

Country	Cross-border trade	Foreign operations	Type of measure affecting trade/affiliate transactions	Description of measure
Australia	Net exporter.	Foreign firms control 25 percent of the solid and hazardous waste management market. Australian exporters of solid and hazardous waste management services focus largely on the Asia-Pacific and European markets.	Investment contingencies.	Prospective foreign investors must obtain investment approval from the the Foreign Investment Review Board, which may deny specific foreign investment on the basis of national interest.
Canada	Net importer of solid waste services, as 1 million tons of Canadian waste products were transferred to foreign markets, virtually all to the United States, while 97,000 tons of foreign-generated waste entered Canada, again virtually all from the United States. Net exporter of hazardous waste services, as 560,000 tons of foreign waste, principally from the United States, entered Canada for treatment and disposal, while 324,000 tons were transferred abroad, virtually all to the United States.	Canada's largest solid waste management firm is a subsidiary of a U.S. firm, and additional U.S. firms compete there. More municipalities are divesting waste management operations and issuing contracts to private firms, attracting domestic and foreign participants. Canadian firms are beginning to establish operations in the U.S. market through acquisitions. Major U.S. hazardous waste management firms compete in the market, although leading European firms are believed to have reduced their operations in Canada. Canadian waste management firms' operations in the U.S. market are thought to be limited to transportation of waste across the U.S.-Canadian border.	Land purchase. Accreditation of engineers: <ul style="list-style-type: none"> • Market access. • National treatment. Accreditation of consulting engineers: <ul style="list-style-type: none"> • Market access. 	Its GATS commitments indicate that numerous provinces place national treatment limitations on the purchase of land by non-residents. In all modes of supply except commercial presence, most provinces require permanent residency; Quebec requires citizenship. Saskatchewan requires residency for engineering services provided by cross-border supply and the presence of natural persons. Manitoba requires commercial presence for services provided through cross-border supply and consumption abroad.
Chile	Imports in 2000 totaled \$1.4 billion for solid and hazardous waste services and equipment.	Three foreign-based companies dominate the solid waste disposal service in the Santiago Metropolitan Region. No foreign-based companies are known to operate outside of Santiago.	Investment contingencies.	Contingencies include percent of local employment for projects and use of local input materials.

Table 8-3—continued

Extent of solid and hazardous waste services trade by certain countries, and measures affecting such trade

Country	Cross-border trade	Foreign operations	Type of measure affecting trade/affiliate transactions	Description of measure
China	Minimal, though believed to be a net importer.	Few foreign companies operate in China's solid and hazardous waste management market.	Equity limitations.	Foreign investors limited to 50 percent financial stake.
			Licensing requirements.	Ambiguous licensing guidelines make it difficult for foreign engineering firms to obtain necessary permits except on a project-by- project basis.
			Land ownership.	All land owned by the government, which grants fee-based usage rights for set periods. Compensation for early repossession of land is assured by law in some cases but is inconsistent and standards are unclear.
Czech Republic	Net importer.	Czech firms primarily operate domestically, where they compete with EU firms.	Full market access.	No known restrictions.
Egypt	Net importer.	Several foreign-based companies have provided various solid waste management services, including collection and disposal of solid waste, and consulting services for developing a hazardous waste management program and for privatizing the solid waste management system. No single company is known to dominate Egypt's emerging solid and hazardous waste market.	Equity limitations.	Limitations apply to construction services.
			Land purchase.	Limitations apply to acquisition of land for commercial purposes.

Table 8-3—continued

Extent of solid and hazardous waste services trade by certain countries, and measures affecting such trade

Country	Cross-border trade	Foreign operations	Type of measure affecting trade/affiliate transactions	Description of measure
European Union	<p>Net exporter.</p> <p>Indicators are that exports to destinations outside the EU generate less than 5 percent of the EU environmental services industry's revenue, while less than 10 percent of the sector's revenue is intra-EU trade.</p>	<p>EU firms operate throughout the EU and face virtually no outside competition within the market.</p>	<p>Classification requirements.</p> <p>No commitments scheduled for refuse disposal services via mode 1, due to technical infeasibility.</p>	<p>The EC proposed a new classification for environmental services that provides for services to be classified as "purely" environmental and classified according to the environmental media (i.e., air, water, solid and hazardous waste, etc.).</p>
Japan	<p>Net exporter.</p>	<p>Few, if any, foreign companies operate in Japan's solid and hazardous waste management market.</p>	<p>Licensing requirements.</p> <p>Market access.</p>	<p>Complicated and expensive licensing procedures for waste management service providers are common throughout Japan.</p> <p>Foreign companies are unlikely to enter the market successfully without a joint venture with a Japanese firm.</p>
Malaysia	<p>Minimal, though believed to be a net importer.</p>	<p>Few foreign companies operate in Malaysia's solid and hazardous waste management market.</p>	<p>Equity limitations.</p> <p>Market access.</p>	<p>Foreign investors limited to 30-percent financial stake.</p> <p>Privatization of solid and hazardous waste management services resulted in exclusive, long-term agreements for Malaysian firms.</p>

Table 8-3—continued

Extent of solid and hazardous waste services trade by certain countries, and measures affecting such trade

Country	Cross-border trade	Foreign operations	Type of measure affecting trade/affiliate transactions	Description of measure
Mexico	<p>Although data on Mexico's solid waste services trade are not available, Mexico is likely a net importer of solid waste services, in part because Mexican landfill capacity is insufficient to meet domestic demand in border areas.</p> <p>Net exporter of hazardous waste services, as available data indicate that the volume of Mexican waste transported to foreign markets for treatment and disposal (84,000 tons) is less than the volume of foreign waste transported to Mexico for treatment and disposal (255,000 tons).</p>	<p>The extent of participation by non-Mexican-owned solid waste firms in the market is believed to be small and largely by U.S. firms. Mexican firms are believed to operate solely in Mexico.</p> <p>Major U.S. hazardous waste firms operate selectively in the market, which is substantially underdeveloped. The extent of Mexican firms' participation in foreign markets is unknown and believed to be negligible.</p>	Equity limitations.	Mexico's GATS commitments limit foreign investment in architectural, engineering, and construction services. However, Mexico's commitments under NAFTA are less restrictive.
South Africa	May be a net importer.	At least one foreign-based company provides waste management services in South Africa. No single company is known to dominate South Africa's emerging solid and hazardous waste market.	Full market access.	No known restrictions.

Table 8-3—continued

Extent of solid and hazardous waste services trade by certain countries, and measures affecting such trade

Country	Cross-border trade	Foreign operations	Type of measure affecting trade/affiliate transactions	Description of measure
United States	<p>Net importer of solid waste services (\$503 million, exports; \$1.3 billion, imports).</p> <p>Net importer of hazardous waste services (\$95 million, exports; \$220 million, imports).</p>	<p>U.S. solid waste management firms serve prominently in the Canadian market; elsewhere abroad, U.S. firms have sold their European operations in order to focus resources primarily on the U.S. market. European firms, facing scant competition from external competitors in their home market, have acquired U.S. waste management firms and thus are competitive in the U.S. market.</p> <p>U.S. hazardous waste management firms are competitive in all North American markets, owning and operating facilities in Canada and Mexico, and participating elsewhere abroad through joint ventures and licensing agreements. European firms compete in the U.S. market significantly, relatively more than in solid waste, while facing virtually no competition from non-European firms in their home market.</p>	<p>Modes of supply 1,2,3:</p> <ul style="list-style-type: none"> • Market access/national treatment. <p>Land use.</p> <p>Licensing of natural persons:</p> <ul style="list-style-type: none"> • Market access. <ul style="list-style-type: none"> • National treatment. <p>Presence of natural persons:</p> <ul style="list-style-type: none"> • Market access. 	<p>U.S. GATS commitments on refuse disposal services only apply to certain services contracted by private industry.</p> <p>Wyoming requires reciprocal rights be extended to U.S. citizens by a foreign country whose citizen in Wyoming seeks to acquire or inherit land.</p> <p>U.S. citizenship is required for licensure for the provision of engineering or integrated engineering services in the District of Columbia.</p> <p>12 States require in-state residency for licensure for the provision of engineering or integrated engineering services.</p> <p>Michigan requires contractors providing construction and related engineering services in Michigan to maintain an office there.</p>

Source: Compiled by the U.S. International Trade Commission from various primary and secondary sources. For more specific information and citations see the country-specific tables presented in chapters 3-7.

and practices that pertain to all sectors, or to related sectors such as architecture and engineering, can potentially limit trade in the waste management industry. The most common trade barriers maintained by developing economies are equity limitations. Specifically, China, Egypt, Malaysia, and Mexico limit the share of equity that foreign investors can hold in any given enterprise. Additionally, complex licensing requirements and limitations on land ownership are prevalent among both developing and high-income countries.

APPENDIX A

REQUEST LETTER

EXECUTIVE OFFICE OF THE PRESIDENT
THE UNITED STATES TRADE REPRESENTATIVE
WASHINGTON, D.C. 20508

char, recd 7/1/03

✓ 1 - Secretary

2 - ER

3 - OPS

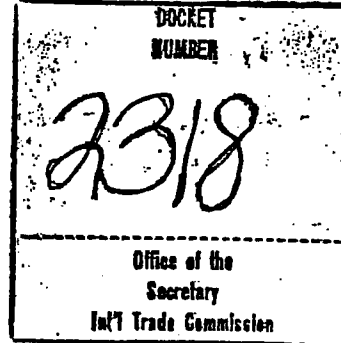
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RECEIVED
OFFICE OF THE SECRETARY
U.S. INTERNATIONAL TRADE COMMISSION
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JUL - 1 2003

The Honorable Deanna Tanner Okun
Chairman
U.S. International Trade Commission
500 E Street, SW
Washington, DC 20436

DOCKET



Dear Chairman:

As you know, members of the World Trade Organization (WTO) have been engaged in negotiations under the General Agreement on Trade in Services (GATS) since January 2000. These negotiations are intended to liberalize services trade by reducing or eliminating measures that limit effective market access.

With these negotiations in mind, two concise reports on discrete segments of the environmental services industry would be of interest to my office. The environmental services industry is currently receiving special emphasis in the WTO, as the reduction or elimination of barriers affecting trade in such services has been identified in the Doha Ministerial Declaration as one of the principal goals of the present negotiating round. Further information about environmental services markets will also be useful in carrying out the environmental review of this element of the current WTO negotiations, and in conducting future negotiations and reviews. Environmental services-- such as solid and hazardous waste management services and nature and landscape protection and remediation services-- are of great importance to the global economy in terms of both market size and the role of such industries in achieving sustainable development. Government efforts to address environmental degradation and industry efforts to increase efficiency and maintain favorable environmental records have increased demand for environmental services. Trade in such services ensures that all economies have access to reliable environmental technologies, and thus facilitates global environmental protection.

Therefore, I request, pursuant to authority delegated by the President under section 332(g) of the Tariff Act of 1930, that the U.S. International Trade Commission conduct two investigations and prepare reports. Each of these reports should, to the extent possible, (1) provide an overview of foreign and domestic markets for certain environmental services; (2) examine trade and investment in environmental services markets, including barriers affecting such trade and investment, if any; and (3) if possible, discuss existing regulatory practices. With regard to the geographic coverage of these reports, the Commission should endeavor to include examples from both developed- and developing-country markets. The Commission is also encouraged to include information gathered through public hearings and other consultations with interested parties.

Title: Solid and hazardous waste

The Honorable Deanna Tanner Okun
Page Two

The Commission is requested to deliver a report on the solid and hazardous waste services industry no later than nine months from receipt of this letter. For the purpose of this report, I urge the Commission to define the solid and hazardous waste management services industry to include the collection of solid and hazardous waste from households and industry; the treatment and disposal of solid and hazardous waste by various means; the collection, separation, and sorting of recyclable materials; waste compacting; waste reduction services; and incidental services. The Commission is requested to deliver a report on the remediation and nature and landscape protection services industry fifteen months from the receipt of this letter. The range of services to be investigated in the remediation and nature and landscape protection services industry report will be determined upon further consultation between USTR and USITC staff.

Upon completion of these reports, this office may make a similar request of the Commission with respect to the air pollution abatement services industry.

My office intends to make the Commission's reports available to the general public in their entirety. Therefore, the reports should not contain any confidential business or national security classified information.

The Commission's assistance in this matter is greatly appreciated.

Sincerely,



Robert B. Zoellick

Thank you for the help!

APPENDIX B
FEDERAL REGISTER NOTICE

(202-205-3438; rbrown@usitc.gov), Office of Industries, U.S. International Trade Commission, Washington, DC, 20436. For information on the legal aspects of this investigation, contact William Gearhart of the Office of the General Counsel (202-205-3091; wgearhart@usitc.gov). Hearing impaired individuals are advised that information on this matter can be obtained by contacting the TDD terminal on (202) 205-1810.

Background: As requested by the USTR, the Commission's report will, to the extent possible, (1) Provide an overview of foreign and domestic markets for remediation and nature and landscape protection services; (2) examine trade and investment in remediation and nature and landscape protection services markets, including barriers affecting such trade and investment, if any; and (3) if possible, discuss existing regulatory practices. USTR has requested that the Commission's study include examples from both developed and developing country markets. As requested by USTR, the range of services to be investigated in this study will be determined upon further consultation between USTR and ITC staff. The USTR asked that the Commission furnish its report by October 1, 2004, and that the Commission make the report available to the public in its entirety.

The USTR letter also requests an investigation on solid and hazardous waste services. In response, the Commission has instituted Investigation No. 332-455, Solid and Hazardous Waste Services: An Examination of U.S. and Foreign Markets, which is due to the USTR on April 1, 2004.

Public Hearing: A public hearing in connection with the investigation will be held at the U.S. International Trade Commission Building, 500 E Street SW., Washington, DC, beginning at 9:30 a.m. on March 17, 2004. All persons shall have the right to appear, by counsel or in person, to present information and to be heard. Requests to appear at the public hearing should be filed with the Secretary, United States International Trade Commission, 500 E Street SW., Washington, DC 20436, no later than 5:15 p.m., March 3, 2004. Any prehearing briefs (original and 14 copies) should be filed not later than 5:15 p.m., March 5, 2004; the deadline for filing post-hearing briefs or statements is 5:15 p.m., March 31, 2004. In the event that, as of the close of business on March 3, 2004, no witnesses are scheduled to appear at the hearing, the hearing will be canceled. Any person interested in attending the hearing as an observer or non-

participant may call the Secretary of the Commission (202-205-1816) after March 3, 2004, for information concerning whether the hearing will be held.

Written Submissions: In lieu of or in addition to participating in the hearing, interested parties are invited to submit written statements (original and 14 copies) concerning the matters to be addressed by the Commission in its report on this investigation. Commercial or financial information that a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of section 201.6 of the Commission's Rules of Practice and Procedure (19 CFR 201.6). All written submissions, except for confidential business information, will be made available in the Office of the Secretary to the Commission for inspection by interested parties. The Commission will not include any confidential business information in the report it sends to the USTR. To be assured of consideration by the Commission, written statements relating to the Commission's report should be submitted to the Commission at the earliest practical date and should be received no later than the close of business on March 31, 2004. All submissions should be addressed to the Secretary, United States International Trade Commission, 500 E Street SW., Washington, DC 20436. The Commission's rules do not authorize filing submissions with the Secretary by facsimile or electronic means, except to the extent permitted by 201.8 of the Commission's Rules (19 CFR 201.18) (see Handbook for Electronic Filing Procedures, ftp://ftp.usitc.gov/pub/reports/electronic_filing_handbook.pdf).

Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202-205-2000. General information concerning the Commission may also be obtained by accessing its Internet server (<http://www.usitc.gov>).

List of Subjects

WTO, GATS, remediation and nature and landscape protection services.

Issued: July 30, 2003.

By order of the Commission.

Marilyn R. Abbott,

Secretary to the Commission.

[FR Doc. 03-19818 Filed 8-4-03; 8:45 am]

BILLING CODE 7020-02-F

INTERNATIONAL TRADE COMMISSION

[Investigation 332-455]

Solid and Hazardous Waste Services: An Overview of U.S. and Foreign Markets

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation and scheduling of public hearing.

EFFECTIVE DATE: July 29, 2003.

SUMMARY: Following receipt of a request on July 1, 2003 from the United States Trade Representative (USTR), the Commission instituted investigation No. 332-455, Solid and Hazardous Waste Services: An Examination of U.S. and Foreign Markets, under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)).

FOR FURTHER INFORMATION CONTACT: Information specific to this investigation may be obtained from Jennifer Baumert, Project Leader (202-205-3450; jbaumert@usitc.gov), or Richard Brown, Chief, Services and Investment Division (202-205-3438; rbrown@usitc.gov), Office of Industries, U.S. International Trade Commission, Washington, DC, 20436. For information on the legal aspects of this investigation, contact William Gearhart of the Office of the General Counsel (202-205-3091; wgearhart@usitc.gov). Hearing impaired individuals are advised that information on this matter can be obtained by contacting the TDD terminal on (202) 205-1810.

Background: As requested by the USTR, the Commission's report will, to the extent possible, (1) Provide an overview of foreign and domestic markets for solid and hazardous waste services; (2) examine trade and investment in solid and hazardous waste services markets, including barriers affecting such trade and investment, if any; and (3) if possible, discuss existing regulatory practices. USTR has requested that the Commission's study include examples from both developed and developing-country markets. For the purpose of this study, solid and hazardous waste management services are defined to include the collection of solid and hazardous waste from households and industry; the treatment and disposal of solid and hazardous waste by various means; the collection, separation, and sorting of recyclable materials; waste compacting; waste reduction services; and incidental services.

The USTR asked that the Commission furnish its report by April 1, 2004, and

that the Commission make the report available to the public in its entirety.

The USTR letter also requests an investigation on remediation and nature and landscape protection services. In response, the Commission has instituted investigation No. 332-454, Remediation and Nature and Landscape Protection Services: An Examination of U.S. and Foreign Markets, which is due to the USTR on October 1, 2004.

Public Hearing: A public hearing in connection with the investigation will be held at the U.S. International Trade Commission Building, 500 E Street SW, Washington, DC, beginning at 9:30 a.m. on October 21, 2003. All persons shall have the right to appear, by counsel or in person, to present information and to be heard. Requests to appear at the public hearing should be filed with the Secretary, United States International Trade Commission, 500 E Street SW, Washington, DC 20436, no later than 5:15 p.m., October 7, 2003. Any prehearing briefs (original and 14 copies) should be filed not later than 5:15 p.m., October 9, 2003; the deadline for filing post-hearing briefs or statements is 5:15 p.m., November 5, 2003. In the event that, as of the close of business on October 7, 2003, no witnesses are scheduled to appear at the hearing, the hearing will be canceled. Any person interested in attending the hearing as an observer or non-participant may call the Secretary of the Commission (202-205-1816) after October 7, 2003, for information concerning whether the hearing will be held.

Written Submissions: In lieu of or in addition to participating in the hearing, interested parties are invited to submit written statements (original and 14 copies) concerning the matters to be addressed by the Commission in its report on this investigation. Commercial or financial information that a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of section 201.6 of the Commission's Rules of Practice and Procedure (19 CFR 201.6). All written submissions, except for confidential business information, will be made available in the Office of the Secretary to the Commission for inspection by interested parties. The Commission will not include any confidential business information in the report it sends to the USTR. To be assured of consideration by the Commission, written statements relating to the Commission's report should be

submitted to the Commission at the earliest practical date and should be received no later than the close of business on November 5, 2003. All submissions should be addressed to the Secretary, United States International Trade Commission, 500 E Street SW., Washington, DC 20436. The Commission's rules do not authorize filing submissions with the Secretary by facsimile or electronic means, except to the extent permitted by section 201.8 of the Commission's Rules, as amended, 67 FR 68036 (Nov. 8, 2002).

Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202-205-2000. General information concerning the Commission may also be obtained by accessing its Internet server (<http://www.usitc.gov>).

List of Subjects

WTO, GATS, solid and hazardous waste services.

Issued: July 30, 2003.

By order of the Commission.

Marilyn R. Abbott,

Secretary to the Commission.

[FR Doc. 03-19817 Filed 8-4-03; 8:45 am]

BILLING CODE 7020-02-P

DEPARTMENT OF JUSTICE

Bureau of Alcohol, Tobacco, Firearms and Explosives

Agency Information Collection Activities: Proposed Collection; Comments Requested

ACTION: 60-Day Notice of Information Collection Under Review: National Tracing Center Trace Request and NTC Obliterated Serial Number Trace Request.

The Department of Justice (DOJ), Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), has submitted the following information collection request to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act of 1995. The proposed information collection is published to obtain comments from the public and affected agencies. Comments are encouraged and will be accepted for "sixty days" until October 6, 2003. This process is conducted in accordance with 5 CFR 1320.10.

If you have comments especially on the estimated public burden or associated response time, suggestions, or need a copy of the proposed information collection instrument with

instructions or additional information, please contact Ben Hayes, ATF National Tracing Center, 244 Needy Road, Martinsburg, WV 25401.

Written comments and suggestions from the public and affected agencies concerning the proposed collection of information are encouraged. Your comments should address one or more of the following four points:

(1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(2) Evaluate the accuracy of the agencies estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;

(3) Enhance the quality, utility, and clarity of the information to be collected; and

(4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Overview of this information collection:

(1) **Type of Information Collection:** Extension of a currently approved collection

(2) **Title of the Form/Collection:** National Tracing Center Trace Request and Obliterated Serial Number Trace Request.

(3) **Agency form number, if any, and the applicable component of the Department of Justice sponsoring the collection:** Form Number: ATF F 3312.1 and ATF F 3312.2. Bureau of Alcohol, Tobacco, Firearms and Explosives, U.S. Department of Justice.

(4) **Affected public who will be asked or required to respond, as well as a brief abstract:** Primary: Federal Government. Other: State, Local, or Tribal Government. The forms are used by the Federal, State, Local, and International law enforcement community to request that ATF trace firearms used, or suspected to have been used, in crimes.

(5) **An estimate of the total number of respondents and the amount of time estimated for an average respondent to respond:** It is estimated that 112,123 respondents will complete each form within 6 minutes.

(6) **An estimate of the total public burden (in hours) associated with the collection:** There are an estimated 22,425 annual total burden hours associated with this collection.

APPENDIX C
CHOICE OF DISPOSAL METHOD: A
COMPARISON OF COUNTRY- AND
U.S. STATE-SPECIFIC DATA

Origin of Disposed Materials

As mentioned above, a large share of industrial hazardous waste is generated by the chemical and petrochemical industries. MSW comes from a broader variety of sources. In most countries, a majority of MSW is produced by households. OECD data for the most recent year available (generally 2000) enables a comparison of household MSW as a share of total MSW for 21 countries. For 17 of these countries¹ household MSW accounts for between 60 and 90 percent of total MSW, and for the other four (Finland, Iceland, Ireland, and Norway) household MSW accounts for between 30 and 60 percent of total MSW.² In most countries, the largest individual waste stream is construction and demolition wastes, with packaging materials ranking second. Not all of these wastes are classified as MSW though they may sometimes be managed in similar ways.³ Across OECD countries, organic material accounts for between 20 and 52 percent of MSW; paper and paperboard account for between 14 and 38 percent; plastics account for between 0.5 and 13 percent; glass accounts for between 3 and 13 percent; metals account for between 2 and 8 percent; and textiles and other materials account for between 7 and 51 percent.⁴

Choice of Disposal Method

Geographic Comparisons

International comparisons

Even at the high levels of income characteristic of most OECD members, the entire population may not be served by municipal waste services, indicating market opportunities for the extension of basic household and commercial service. Among middle-income OECD members, the share of the population not yet served by MSW services was 14.9 percent in Hungary (2000), 15.0 percent in Greece (1997), 16.5 percent in Mexico (2000), 27.0 percent in the Russian Federation (1992), and 28.1 percent in Turkey (1998).

Table C-1 provides information on the share of MSW destined for different disposal methods across OECD member countries. The share of MSW destined for landfills ranged from 17 percent (Denmark) to a high of 100 percent (New Zealand). Countries with high landfill use (between 90-100 percent of MSW) include Hungary, Iceland, Ireland, Mexico, New Zealand, Poland, and Turkey. Countries with low

¹ Austria, Belgium, Denmark, France, Germany, Hungary, Japan, Korea, Luxembourg, Mexico, the Netherlands, Poland, Slovakia, Spain, Sweden, the United States, and the United Kingdom.

² In making these comparisons it should be borne in mind that national definitions differ. *OECD Environmental Data Compendium 2002: Waste* (Paris: OECD), p. 11; and USITC calculations.

³ *OECD Environmental Data Compendium 2002*, p. 9.

⁴ *Ibid.*, p. 13.

Table C-1
Disposal of municipal waste, selected countries, year of most recent data

Country	Year of most recent data	Total	Percent			
			Recycling	Composting	Incineration	Landfill
		<i>1000 Metric tons</i>				
Austria	1999	3,096	34	15	15	29
Belgium	1999	5,473	40	16	27	32
Canada	1998	9,926	30	11	(¹)	(¹)
Czech Republic	2000	3,434	(¹)	(¹)	(¹)	(¹)
Denmark	2000	3,546	22	16	52	10
Finland	1999	2,400	(¹)	(¹)	8	60
France	1999	30,744	10	8	33	48
Germany	1998	44,094	34	7	21	37
Greece	1997	3,900	8	(¹)	(¹)	91
Hungary	2000	4,084	(¹)	(¹)	9	91
Iceland	2000	192	9	2	9	81
Ireland	2000	2,302	8	1	0	91
Italy	1997	27,425	7	9	6	78
Korea	2000	16,950	4	(¹)	12	47
Japan	1999	51,446	9	(¹)	78	21
Luxembourg	1999	227	(¹)	15	59	26
Mexico	2000	30,733	2	(¹)	(¹)	98
Netherlands	2000	9,691	23	24	41	13
New Zealand	1999	1,450	(¹)	(¹)	(¹)	100
Norway	2000	2,755	22	9	15	55
Poland	2000	12,226	(¹)	2	3	98
Portugal	2000	4,531	6	6	21	67
Russian Federation	1992	26,000	(¹)	1	4	95
Slovak Republic	2000	1,706	2	5	12	62
Spain	1999	18,377	5	18	6	72
Sweden	1998	4,000	25	8	35	32
Switzerland	2000	4,681	32	14	48	6
Turkey	1999	24,945	(¹)	1	(¹)	96
United Kingdom	1999	33,200	9	2	8	81
United States	1999	208,520	22	6	15	57

¹ Not available.

Source: *OECD Environmental Data Compendium 2002: Waste*, and USITC calculations. Percentages may not add to 100 due to inconsistencies in underlying data and a small category of "other" disposal in some countries. Some values reported as not available may represent zero values.

landfill use (between 17-39 percent of MSW) include Denmark, Japan, Luxembourg, the Netherlands, and Sweden. Incineration is particularly prevalent where land is scarce, with the share of total MSW incinerated reaching 78 percent in Japan, 59 percent in Luxembourg, 52 percent in Denmark, and 48 percent in Switzerland. The reported recycling rate is over one-third of total MSW in Austria, Belgium, and Germany, and less than 10 percent in Iceland, Ireland, Korea, Mexico, Portugal, and the United Kingdom.⁵ The United States ranks near the middle in terms of the share of its MSW that is landfilled (57 percent), recycled (22 percent), composted (6 percent), and incinerated (15 percent).⁶ However, the total quantity of MSW landfilled in the United States, as measured in metric tons, is four times larger than in Japan, the OECD runner-up in this category.⁷

Figures C-1 through C-3 show the relationship among the shares of MSW disposed of by landfilling, incineration, and recycling for OECD countries, using data for 2000 or the most recent year available. Figure C-1 shows that less densely populated countries are more likely to rely on landfilling, while Figure C-2 shows that more densely populated countries are more likely to rely on incineration.

Figure C-3 shows that there is no apparent relationship between population density and the recycling rate, which may in part be due to the definition of recycling being less standardized between countries than for the other methods of disposal.

In the United States

State-level U.S. data for 2001 confirm the general pattern that incineration tends to be used in land-scarce jurisdictions, while landfills dominate in land-rich jurisdictions. Landfills account for over 85 percent of MSW disposal in Colorado, Kansas, Nevada, New Mexico, North Dakota, Oklahoma, Utah, and Wyoming. Incineration rates reach a maximum of 79 percent in the District of Columbia and 65 percent in Connecticut, while Hawaii, Maine, Maryland, Massachusetts, and Minnesota each incinerate between 20 and 50 percent of MSW. Bearing in mind definitional differences, reported recycling rates reach a level of 59 percent in Delaware and between 40 and 50 percent in Arkansas, California, Maine, Minnesota, and New York.⁸

A comparison of U.S. data on tipping fees, which provide a direct measure of landfill demand relative to supply, reinforces the positive relationship between landfill

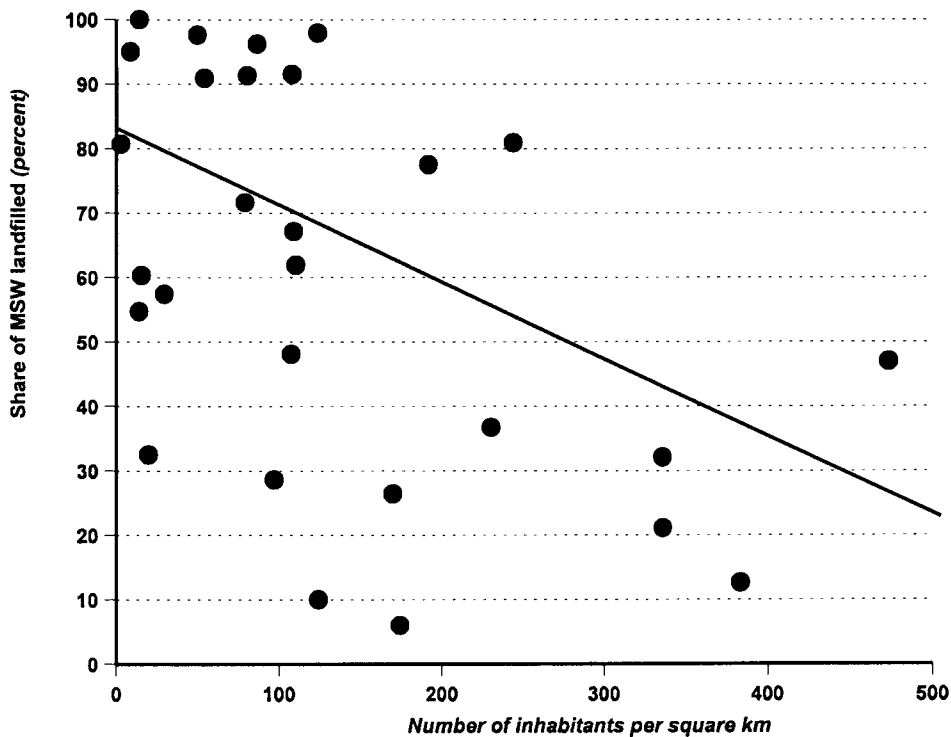
⁵ Ibid., p. 14; and USITC calculations.

⁶ This compares to *Biocycle's* estimate for the United States of 61 percent landfilled, 31 percent recycled or composted, and 7 percent incinerated in 2001. "The State of Garbage in America," *Biocycle*, vol. 42, No. 12, Dec. 2001, p. 43.

⁷ *OECD Environmental Data 2002: Waste*, p. 14; and USITC calculations.

⁸ "The State of Garbage in America," p. 45.

Figure C-1
Share of MSW landfilled and population density, most recent year

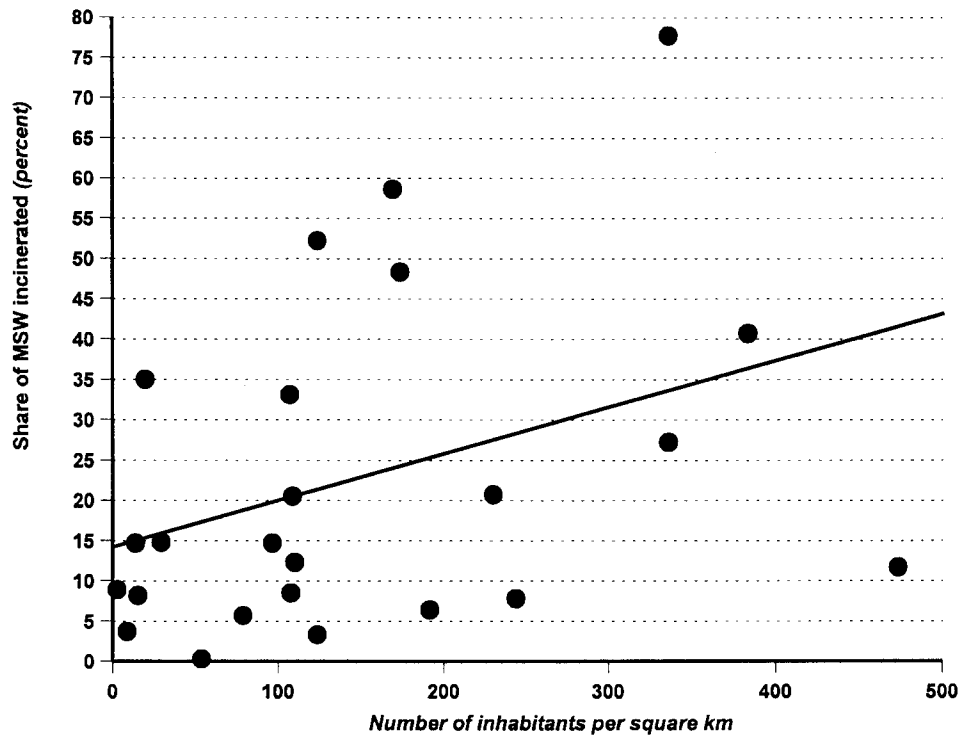


Source: OECD and USTIC calculations.

abundance and land availability.⁹ Figures C-4 and C-5 show the relationships among population density, tipping fees for landfills, and the share of MSW landfilled in individual U.S. states. In general, there is a strong positive relationship between tipping fees and population density and a negative relationship between tipping fees and landfill usage across the U.S. states. Since high tipping fees are likely a direct result of land scarcity as measured by population density, it is reasonable to suppose that a similar relationship holds in cross-country comparisons; i.e., countries with high population densities and/or low relative use of landfilling are also likely to have higher tipping fees for landfilling.

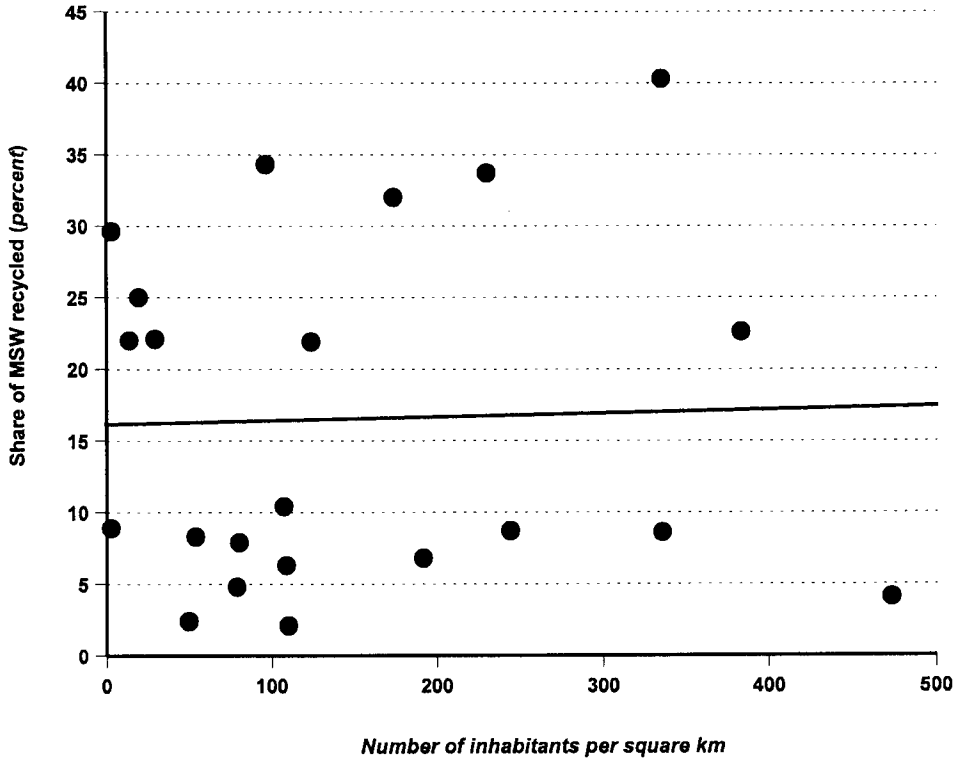
⁹ *EBI Report 2000*, reports that in 2001 tipping fees per metric ton were in the \$10-\$20 range in Colorado, Idaho, Montana, New Mexico, Nevada, and Wyoming, but reached the \$45-\$60 range in Delaware, Massachusetts, Maryland, New Hampshire, New York, Pennsylvania, and Rhode Island. Since land cannot in general be made more abundant by producing it (except for seashore reclamation), prices of land are generally understood by economists to be driven by demand for land uses. International comparisons of tipping fees are not available, but would probably show a similar pattern. For the sake of comparability, year-2000 data were used in both figure C-4 and figure C-5. Fees in metric units generated by USITC staff calculation. Environmental Business International, Inc. (EBI), *EBI Report 2000: The U. S. Environmental Industry and Global Market*, Sept. 2002, pp. 9-21.

Figure C-2
Share of MSW incinerated and population density, most recent year



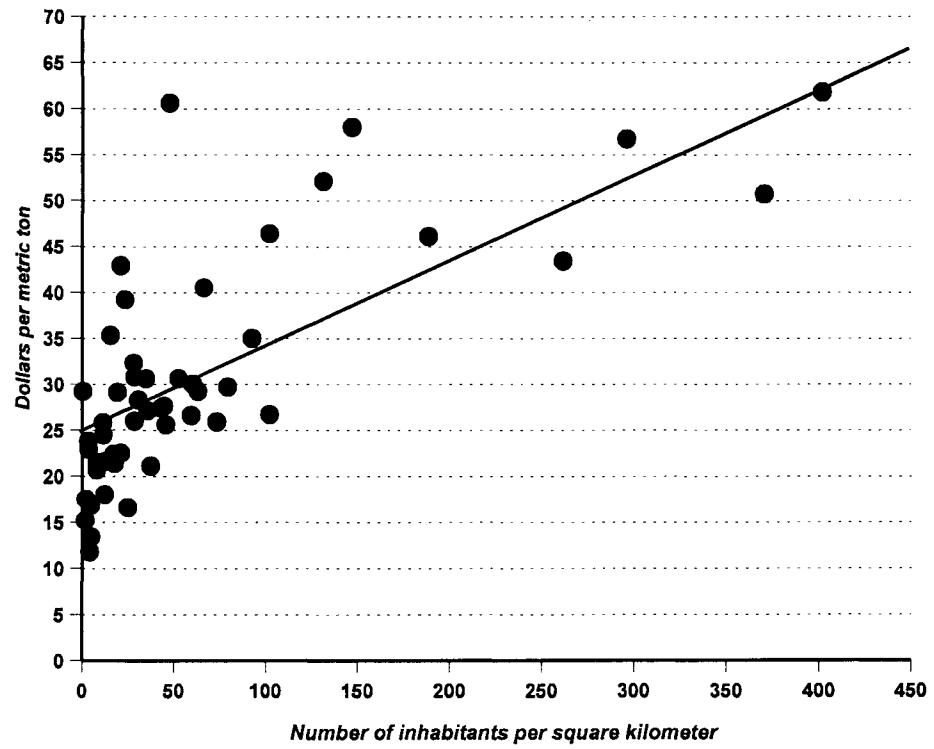
Source: OECD and USTIC calculations.

Figure C-3
Share of MSW recycled and population density, most recent year



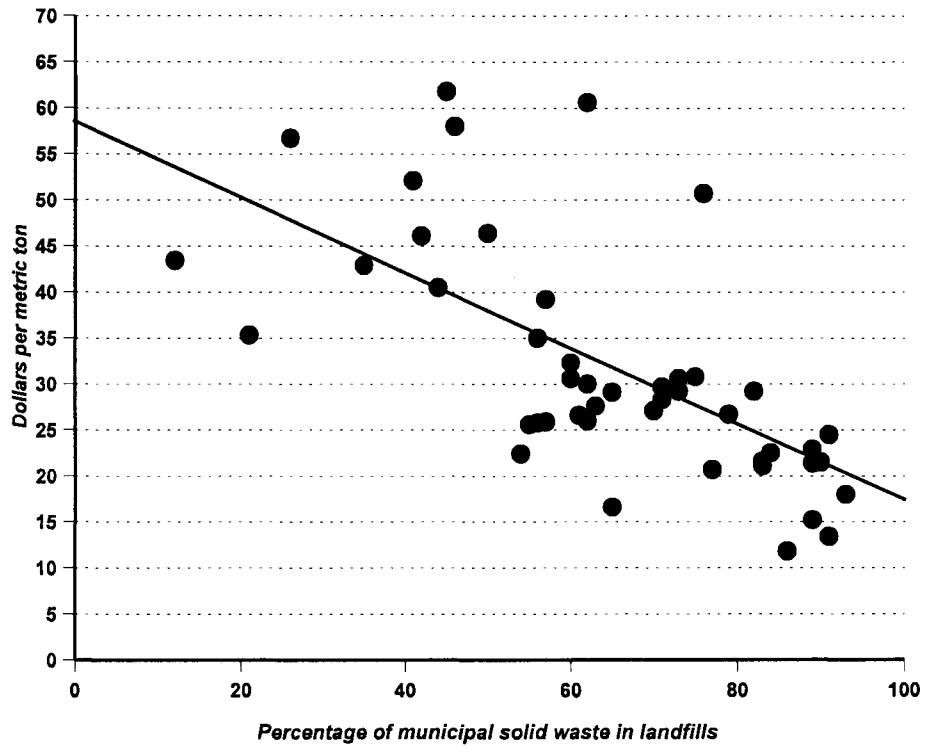
Source: OECD and USTIC calculations.

Figure C-4
Tipping fees and population density in U.S. states, 2000



Source: EBI, U.S. Bureau of the Census, and USTIC calculations.

Figure C-5
Tipping fees and landfill use in U.S. states, 2000



Source: EBI, *Biocycle*, and USTIC calculations.

**APPENDIX D
SOLID AND HAZARDOUS WASTE
SERVICES IN THE GENERAL
AGREEMENT ON TRADE IN
SERVICES (GATS)**

The General Agreement on Trade in Services (GATS) was signed in April of 1994 and entered into force in January of 1995. The GATS is the first multilateral, legally enforceable agreement covering trade and investment in the service sector. Modeled after the agreement on goods, the GATS is a “positive-list” agreement¹ which binds signatories to provide foreign firms with market access and nondiscriminatory treatment, subject to defined exemptions. The primary purpose of the agreement is to reduce or eliminate measures that prevent services from being provided across borders or that discriminate against locally established service providers with foreign ownership. The agreement is organized in four parts: the main text containing general principles and obligations; annexes dealing with rules for specific sectors; individual countries’ specific commitments; and lists indicating temporary exemptions from the most-favored-nation principle of nondiscrimination.

Country-Specific Commitments

Country-specific commitments typically are organized based on the Services Sectoral Classification List,² which organizes services industries into 12 broad sectoral categories and provides corresponding numbers from the United Nations Provisional Central Product Classification (CPC). Under this classification scheme, the environmental services sector includes four subsectors: sewage services (CPC 9401); refuse disposal services (CPC 9402); sanitation and similar services (CPC 9403); and other environmental services, which are generally presumed to include cleaning of exhaust gasses (CPC 9404), noise abatement (CPC 9405), nature and landscaping protection services (CPC 9406), and other environmental services (CPC 9409). Waste management services, excluding the sale of wastes, are captured in the “Refuse Disposal Services” subcategory, which the World Trade Organization (WTO) defines as “...services to collect, transport, treat and dispose of waste from homes, municipalities, commercial establishments and manufacturing plants.”³

Fifty-one countries have scheduled specific commitments in the environmental services sector, and 43 countries have scheduled commitments on refuse disposal services. Of these, 29 countries have scheduled commitments granting full market access and national treatment to foreign service suppliers that provide refuse disposal services through consumption abroad (mode 2)⁴ or a commercial presence (mode 3)⁵ (table D-1). Limitations listed by the remaining 14 countries include, *inter alia*,

¹ Under a “positive-list” agreement, members are only bound by those commitments that they specifically list within their schedules which comprise part of the agreement. By contrast, a “negative-list” agreement binds member countries to all provisions covered by the agreement unless otherwise specified.

² World Trade Organization (WTO), “Services Sectoral Classification List,” MTN.GNS/W/120, July 10, 1991.

³ WTO, “Background Note by the Secretariat,” S/C/W/46, July 6, 1998, footnote 6, page 2.

⁴ One of four possible modes of delivering services to foreign consumers, whereby the consumer, or the consumer’s property, receives a service outside the territory of the home country, either by moving or being situated abroad.

⁵ One of the four possible modes of delivering services to foreign consumers, whereby a service supplier establishes any type of business or professional establishment in the foreign market. Commercial presence comprises entities such as corporations, trusts, joint ventures, partnerships, sole proprietorships, associations, representative offices, and branches.

licensing restrictions, provisions requiring approval for the establishment of a commercial presence, a provision requiring foreign firms to form a joint venture (listed in China's schedule), and a measure limiting foreign equity participation in the refuse disposal sector to 49 percent (listed in Thailand's schedule). Several member countries have not scheduled bindings on refuse disposal services provided through cross-border supply (mode 1)⁶ as they consider such transactions technically infeasible, and most measures regarding the supply of services through the presence of natural persons (mode 4)⁷ are addressed in a member country's horizontal commitments.

With regard to scope, 29 countries have scheduled commitments that cover the full range of services in the refuse disposal sector. Among the countries that committed to partial coverage of the sector, eight countries include an overall exemption limiting their refuse disposal commitments to services supplied and/or purchased by private entities. Provisions that limit the range of activities covered under refuse disposal commitments also appear in eight schedules of commitments. For example, both Lesotho and South Africa indicate that their refuse disposal commitments apply only to consultancy services.

Current GATS Negotiations

In keeping with Article XIX of the GATS,⁸ a new round of services negotiations began in January 2000. WTO Member economies submitted over 100 negotiating proposals to the GATS Council for Trade in Services,⁹ in preparation for the negotiations. In these proposals, member economies outlined their positions regarding specific service sectors and various issues that affect multiple service sectors, such as transparency and autonomous liberalization. The negotiations themselves, which are currently underway, are being conducted through a request-offer approach. Under this approach, WTO Member economies have submitted initial requests, formally asking other WTO Members to make specific changes to their schedules of commitments. Following the receipt of these requests, WTO Members submitted initial offers. These nonbinding offers are presented in redline-strikeout format, illustrating the changes that member economies may be willing to make in their schedules of commitments in response to other members' requests.

⁶ One of four possible modes of delivering services to foreign consumers, whereby the service is transported beyond the home country of the services supplier to the foreign consumer. Cross-border supply may entail transportation by mail, telecommunications, or the physical movement of merchandise embodying service (e.g., a diskette storing information) from one country to another. The mode is "cross-border" when the service supplier is not present within the territory where the service is delivered.

⁷ One of four possible modes of delivering services to foreign consumers, whereby one individual, acting alone or as an employee of a service supplier, provides a service while present in a foreign market.

⁸ Article XIX of the GATS requires WTO member economies to initiate a new round of services negotiations no later than five years after the entry into force of the WTO agreement.

⁹ WTO, "List of 2000 Service Proposals," found at Internet address http://www.wto.org/english/tratop_e/serv_e/s_propnewnegs_e.htm/, retrieved July 14, 2003.

Table D-1
Nature of GATS commitments on refuse disposal services

Member country	Do commitments apply to all or part of the sector?	Did the member country schedule full or partial commitments?¹	Nature of limitations listed in GATS schedule
Albania	All	Full	No restriction or limitations exist.
Armenia	All	Full	No restriction or limitations exist.
Australia	All	Full	No restriction or limitations exist.
Austria	All	Full	No restriction or limitations exist.
Bulgaria	Part	Full	Commitments do not include environmental services supplied in the exercise of governmental authority, which includes regulatory, administrative, and control services by government and municipal bodies related to environmental issues. Additionally, the commitments do not apply to services related to the collection, transportation, storage, secondary use, recycling, restoration, use in the production of energy and materials, and disposal of dangerous waste, refuse and substances.
Canada	All	Full	No restriction or limitations exist.
China	Part	Partial	Commitments exclude quality monitoring and pollution source inspection. Additionally, foreign firms are permitted market access through a commercial presence only in the form of joint ventures, with foreign majority ownership permitted. Environmental consultation is the only cross-border service included.
Croatia	All	Partial	Refuse disposal services are legally considered as municipal activities, provided primarily by entities owned by local authorities. Private firms may be allowed to provide these services on the basis of a concession granted by local authorities.
Czech Republic	All	Full	No restriction or limitations exist.
Ecuador	All	Full	No restriction or limitations exist.
Estonia	Part	Full	Commitments apply only to refuse disposal services contracted by private industry.

See footnote at end of table.

Table D-1—continued
Nature of GATS commitments on refuse disposal services

Member country	Do commitments apply to all or part of the sector?	Did the member country schedule full or partial commitments?¹	Nature of limitations listed in GATS schedule
EU	All	Full	No restriction or limitations exist.
Finland	All	Full	No restriction or limitations exist.
France in respect of New Caledonia	Part	Partial	Commitments apply to treatment of industrial and/or household waste, excluding collection. Commercial presence in the Loyalty Islands Province requires authorization by the competent authorities. Additionally, reserves the right to limit the provision of refuse disposal services through the presence of natural persons.
D-6 FYR Macedonia	All	Full	No restriction or limitations exist.
Georgia	All	Full	Consulting and advisory services are the only refuse disposal services covered through cross-border supply.
Hungary	All	Full	No restriction or limitations exist.
Iceland	All	Partial	Environmental operating license required for market access through commercial presence and presence of natural persons.
Israel	Part	Full	Commitments do not include industrial activities. Also notes that it is common practice in this sector to require a local representative.
Japan	All	Partial	The number of licenses conferred to service suppliers of waste oil disposal at sea from vessels may be limited.
Korea	Part	Partial	Commitments include only collection, transport, and disposal services of industrial refuse. Additionally, establishment of a commercial presence is subject to the economic needs test. Refuse collection and transport service suppliers may conduct business only within jurisdiction of the respective Regional Environment Office which has granted them approval for operation.
Kuwait	All	Partial	Undertakes no commitments on the provision of refuse disposal services through consumption abroad.
Kyrgyz Republic	All	Full	No restriction or limitations exist.

See footnote at end of table.

Table D-1—continued
Nature of GATS commitments on refuse disposal services

Member country	Do commitments apply to all or part of the sector?	Did the member country schedule full or partial commitments?¹	Nature of limitations listed in GATS schedule
Latvia	All	Full	No restriction or limitations exist.
Lesotho	Part	Full	Commitments restricted to consultancy services only.
Liechtenstein	Part	Partial	Commitments do not apply to public work functions whether owned and operated by municipalities or Liechtenstein Government or contracted out by them. Additionally, market access through commercial presence excludes garbage dumps. Commercial presence in Liechtenstein is required for provision of services through presence of natural persons.
Lithuania	All	Full	No restriction or limitations exist.
Moldova	All	Full	No restriction or limitations exist.
Morocco	All	Partial	Undertakes no bindings on market access through consumption abroad.
Norway	Part	Partial	Commitments do not include public service functions whether owned and operated or contracted out by local, regional, or central government. For some categories of waste there exists a monopoly.
Oman	All	Full	No restriction or limitations exist.
Qatar	All	Partial	Undertakes no bindings on the provision of refuse disposal services through consumption abroad.
Sierra Leone	All	Partial	Undertakes no bindings on the provision of refuse disposal services through consumption abroad.
Slovak Republic	All	Full	No restriction or limitations exist.
Slovenia	Part	Full	Public utilities exist for refuse disposal services, but concession rights can be granted to the private operators established in the Republic of Slovenia.
South Africa	Part	Full	Commitments restricted to consultancy services only.

See footnote at end of table.

Table D-1—continued

Nature of GATS commitments on refuse disposal services

Member country	Do commitments apply to all or part of the sector?	Did the member country schedule full or partial commitments?¹	Nature of limitations listed in GATS schedule
Sweden	Part	Full	Commitments do not include public works functions whether owned and operated by municipalities, state, or federal governments, or contracted out by these governments.
Switzerland	Part	Partial	Commitment does not include public work function whether owned and operated by municipalities, cantons, or federal government, or contracted out by them. Additionally, presence of natural persons requires commercial presence in Switzerland.
Taiwan	All	Full	No restriction or limitations exist.
Thailand	All	Partial	No limitations on national treatment as long as foreign equity participation does not exceed 49 percent.
Turkey	All	Full	No restriction or limitations exist.
United Arab Emirates	All	Full	No restriction or limitations exist.
United States	Part	Full	Commitments apply only to services contracted by private industry, and are limited to the following activities: implementation and installation of new or existing systems for environmental cleanup, remediation, prevention, and monitoring; implementation of environmental quality control and pollution reduction services; maintenance and repair of environment-related systems and facilities not already covered by the US commitments on maintenance and repair of equipment; on-site environmental investigation, evaluation, and monitoring; sample collection services; training on-site or at the facility; consulting related to these areas.

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¹ The cross-border supply of refuse disposal is often considered unfeasible, and most measures regarding the supply of services through the presence of natural persons are addressed in a member country's horizontal commitments. Thus, for the purposes of this table, a full commitment is any commitment that grants full market access or national treatment to foreign individuals or firms that provided refuse disposal services through consumption abroad or commercial presence. A partial commitment is any commitment that limits market access and/or national treatment through consumption abroad or commercial presence.

Source: Compiled by the U.S. International Trade Commission.

The environmental services sector, including the solid and hazardous waste services segment, is one of many industries under discussion in the ongoing WTO services negotiations. This section discusses environmental services proposals submitted to the WTO, provides an overview of initial requests and offers that specifically address the refuse disposal segment, and presents a general overview of the current status of WTO services negotiations.

Environmental Services Submissions

Australia, Canada, Colombia, Cuba, the European Union (EU), Switzerland, and the United States have submitted negotiating proposals on environmental services.¹⁰ These proposals focus primarily on the environmental services sector as a whole, though refuse disposal services are specifically mentioned in certain proposals with respect to classification issues. Only Australia's proposal includes a specific reference to refuse disposal services (landfills) when listing barriers to trade. Six proposals¹¹ suggest that the current WTO classification of the environmental services sector does not adequately cover all activities of the industry. Nearly identical proposals from the EU and Switzerland include modifications to the current environmental services classifications, as well as the addition of a specific list of related services - such as construction, engineering, and research and development. Among other changes, the proposals suggest combining refuse disposal services (CPC 9402, currently categorized as 6B) with sanitation and similar services (CPC 9403, currently categorized as 6C) to create a broader category 6B entitled solid/hazardous waste management. Australia endorses the EU/Switzerland approach, but does not specifically list services that should be addressed within these negotiations. Colombia also favors the EU classification and proposes that environmental impact assessment, monitoring, and auditing, as well as the design of environmental technologies, be included. The United States and Canada propose the consideration of both core environmental services, consisting primarily of the currently classified environmental services sectors, and an expansion to include environmentally related services, although neither proposes a specific list of such related services.

The principal objective of the proposals submitted by Australia, Canada, the EU, Switzerland, and the United States is the reduction and removal of barriers to trade in environmental services. Each paper supports the liberalization of a similar list of trade impediments, including restrictions on the provision of services through a foreign-invested commercial presence (mentioned in all five papers), limitations on the temporary entry and stay of foreign personnel (included in papers submitted by Canada, the EU, Switzerland, and the United States), and a lack of regulatory

¹⁰ WTO, "Communication from Australia, Negotiating Proposal for Environmental Services," S/CSS/W/112, Oct. 1, 2001; "Communication from Canada, Initial Negotiating Proposal on Environmental Services," S/CSS/W/51, Mar. 14, 2001; "Communication from Colombia: Environmental Services," S/CSS/W/12, Nov. 27, 2001; "Communication from Cuba, Negotiating Proposal on Environmental Services," S/CSS/W/142, Mar. 22, 2002; "Communication from the European Communities and their Member States, GATS 2000: Environmental Services," S/CSS/W/38, Dec. 22, 2000; "Communication from Switzerland, GATS 2000: Environmental Services," S/CSS/W/76, May 4, 2001; and "Communication from the United States, Environmental Services," S/CSS/W/25, Dec. 18, 2000, all found at Internet address <http://www.wto.org/>, retrieved June 20, 2003.

¹¹ The proposal submitted by Cuba does not address classification issues.

transparency (included in papers submitted by Australia, Canada, the EU, and the United States). The EU and Switzerland also propose the liberalization of barriers relating to the provision of environmental services through cross-border supply or consumption abroad. Each of these papers recognizes that some of these objectives, such as increased transparency and reduction of certain restrictions on commercial presence, will require liberalization of those trade measures that apply to service providers in all industry sectors.

The proposal from Colombia indicates that the commercial presence of foreign enterprises in the provision of environmental services may be beneficial for developing countries, and commitments should be evaluated based on the member country's level of economic development. In addition, the paper proposes that member countries evaluate the professional qualification of foreign service providers using the same criteria applied to domestic service providers. The proposal submitted by Cuba also focuses on the interests of developing countries, indicating that such countries should be able to engage in environmental services trade liberalization on terms that will enable them to realize the benefits of such liberalization.

Requests for Commitments on Refuse Disposal Services

Paragraph 15 of the Doha Development Agenda established a schedule for the initial request-offer phase of the services negotiations. According to this schedule, WTO Member countries were asked to submit their first specific requests of other member countries by June 30, 2002. These requests are not publically available. However, summaries issued by several countries indicate that there have been a number of requests on the environmental services sector as a whole, and on solid and hazardous waste services specifically. For example, a summary of the U.S. requests indicates that the United States has asked other WTO member countries to liberalize a number of environmental services segments, including solid and hazardous waste management.¹² The EU states that it has requested the elimination of restrictive and discriminatory measures facing EU providers of environmental services. The EU summary also indicates that EU requests are modeled after the environmental services classification included in its proposal (see above), which lists waste management services among other environmental services activities.¹³ Canada defines the environmental services sector to include several activities, such as refuse disposal

¹² United States Trade Representative (USTR), "U.S. Proposals for Liberalizing Trade in Services: Executive Summary," press release, July 1, 2002, found at Internet address <http://www.ustr.gov/>, retrieved Oct. 23, 2003.

¹³ European Commission (EC), "Summary of the EC's Initial Requests to Third Countries in the GATS Negotiations," July 1, 2002, found at Internet address <http://europa.eu.int/>, retrieved Oct. 27, 2003.

services, and indicates that it has requested the elimination of local partnership and licensing requirements.¹⁴ Further, Japan's summary states that it has made requests on all environmental services subsectors.¹⁵

Offers Regarding Refuse Disposal Services

Paragraph 15 of the Doha Development Agenda established March 31, 2003 as the due date for the submission of initial services offers. As of October 30, 2003, 39 economies had submitted offers to the WTO,¹⁶ and 12 of these offers had been derestricted and made available to the public. Among the 12 economies that submitted derestricted offers, only a small number have proposed substantial changes to their commitments on refuse disposal services (table D-2), largely due to the fact that many of these economies had already undertaken substantial bindings on refuse disposal services during the Uruguay Round. Although six of these economies chose to recast their Uruguay Round commitments using the classification scheme outlined in the EU proposal, none of the derestricted offers proposed substantive changes to the scope of refuse disposal commitments scheduled during the Uruguay Round. This is partially due to the fact that five of these derestricted offers were submitted by economies that had already made Uruguay Round commitments on the entire refuse disposal category.

With regard to the content of the commitments themselves, six of the economies that submitted publically available offers already maintain full commitments on the provision of refuse disposal services through modes 2 and 3, and thus, did not propose significant liberalization in their offers. This includes the European Union, which made some minor alterations to its mode 4 commitments on refuse disposal services. Four of the publically available offers do propose some measure of liberalization in the refuse disposal segment. New Zealand, which did not schedule any commitments on refuse disposal services during the Uruguay Round, is proposing to schedule full commitments on consultancy services related to refuse disposal. Moreover, the offers submitted by Iceland, Japan, and Norway propose to eliminate certain restrictions affecting the provision of refuse disposal services through mode 3 or 4. Chile submitted the only publically available offer that neither contained Uruguay Round commitments on refuse disposal services nor offered to schedule commitments on this industry segment during the current negotiating round.

Minutes from recent meetings of the WTO Council for Trade in Services suggest that at least two additional countries— Mexico and the Slovak Republic— have submitted offers on the environmental services sector.¹⁷ However, the minutes do not provide

¹⁴ "Description of Requests Presented by Canada to its WTO Partners," Mar. 31, 2003, found at Internet address <http://strategis.ic.gc.ca/>, retrieved Oct. 27, 2003.

¹⁵ Ministry of Foreign Affairs (MOFA), "WTO Services Trade Negotiations Submission of Initial Requests," June 2002, found at Internet address <http://www.mofa.go.jp/>, retrieved Oct. 27, 2003.

¹⁶ WTO, "Services: Negotiations, The New Negotiations," found at Internet address <http://www.wto.org/>, retrieved Nov. 17, 2003.

¹⁷ WTO, "Report of the Meeting Held on 19-22 May 2003," June 30, 2003, p. 30, and "Report of the Meeting Held on 4 and 10 July and 3 September 2003," Sept. 29, 2003, p. 40, found at Internet address <http://www.wto.org/>, retrieved Nov. 18, 2003.

Table D-2
Publicly available offers submitted by WTO members on refuse disposal services

WTO Member	Basis of Environmental Services Classification	Changes to Scope of Uruguay Round Commitments	Changes to content of Uruguay Round commitments
Australia	EU proposal	None- Uruguay Round commitments cover the entire industry segment.	None- Uruguay Round schedule includes full commitments on this industry segment.
Canada	W/120	None- Uruguay Round commitments cover the entire industry segment.	None- Uruguay Round schedule includes full commitments on this industry segment.
Chile	None used	None- There continue to be no commitments schedule on this industry segment.	None- There would continue to be no commitments schedule on this industry segment.
European Union	EU Proposal	None- Uruguay Round commitments for most EU member countries cover the entire industry segment. Sweden excludes public works functions from its environmental services commitments.	The EU is offering to make some minor changes, making its mode 4 commitments on this industry segment compatible with its new horizontal commitments on mode 4.
Iceland	W/120	None- Uruguay Round commitments cover the entire industry segment.	Iceland is offering to eliminate the provision requiring an environmental operating licence for the supply of refuse disposal services through mode 4. Iceland would continue to require such licenses for the provision of services through mode 3.
Japan	EU proposal	None- Uruguay Round commitments cover the entire industry segment.	Japan is offering to remove a mode 3 restriction limiting the number of licenses for providers of waste oil disposal at sea. Japan is also offering to remove references to its horizontal commitments under mode 3.
Liechtenstein	W/120	None- Commitments on this industry segment exclude public works functions.	None- Commitments would continue to contain a mode 3 restriction on garbage dumps.

Table D-2–continued

Publicly available offers submitted by WTO members on refuse disposal services

WTO Member	Basis of Environmental Services Classification	Changes to Scope of Uruguay Round Commitments	Changes to content of Uruguay Round commitments
New Zealand	EU proposal	New Zealand previously had no commitments on refuse disposal services. New commitments would be limited to consultancy services related to the provision of refuse disposal.	New Zealand, which previously had no commitments on refuse disposal services, is offering to schedule full commitments on consultancy services related to the provision of refuse disposal.
Norway	EU proposal	None- Commitments on this industry segment exclude public service functions.	Norway is offering to eliminate a mode 3 provision indicating that monopoly situations exist for certain categories of waste.
Slovenia	W/120	None- Slovenia would continue to limit the scope of these commitments by indicating that concession rights for the operation of public utilities can be granted to private firms established in Slovenia.	None- Uruguay Round schedule includes full commitments on this industry segment.
Turkey	W/120	None- Uruguay Round commitments cover the entire industry segment.	None- Uruguay Round schedule includes full commitments on this industry segment.
United States	EU proposal	None- The United States would continue to limit its commitments to certain activities contracted by private industry.	None- Uruguay Round schedule includes full commitments on this industry segment.

any details regarding the content of these offers and thus, they cannot be compared to the publically available offers that are discussed above.

Current Status of Services Negotiations

WTO member economies continue to conduct services negotiations through the Council for Trade and Services, which met several times during 2003, and through bilateral consultations.¹⁸ To date, the WTO has not established any further interim deadlines for these negotiations. The current round of services negotiations is scheduled to conclude by January 1, 2005.¹⁹

¹⁸ Ibid.

¹⁹ WTO, "Services: Negotiations, The New Negotiations," found at Internet address <http://www.wto.org/>, retrieved Nov. 17, 2003.

APPENDIX E
POSITION OF INTERESTED PARTIES

Environmental Technology Council

The Environmental Technology Council (ETC)¹ is an association of hazardous and industrial waste management firms that provide waste treatment, disposal, and recycling services under U.S. and Canadian regulations. ETC believes that U.S. hazardous waste facilities are highly advanced, particularly with regard to the management of wastes containing polychlorinated biphenyls (PCBs). ETC also contends that the United States and Canada generally do not restrict the transfer of hazardous wastes between their countries. However, ETC indicates that the United States does not allow the cross-border transfer of PCB-contaminated wastes. ETC further notes that despite the U.S. Senate's likely ratification of the Stockholm Treaty on Persistent Organic Pollutants, which allows the cross-border transfer of PCBs and other pollutants destined for proper disposal, ETC does not expect the United States to approve or implement those portions of the treaty that allow such transfers. ETC argues that the inability to import such waste for treatment may not be consistent with the United States' international obligations. ETC also argues that this prohibition has an economically deleterious effect on the U.S. hazardous waste industry and increases the probability that such waste will be improperly disposed. ETC contends that if the United States does not import PCB-contaminated wastes for disposal, air currents may transfer these pollutants to the United States, contaminating U.S. land and water. ETC requests the USITC investigate whether there are inconsistencies between U.S. international obligations and the U.S. ban on PCB-contaminated waste trade.

Friends of the Earth - USA

Friends of the Earth - USA² is the U.S. arm of a global network of environmental groups. The group was founded in San Francisco in 1969 and has voiced its opinion on many environment-related issues. Friends of the Earth submitted an article entitled "Environmental Services Liberalization: A Win-Win or Something Else Entirely?," which is to be published in *International Lawyer's* Fall 2003 edition. The article states that environmental services negotiations, instead of being a win-win solution for trade and the environment, may actually harm environmental goals. Friends of the Earth claims that the definition of environmental services used in these negotiations is too broad, including service activities that are actually harmful to the environment. The submission raises possible conflicts between the environmental services negotiations, GATS fundamentals such as the nondiscrimination principle, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and other government efforts to protect the environment. The GATS environmental exceptions must also be revised, according to the submission. Although both the GATT and GATS provide exceptions when "necessary to protect human, animal or plant life or health," the GATS exceptions in Article XIV are missing a vital environmental exception that can be found in GATT Article XX, namely "(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption." Friends of the Earth voices two principal concerns: that a number of nonliving exhaustible natural resources are left

¹ Scott L. Slesinger, Vice-President for Governmental Affairs, Environmental Technology Council, Washington, DC, written submission to the Commission, Nov. 6, 2003.

² David Waskow, International Policy Analyst and Trade Policy Coordinator, Friends of the Earth-USA, Washington, DC, written submission to the Commission, Nov. 5, 2003.

unprotected in GATS and that the word “necessary” may make the exception that has been included in the GATS more susceptible to narrow interpretation. The submission asserts that, at a minimum, an exception equal to GATT Article XX(g) should be incorporated into the GATS. Friends of the Earth cautions WTO Member countries to assess the impacts of these environmental services negotiations before proceeding any further.

Weston Solutions, Inc.

Weston Solutions, Inc.³ is a leading environmental engineering firm with over 1800 employees in more than 60 offices worldwide. The firm actively promotes international trade in a variety of environmental technologies and services. Weston believes that while significant opportunities exist worldwide for environmental services firms, the demand for such services is often limited. For example, Weston has evaluated the hazardous waste treatment markets in numerous countries and believes that significant volumes of hazardous wastes are continually being added to substantial stockpiles. Weston believes that this situation needlessly threatens the local environment, as solutions are available in the international marketplace. However, constructive solutions often fail to reach fruition due to factors such as vague project application, approval, and appeal processes, and a lack of development capital. When interacting with local governments, Weston reportedly has also encountered difficulties relating to project administration, often resulting from a lack of technical expertise. Consequently, timely decisions are not made as to the feasibility of Weston’s proposed technology or any of the alternatives evaluated. Another factor that frequently limits the international demand for Weston’s services is the less-than-stringent enforcement of hazardous waste management regulations, which often results from an inadequate enforcement budget, and standards that are imposed arbitrarily or without reference to clear standards of conduct. In spite of these hurdles, Weston believes that substantial markets exist for services and technologies for solid and hazardous waste treatment.

³ Michael T. Werner, Esq., Client Service Manager, Weston Solutions, Inc., West Chester, PA, written submission to the Commission, Oct. 6, 2003.

APPENDIX F

GLOSSARY

Autoclave: Steam-heated machine used for sterilization.

Characteristic waste: Waste characterized as hazardous by RCRA because it exhibits ignitability, corrosive activity, reactivity, and/or toxicity.

Collection: Picking up solid waste at its point of generation or storage and putting it in a solid or hazardous waste vehicle.

Commercial presence (mode 3): A service supplier establishes a type of business or professional enterprise in a foreign market.

Composting: The biological process involving aerobic decomposition of organic waste under controlled conditions to treat putrescible waste and/or sewage sludge.

Construction and demolition waste (C&D): Debris from new structures and debris from renovated or demolished existing structures.

Consumption abroad (mode 2): A consumer, or the consumer's property, receives a service outside the territory of the consumer's country.

Cross-border supply (mode 1): A service is transported beyond the country of the service supplier to a foreign consumer (the service supplier is not present within the territory of the consumer).

Deep-well injection (or underground injection): The process of placing raw or treated, filtered hazardous waste in the pores of permeable subsurface rock by pumping it into deep wells.

Dioxins: Impurities (i.e., any carcinogenic or teratogenic heterocyclic hydrocarbons) in petroleum-derived herbicides.

Disposal: The final disposition of solid or hazardous waste.

Energy recovery: Recovery of heat or the creation of steam through the burning of waste.

Food-to-people program: A program under which food that may otherwise be destined for disposal is redirected towards consumption. For example, produce stored in warehouses that can no longer be sold may be destined for such programs.

Gasification: 1) The process of converting a substance to gas through the use of chemicals and high heat. 2) The production of gaseous fuels by combining carbonaceous materials with air, steam, or oxygen and subjecting the combination to very high temperatures. The end product is a mixture of particles, tar compounds, combustible gases, and water vapor. The proportion of mixture components varies depending on the process, but common to all processes is the need to purify the resulting gas before commercial use.

Generic waste: General solid and/or hazardous waste that is not the result of a specific product or process.

Hazardous waste: Any waste material that can cause serious illness, injury, or death, and environmental damage if improperly managed.

Incineration: A method for the volume reduction and disposal of solid waste and for sewage sludge through controlled combustion.

Industrial waste: Waste consisting of a wide variety of nonhazardous materials subject to Schedule D of the RCRA that result from the production of goods. Most of these wastes are in the form of waste waters.

Informal recycling sector: Individuals that work independently to collect recyclable materials from businesses, households, or waste disposal sites. These individuals sell the collected recyclable materials to intermediaries, or to facilities that reprocess the material for use.

Landfill: Disposal site for refuse that is on or below ground level.

Large quantity generators: Facilities that generate more than 1,000 kg of hazardous waste or more than 1 kg of acutely hazardous waste per calendar month.

Leachate: Contaminated liquid by-product of solid waste that has percolated through the soil or some other medium.

Listed waste: Waste that is considered hazardous under RCRA because it meets specific criteria.

Low-level radioactive waste: Less hazardous wastes than most of those associated with a nuclear reactor; includes those generated by hospitals, research laboratories, and certain industries. In the United States, the Department of Energy, Nuclear Regulatory Commission, and EPA share responsibilities for managing them.

Material recovery facility: Facility at which recyclable products are sorted for sale and reuse as production inputs.

Medical waste: Waste from healthcare facilities that came into contact or is contaminated with diseased tissues or infectious microorganisms. May also be referred to as infectious waste, defined as hazardous waste with disease contaminating characteristics, including animal waste, human blood and blood products, pathological waste, and discarded sharp objects (e.g., needles, scalpels, and broken medical instruments).

Mixed waste: Radioactive waste that is also a hazardous waste. Mixed waste is jointly regulated by RCRA and Atomic Energy Act.

Municipal solid waste: Nonhazardous waste generated through household and community activities.

Open dump: A disposal site where waste is simply placed on top of the ground.

Persistent Organic Pollutants: A variety of potential food and water supply contaminants, including pesticides such as DDT and chlordane, and industrial chemicals such as PCBs and dioxin.

Plasma technology: 1) A common phrase for a variety of industrial applications using plasma, an electrically neutral matter also known as the fourth state of matter—solid, liquid, gas, plasma. Plasma applications include etching semiconductor chips; depositing silicon to produce solar cells; depositing silicon dioxide on chemically active surfaces to put them in a passive state or, in contrast, to activate surfaces; and melting or welding with plasma arcs as well as plasma chemistry. 2) Plasma technology constitutes minute gas-filled cells that emit light with the passage of an electric current.

Polychlorinated biphenyl (PCB): A generic term for a family of man-made chemical compounds produced by replacing hydrogen atoms on a biphenyl molecule with chlorine atoms resulting in a clear, pale yellow, viscous fluid. Although no longer produced, characteristics that made PCBs desirable for industry also made them persistent in the environment, including chemical stability, ability to withstand high temperatures without degradation, and insolubility in water. Consequently, they remain in the atmosphere, landfill sites, and waterways. PCBs are easily consumed by aquatic animals where they enter the food chain. They are fat-soluble and therefore easy to consume but difficult to excrete. Common industrial uses included electrical equipment such as transformers and capacitors, heat transfer and hydraulic systems, fluorescent light ballasts, paints, glues, waxes, carbonless copy paper, newspaper inks, dust-control agents for dirt roads, solvents for spreading insecticides, and additives in lubricating and cutting oils.

Presence of natural persons (mode 4): One individual, acting alone or as an employee of a service provider, provides a service while present in a foreign market.

Putrescible: Organic matter liable to decompose or pass into a state of foul decay.

Reclamation: Treating material to recover a usable product, or to regenerate material. For example, recovery of lead values from spent batteries, regeneration of spent solvents, and removal of impurities from spent solvents or other hazardous wastes to render them usable as fuels.

Recovery: Reclaiming materials from the solid waste stream to use for composting and recycling purposes. This does not include reuse and source reduction activities, such as reusing yard trimmings for on-site compost, refilling beverage containers, and repairing wood pallets.

Recycling: The recovery, reprocessing, and reuse of certain waste materials.

Remanufacturing: The process of making a finished product from used material.

Reuse: Using certain municipal solid waste products in their original form more than once, such as refilling glass or plastic bottles, repairing wood pallets, using corrugated or plastic containers for storage, and returning milk crates.

Sanitary landfill: A facility for solid waste disposal that is designed, constructed, and operated in such a way as to minimize public nuisances (e.g., windblown litter and unpleasant odors) and not pose a threat to public health or safety. Three important characteristics distinguish a sanitary landfill from an open dump: (1) an appropriately selected and prepared (lined with an impermeable material) landfill site, (2) deposited waste is spread out and compacted, and (3) each day a soil cover is placed over the waste and compacted.

Slag: Partially fused or vitrified nonmetallic material released and formed by chemical action at high temperatures during the smelting and refining of metals.

Solid Waste: Refuse and trash that requires routine or irregular collection and transport to a processing and/or disposal site.

Source reduction (waste minimization): The reduction of waste, through processing changes or recycling at the source.

Special waste: Any of the industrial process, pollution control, or hazardous waste materials, including potentially infectious medical waste, except as may be in conformity applicable laws with Section 22.9 of the Resource Conservation and Recovery Act (RCRA).

Stabilization process: Altering an active substance into inert, harmless material. Also, limiting the further spread of contamination without actual reduction of toxicity at a given site.

Storage: Holding waste for a temporary period, after which the waste is treated, disposed of, or stored elsewhere.

Surface impoundment: Any natural or man-made topographic depression, hole, or embankment that is composed primarily of earth materials and used to treat, store, or dispose of hazardous waste.

Tipping: The discharge of waste from the collection vehicle.

Tipping fee: Fees charged to haulers for delivering waste at recovery or disposal facilities.

Transfer station: A facility that receives solid waste from individual collection trucks and consolidates the waste into larger shipping containers, such as tractor-trailer units, for long-distance shipping to waste processing plants. Typically such waste processing plants are located more than 12 miles from the community in which the waste was collected.

Treatment: (1) A systematic process for removing solids and/or pollutants from solid waste, waste-streams, effluents, and air emissions. (2) Any method used to remove or reduce potential disease-causing components from regulated medical waste by changing the biological composition of that waste material.

Underground injection (or deep-well injection): The process of placing raw or treated, filtered hazardous waste in the pores of permeable subsurface rock by pumping it into deep wells.

Waste generation: The weight or volume of material entering the waste stream before said waste is disposed of or recycled. The phrase can be applied to the amount of waste produced by a specific source or category of sources.

Waste management: The process of collection, storage, treatment, or disposal of waste, not including hauling or transport.

Waste minimization (source reduction): The reduction of waste, through processing changes or recycling) at the source.

Waste stream: The flow of all solid waste from point of generation to method of disposal, such as incineration, depositing in landfills, or recycling. The term may also apply to segments of the waste flow, such as “residential waste stream” or “recyclable waste stream.”

Waste-to-energy: A usable form of energy that is manufactured (primarily by combustion) from solid waste.