End-Market Demand for Recyclables

Although projecting end-market demand is beyond the scope of this market analysis, the prospects for increased recovery of recyclable MSW are reflected in a variety of industry investments to expand the end-market demand for recycled materials.[51] For example, the paper industry anticipates an increased demand for nearly 5 million tons of OCC, with expansions at 18 containerboard mills from 1993 to 1995; and AFPA reports that nearly four million tons of expanded de-inking capacity will come on-line by 1995. The paper industry has set a goal of 50 percent recovery (an additional 17.4 million tons compared to 1992) by 2000.

Anecdotal data also indicate expanding end-markets for other recycled materials. For example, the largest plastics processor in the country plans to increase processing capacity in one of its plants by 70 percent for post-consumer PET containers - adding 40,000 tons of annual capacity for PET bottles by the end of 1994. Also, 6 more glass cullet beneficiation plants came on-line in 1993, and 3 major steel companies have new facilities that utilize 100 percent recycled material scheduled to come on-line in the next few years.

D. WASTE-TO-ENERGY MARKET SEGMENT

Key Findings

- WTE facilities and incinerators together combusted approximately 32 million tons of MSW in 1992. Respectively, WTE accounted for approximately 31 million tons, and incinerators, approximately 1 million tons.

- The use of flow controls to guarantee waste flows to WTE facilities is significant; approximately 58 percent of WTE throughput (from 61 facilities) is guaranteed by flow control. One reason for this high percentage is the substantial debt service entailed by the large initial capital investment required to construct WTE facilities.[52] WTE facility operators and owners need to ensure adequate, long-term supplies of waste and operate at high capacity utilization rates (e.g, 85 percent) in order to generate sufficient tipping fee revenues to meet debt service payments. Data show a strong association between magnitude of capital costs and use of flow controls by WTEs.

- Data also reveal that the use of flow controls is strongly associated with the size (throughput) of WTE facilities. WTEs supported by flow control have an average throughput three times the average throughput of WTEs that are not supported by flow controls or long-term contracts. Regardless of ownership, the larger facilities on average were much more likely to be supported by flow controls than the smaller WTEs.

- Although WTE facilities require substantial initial capital investments, they are cost-competitive with landfills in regions of the country where land and energy costs are relatively high, such as the Northeast. Higher land costs raise the cost of landfill disposal, and higher energy prices reduce the

[51] See Lisa Rabasca, "1993 Recycling Market - Ebbs and Flows," *Recycling Times*, December 1993; and Robert Steuteville, "Year End Review of Recycling," *BioCycle*, December 1993. (Unless otherwise noted.)

[52] In 1992, the average initial capital cost for existing WTE facilities was $60 million (adjusted for inflation). For facilities being constructed, the average capital cost was approximately $136 million. Because they are more modern, larger, and include more up-to-date pollution control equipment, facilities under construction cost more than existing facilities.

net cost of WTE facilities. Nearly half of all MSW combusted in 1992 took place in WTE facilities located in the Northeast.

- There will be only a modest gain in the amount of waste managed by this market segment in the future for the following reasons: (1) existing facilities already operate at nearly 85 percent of capacity; (2) the number of new facilities being planned and constructed has declined significantly from 202 expected in 1988 (as reported by GAA) to 53 expected in 1993; and, (3) various other factors, such as increasingly higher initial capital investments due to land and pollution control costs, increased emphasis on recycling and waste reduction strategies, and public opposition likely will limit potential growth of this segment.

Data Sources and Limitations

The primary source of information for this section is the *1993-94 Resource Recovery Yearbook: Directory & Guide*, published by Government Advisory Associates, Inc. (GAA). This biennial survey of all WTE facilities located in the United States provides detailed operating data on each facility, as well as data on use of flow controls. This section relies primarily on the raw data for each facility, sorted according to parameters necessary for this analysis. Appendix III-D presents data used to prepare this section. Where footnoted, several other data sources also were used in preparation of this section.

D.1 OVERVIEW OF GROWTH TRENDS

MSW is combusted in two types of facilities: (1) waste-to-energy (WTE) facilities, which recover heat from the combustion of waste to produce either steam or electricity; and, (2) incinerators, which combust waste without energy recovery. Exhibit III-26 illustrates the amount of waste

EXHIBIT III-26[53]

Combustion Market Since 1960: Throughput of Waste-to-Energy (WTE) Facilities and Incinerators

Contains Data for

Postscript Only.

combusted in both WTE facilities and incinerators from 1960 to 1992. As this exhibit shows, WTE facilities have largely replaced the older and now obsolete incinerators. Since WTE is dominant, this section discusses WTE only.

There are three stages of development for WTE facilities (for a complete listing of all WTE facilities and location by State, see Appendix III-D):

[53] Data on incineration are provided in EPA's *Characterization of Municipal Solid Waste in the United States: 1992 Update*, EPA. The estimated amount of waste incinerated without energy recovery in 1992 (1 million tons) is based on the trend line decline in the amount of waste incinerated as reported in that publication.

1. **Existing**. In 1992, there were 145 existing WTE facilities, including 135 that were operating and 10 that were temporarily shutdown for rebuilding or retrofitting. The 135 facilities in operation combusted 31.1 million tons of MSW in 1992. The remaining 10 facilities temporarily shutdown represent a potential throughput of an additional 0.6 million tons. Six (6) are expected to come back on-line by 1995.[54]

2. **Advanced Planned**. An "advanced planned" facility is defined as one in which the sponsors have initiated the permitting process, established construction schedules, and determined vendors. In 1992, 26 WTE facilities were advanced planned, of which 5 were under construction.

3. **Conceptually Planned**. Twenty-seven (27) facilities were conceptually planned in 1992. Sponsors of a "conceptually planned" facility have completed a feasibility study and submitted requests for qualifications and proposals. These sponsors had not initiated the permitting process as of 1992.

D.2 MARKET SUBSEGMENTS

The 135 operational WTE facilities can be divided into 3 subsegments based on the type of technology employed:

1. **Mass Burn** plants combust unprocessed MSW, with or without removal of recyclables prior to combustion.

2. **Refuse-Derived Fuel (RDF)** plants pre-process the incoming MSW to remove noncombustibles and prepare a more homogenous fuel product (i.e., RDF). The refuse usually is shredded to reduce particle size for burning in semi-suspension or suspension-fired furnaces.[55]

3. **Modular Mass Burn** facilities employ 1 or more small-scale combustion units to process lesser quantities of wastes than the more typical mass burn facilities. The average existing modular facility has a design capacity of 147 tpd or 15 percent of the design capacity of an average size mass burn facility.[56]

[54] The GAA Yearbook notes that 6 facilities are expected to resume operations by 1995, with the expected start-up date of the other 4 listed as "unknown."

[55] The RDF either is sold to outside customers or burned in a dedicated furnace. Facilities that sell RDF (and do not combust on site) do not have boilers and/or turbines, which lowers their capital costs (see Section D.3).

[56] Modular facilities usually are pre-fabricated and can be shipped fully assembled or in modules to a site. In contrast, mass burn facilities typically are custom designed and field-erected.

Throughput of Market Subsegments

Exhibit III-27 illustrates that mass burn facilities accounted for almost two-thirds of WTE waste throughput in 1992 (20.6 million tons). Modular facilities combusted only 1.5 million tons, and RDF facilities accounted for 9.0 million tons of total throughput.

EXHIBIT III-27
Waste-to-Energy Market Subsegments by Throughput

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Geographic Distribution of WTE Market Subsegments

Exhibit III-28 shows the distribution of throughput for WTE facilities by 4 geographic regions of the nation. (Appendix III-D includes a detailed listing of throughput for each State by the 3 market subsegments.) As this exhibit indicates, nearly 47 percent of all MSW combusted took place in WTE facilities located in the Northeast, where land and electricity costs are relatively higher than in other parts of the nation. In this region, WTE facilities are more likely to be cost-competitive since high land costs raise the costs of landfills, and high energy prices reduce the net costs of WTE facilities.

EXHIBIT III-28[57]

Geographic Distribution of Waste-to-Energy Market Subsegments

Contains Data for

Postscript Only.

D.3 MARKET SEGMENT COMPETITIVE STRUCTURE

WTE facilities rely on flow controls or long-term contracts to ensure high capacity utilization. Consistently high utilization is essential for facilities to meet their high debt service costs and achieve a net cost that is competitive with landfill costs. WTE costs are competitive with modern landfill costs, especially in the Northeast. However, even though WTE costs are competitive with landfill costs, WTE tipping fees supported by flow controls generally are higher than landfill tipping fees. Due to flow control, such WTE tipping fees need not be constrained by competition and often cover other municipal system costs (e.g., curbside recycling). In contrast, private regional landfills are more likely to set tipping fees at (lower) levels that recover disposal costs only (including return on investment), in order to remain competitive. Landfill tipping fees also may be lower due to competitive pressures, lower costs (for older landfills), and lack of full cost accounting in the landfill segment (discussed in Section III.E below). As stated previously, due to data limitations, the Report does not analyze price-cost relationships in jurisdictions with and without flow control authority. This section describes the competitive economics of the WTE market, use of flow controls, and level of tipping fees to assess the role of flow controls for this market segment.

Role of Flow Control in WTE Market

[57] Regions with States containing 1 or more WTE facilities are as follows: Northeast Region -- Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont; South Region -- Alabama, Arkansas, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia; Midwest Region -- Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin; and West Region -- Alaska, California, Hawaii, Montana, Oklahoma, Oregon, Utah, and Washington. States that have no existing WTE facilities include: Arizona, Colorado, Idaho, Kansas, Kentucky, Louisiana, Missouri, Nebraska, Nevada, New Mexico, North Dakota, Rhode Island, South Dakota, West Virginia, and Wyoming.

Flow controls play a significant role in the WTE market segment. As Exhibit III-29 shows, 58 percent of waste throughput is subject to flow controls.

EXHIBIT III-29

Guaranteed Flows of Municipal Solid Waste to Existing Facilities

Number of Facilities	Guarantee Mechanism	Throughput	Average Throughput	Percent of Throughput
61	Flow Controls	18,129,988	297,210	58
40	Contract	9,645,551	241,150	31
34	None	3,319,362	91,620	11
10	N/A (Temporarily Shutdown)	0	N/A	0
145		**31,094,901**		**100**

In addition to throughput supported by flow controls, 31 percent of throughput is guaranteed through contractual arrangements. As was stated for MRFs, the contractual arrangements with WTEs may, but need not, be supported by some form of municipal control over waste disposition including a flow control ordinance to ensure that enough waste is delivered to meet the terms of the contract.[58] Thus, some of the waste guaranteed by contracts also may be backed by local government use of flow controls; however, data are not currently available to assess how often this situation occurs. Finally, only 11 percent of waste received at WTE facilities was not guaranteed.

The types of waste guarantees, if any, used by WTEs differ across the three different types of WTE facilities. As shown in Exhibit III-30, most mass burn facilities, are supported by flow controls; most RDF facilities rely on either flow controls or contracts; most modular facilities do not rely on flow controls, instead they operate with either contracts or no form of waste guarantee. These differences mirror differences in average size (measured as throughput) and capital cost for the three types of WTEs.

EXHIBIT III-30

Use of Waste Guarantees by Type of Waste-to-Energy Facility Operational in 1992

Facility Type	Waste Guarantees								
	Flow Controls			Contracts			Neither		
	# Facilities	Through-put	% Total	# Facilities	Through-put	% Total	# Facilities	Through-put	% Total

[58] Telephone conversation with Mr. Mark Ryan, formerly Director of Municipal Finance for Standard & Poor's, and with Ms. Marie Pisecki, Vice President and Manager of the Solid Waste Group for Moody's (May 12, 1994).

Mass Burn	44	14,365,752	69.9	15	5,376,367	26.1	6	826,886	4.0
RDF	11	3,426,933	38.1	13	3,645,638	40.8	8	1,901,199	21.1
Modular	6	337,623	22.2	12	593,547	39.0	20	591,327	38.8
Total	61	18,129,988	58.0	40	9,645,551	31.0	34	3,319,362	11.0

As shown in Exhibit III-31, average facility throughput for the 61 WTE's with flow controls is three times the average throughput of the 34 WTE facilities without guarantees. Publicly-owned and operated facilities have both the smallest average throughput and the lowest level (i.e., 2.4 million tons out of 4.7 million tons or about 50 percent) of flow control support. In general, the throughput of privately owned and/or operated facilities averages almost three times the throughput of publicly owned and operated WTEs. Facilities owned and operated by the private sector and lacking the support of flow controls or contracts are among the smallest WTEs, in terms of average throughput; however, over 97 percent of the throughput of WTEs owned and operated by the private sector has the support of either flow controls or contracts.

EXHIBIT III-31
Waste-to-Energy Ownership and Use of Flow Controls

	Flow Control		Contract		Neither		Total	
	#	Total Throughput (average)	#	Total Throughput (average)	#	Total Throughput (average)	#	Total Throughpu t (average)
Privately Owned and Operated	23	8,843,776 (384,512)	27	7,083,744 (262,361)	8	430,364 (53,796)	58	16,357,884 (282,032)
Privately Operated/ Publicly Owned	23	6,929,624 (301,288)	6	2,122,423 (353,737)	5	1,000,114 (200,023)	34	10,052,161 (295,652)
Publicly Owned and Operated	15	2,356,588 (157,106)	7	439,385 (62,769)	21	1,888,884 (89,947)	43	4,684,857 (108,950)
Total	61	18,129,988 (297,213)	40	9,645,551 (241,150)	34	3,319,362 (97,628)	135	31,094,901 (230,333)

Data indicate that WTEs supported by flow controls are more likely to have greater throughput than WTEs not supported by flow controls. The association between the capital costs of WTE facilities and use of flow controls is similarly strong. WTEs supported by flow controls generally have higher mean and median capital costs, regardless of facility type (mass burn, RDF, or modular). Facilities supported by neither flow controls nor contracts generally have lower capital costs. (See Exhibits III-D.7 and III-D.8 in Appendix III-D.) Because of the large capital costs, financing is important; the better the terms, the lower the resulting net operating costs, due to reduced debt service costs.

Individuals with Standard & Poor's (S&P) and Moody's estimate that WTE facilities account for 50 percent ($12 billion) of the total dollar volume of outstanding solid waste bonds, both general obligation and revenue bonds.[59] Moody's and S&P view flow controls as a positive rating factor but also state that flow controls are only one factor in the rating of solid waste bonds. Moody's states that its "ratings are not based solely on legal structures; factors involving comparative efficiency and cost effectiveness are taken into account."[60] S&P notes that:

> "While important, legal waste flow control is not a requirement for receiving a rating. It is not necessarily even a requirement for receiving a high rating. If a system can provide solid waste disposal at a cost level below the surrounding market, the incentive for a hauler to avoid the system is eliminated. The more competitive the rate, the higher the rating the system's debt is likely to enjoy."[61]

[59] Telephone conversations with Mr. Mark Ryan, formerly Director of Municipal Finance for Standard & Poor's, and Ms. Marie Pisecki, Vice President and Manager of the Solid Waste Group at Moody's (May 12, 1994).

[60] "Solid Waste Flow Control Ordinances," Perspective on Solid Waste, *Moody's Public Finance*, October 5, 1993.

[61] "Courts Complicate Solid Waste Financings," *Standard and Poor's Creditweek Municipal*, November 9, 1992.

In sum, this is one market segment in which existing market conditions reflect a high use of flow controls and other mechanisms to guarantee waste flows particularly for larger capacity facilities.

Competitive Economics

Mass burn and RDF facilities have total capital costs that are an order of magnitude larger than the capital costs of modular facilities; however, because of their greater throughput, the former's capital costs per ton, and resulting debt service costs, are competitive with modular facilities. For each market subsegment, Exhibit III-32 lists the weighted average costs of operation and maintenance (O&M), debt service, and ash disposal, as well as revenues from the sale of electricity and net cost per ton of throughput.

Mass burn facilities operate at the lowest net cost, $38 per ton of throughput. Even though these facilities have the highest debt service cost, $30 per ton, they have relatively low costs of O&M per ton. Because they are smaller than mass burn facilities and cannot achieve similar economies of scale, modular facilities have higher O&M costs. O&M costs at RDF facilities also are high because, unlike mass burn facilities, they separate incoming waste and process it into a fuel for combustion.

It is important to note that debt service costs listed in Exhibit III-32 account for more than 60 percent of net WTE cost (79 percent at mass-burn facilities). This is one reason why many WTE

EXHIBIT III-32[62]

Average Costs and Revenues of Waste-to-Energy Market Subsegments

Subsegment	O&M ($/ton) (A)	Debt Service ($/ton) (B)	Ash Disposal ($/ton) (C)	Electricity Sale ($/ton) (D)	Net Cost ($) per ton Throughput [(A+B+C)-D]
Mass Burn	24	30	10	26	38
Modular	34	26	9	26	43
RDF	32	28	11	26	45

facilities rely on flow controls or long-term contracts: to guarantee enough waste to spread their fixed costs of debt service and lower their net costs per ton.

The costs in Exhibit III-32 do not include facility siting cost, contingency cost (e.g., the costs incurred during a temporary shutdown), or profit. When these factors are considered, WTE costs are likely to be similar to modern landfill costs, although costs will vary due to location-specific factors. S&P and Moody's agree that most WTE facilities could compete with landfills on the basis of net operating costs.

Tipping Fees

Although WTEs appear competitive with landfills on the basis of net operating costs, reported tipping fees at WTE facilities in several major WTE States are substantially higher than tipping fees at landfills in those same States. *BioCycle's* 1993 survey of MSW generation and management lists average tipping fees charged by landfills and WTE

EXHIBIT III-33

Tipping Fees: Landfills Versus Waste-to-Energy Facilities (WTE) ($/ton)

State	Average Landfill Tipping Fee	Average WTE Tipping Fee	Difference
Connecticut	65	74	+9
Maryland	43	49	+6
Massachusetts	65	65	0
Minnesota	50	84	+34
New Jersey	74	93	+19
New York	62	75	+13
Virginia	25	35	+10

[62] This exhibit includes all 135 operating facilities and the 10 facilities temporarily shutdown. Costs may vary depending on the efficiency of the facility, debt service arrangement (e.g., interest rate), and location (e.g., costs for ash disposal). Electricity sale revenues may vary depending on location, contractual arrangement with end user, and the amount of electricity generated per ton of waste throughput. Exhibit III-25 reflects an average revenue of approximately 5.5 cents/kwh, which varies considerably across regions of the country (e.g., 3.2 cents/kwh in the South to 6.8 cents/kwh in the Northeast).

facilities in States that reported this information.[63] For major WTE States that reported tipping fees for both landfills and WTE facilities, the average tipping fees charged are listed in Exhibit III-33. Average WTE tipping fees for these States, with the exception of Massachusetts, are higher than the average tipping fees at landfills in these States. This tipping fee differential is consistent with the inference that, because their waste flows are guaranteed, WTE facilities are more likely to charge higher prices to cover other municipal system costs, whereas competition will limit the ability of private landfills to recover amounts greatly in excess of costs. It is worth noting that the tipping fees at landfills in most of these major WTE States are already much higher than landfill tipping fees in the other 43 States.

The financial community has confirmed as common practice that tipping fees at many WTE facilities (and some municipal landfills) are used by local governments to recover the costs of other integrated waste management activities, such as collection and disposal of household hazardous waste, closure and remediation of older landfills, and recycling programs:[64]

> "The fee structure at most municipal systems [e.g., WTE facilities and municipal landfills] covers other costs in addition to disposal, such as recycling programs and transfer stations. In contrast, charges at private landfills cover only disposal costs. When the tipping fee is broken down into its component parts, prices are usually comparable for facilities sited in similar locations and built about the same time."[65]

[63] "The State of Garbage in America," *BioCycle*, May 1993.

[64] Telephone conversations with Mr. Mark Ryan, Director of Municipal Finance for Standard & Poor's, and Ms. Marie Pisecki, Vice President and Manager of Solid Waste Group at Moody's (May 12, 1994.)

[65] Moody's Public Finance, *Perspective on Solid Waste*, August 16,1993, page 3.

Public/Private Infrastructure

Exhibit III-34 shows WTE throughput by ownership status. In this market segment the distinction between publicly- and privately-owned facilities alone does not necessarily determine whether a facility is more likely to be supported by flow controls.

EXHIBIT III-34
Waste-to-Energy (WTE) Ownership Status and Throughput

WTE Ownership	WTE Throughput
Privately owned and operated	52%
Publicly owned and privately operated	32%
Publicly owned and operated	16%
	100%

It is noteworthy that the private sector has an ownership or operational role for 84 percent of WTE throughput, including most of the larger WTEs. As noted above in connection with the discussion of Exhibit III-31, WTE throughput for these facilities averages nearly three times the amount of the throughput at facilities owned and operated exclusively by the public sector. The involvement of the private sector has been critical to the growth of this market. Conversely, the public sector has an ownership stake in 48 percent of WTE throughput. Some of the largest WTE facilities represent public-private partnerships. Without the involvement and support of the public sector, this market segment would be much smaller.

D.4 MARKET SEGMENT POTENTIAL

Between 1980 and 1990 the amount of MSW combusted in WTE facilities increased ten-fold. Recent trends indicate that the WTE market segment will continue to grow but not at the rate experienced in the 1980s. The reasons for this limited rate of growth are discussed below.

Existing Facilities

Exhibit III-35 indicates that the average ton per day capacity of operating facilities is 742 tons, while the average throughput per day is 630 tons. As a result, the average facility is operating at 84.9 percent of capacity. In addition, the average facility is operating 6.5 days per week or 338 days per year. This high capacity utilization rate means that potential growth resulting from higher utilization of operating facilities is limited.

EXHIBIT III-35

Waste-to-Energy Market Subsegment Capacity and Utilization Rate

Subsegment	Capacity (tpd)	Throughput (tpd)	Utilization (percent)
Mass Burn	983	848	86.3
Modular	147	123	83.7
RDF	1,035	855	82.6
Weighted Average	**742**	**630**	**84.9**

As of 1992, 10 facilities were temporarily shutdown for rebuilding or retrofitting. These 10 facilities together represent 0.6 million tons of additional annual throughput. Six (6) of these facilities are expected to come on-line by 1995, while the re-start date for the other 4 is unknown.

New Facilities

The number of new facilities being planned and coming on-line has decreased in recent years, further suggesting that future growth will not keep pace with the growth experienced since 1980. Exhibit III-36 shows the number of facilities that were reported as conceptually planned and advanced planned in Government Advisory Associate, Inc. (GAA) surveys from 1986 to 1993. For example, in 1988, GAA found that 139 facilities were in the conceptual planning stages of development, and 63 facilities were advanced planned. By 1993, however, GAA found only 27 conceptual and 26 advanced planned facilities.

This decrease in the number of conceptual and advanced planned facilities has affected the number of new facilities coming on-line. The number of new facilities coming on-line peaked in 1988. For example, in the four years prior to 1988, 60 new WTE facilities came on-line; while in the 4 years following 1988, only 41 new facilities came on-line.

EXHIBIT III-36

Number of Conceptually Planned and Advanced Planned/Under Construction Facilities 1986 to 1993

Contains Data for

Postscript Only.

Another indicator of diminished growth in future capacity from new WTE facilities is the number of facilities under construction. In its survey, GAA found only 5 facilities in 1992 under construction: three in the Northeast, one in the South, and one in the West. Four (4) of these facilities are expected to come on-line by 1995, with the fifth scheduled to come on-line by 2000. Together, these five facilities would add approximately 1.6 million tons of annual throughput.

Should the 10 facilities temporarily shut down (discussed above) and the 5 facilities under construction all come on-line by 2000 as planned, 2.2 million tons of throughput will be added to the existing throughput of 31.1 million tons, an increase of seven percent. The remaining 21 facilities that are advanced planned (but not under construction) could add up to an additional 6.5 million tons of throughput. However, GAA data indicate that many advanced planned projects have been abandoned in recent years prior to beginning construction. Therefore, it is uncertain whether facilities not actually under construction will ever come on-line.

Other Factors Inhibiting Future Growth Rates

Other factors occurring both inside and outside the market may limit future growth in WTE throughput, for example:

- **High capital investment**. Relative to the other market segments, WTE facilities require a substantial initial capital investment. The average capital investment for planned facilities is approximately $136 million, which is much greater than the original capital investment for existing WTE facilities. Even high technology MRFs require capital of no more than $7 million, on average; capital costs of landfills can be spread out over time as cells are opened and closed.

- **Increased emphasis on recycling, composting, and waste reduction strategies**. Recycling and composting rates have increased significantly in recent years as many State and local governments attempt to reach recycling goals. Increased recycling and composting, as well as source reduction, decrease the amount of waste available for combustion in WTE facilities.

- **Landfill competition**. Price competition from landfills has left many WTE facilities at a relative price disadvantage. *Solid Waste Price Digest* (November, 1992), for example, estimates that the average price of disposal at a landfill is $28 per ton versus $56 per ton at WTE facilities. (These estimates are similar to those reported in *BioCycle*, May 1993). Competition for waste can be seen in the tipping fees charged by WTE facilities for local waste versus waste brought in from outside of the area of operation. For example, in Broward County, Florida, the tipping fee for local waste is $55 per ton, while the fee for outside waste is $42 per ton. Montgomery County, Pennsylvania, charges $63.50 per ton for local waste, but $41 per ton for outside waste. Both localities use flow controls to guarantee local waste inflows at higher tipping fees.[66]

- **Public opposition**. In the past 5 years, Massachusetts, Florida, and New Jersey (all States with significant amounts of existing WTE capacity) placed temporary moratoria on new WTE development. This led to a general decrease in the number of planned WTE facilities, as well as increases in the number of cancelled and delayed projects.[67]

The combination of high capital costs, competition from other market segments, and political uncertainties are likely to limit the growth of this market segment in future years.

E. LANDFILL MARKET SEGMENT

Key Findings

- The number of municipal solid waste landfills (MSWLFs) has declined rapidly since 1988, although estimated total landfill capacity has not shown this same decline. On a national basis, very small landfills account for most landfill closings, and large, regional landfill openings and expansions have offset this lost capacity.

- Large private landfills account for approximately 30 percent of the landfill market segment, smaller private landfills are estimated to account for 25 percent, and government-owned landfills are estimated to account for 45 percent of this market segment.

- No evidence was found that flow controls have played a significant role in financing new landfills or landfill expansions. Private firms have demonstrated their ability to raise substantial capital from publicly-issued equity offerings, indicating that investors have been willing to provide capital for the expansion of landfill capacity in response to a perceived market demand for this segment and its cost-competitiveness.

- Modern landfills are more cost-competitive when designed for large-scale operations receiving 750 tons per day or more. The cost for such large landfills is approximately $40 to $50 per ton. Smaller, older landfills generally charge lower tipping fees at present, due to lower historical landfill

[66] "Fading Garbage Crisis Leaves Incinerators Competing for Trash," *The Wall Street Journal*, Jeff Bailey, August 11, 1993.

[67] GAA Yearbook, 1993-94.

costs, including land acquisition costs. New landfills incur higher land acquisition costs and regulatory costs.

- Anticipated growth in composting and recycling, modest growth in WTE, and increased source reduction efforts likely will result in a continuing decline in the share of waste received at MSW landfills. However, the nation will continue to rely on landfills as a component of integrated solid waste management for the foreseeable future.

Data Limitations

Available data on the total number of landfills are not entirely consistent. In addition, there are no systematic data on the total amount of remaining landfill capacity; however, available reports over recent years indicate that remaining national landfill capacity has not been significantly reduced by the closing of many small landfills.

Quantitative data on the role of flow controls in this market segment also are unavailable. However, indirect evidence indicates that flow controls are not a major factor in this market segment. For example, private firms have demonstrated their ability to raise capital from publicly-issued equity offerings, indicating that investors are willing to provide capital for capacity expansion on a general nationwide basis (e.g., without site-specific flow control guarantees). Also, financial experts[68] familiar with publicly-issued solid waste bonds have indicated that flow controls are not as significant in the financing of landfills as they are for WTE facilities because of the much greater amounts of upfront capital required for WTEs.

E.1 OVERVIEW OF GROWTH TRENDS

Landfills have long been the dominant segment of the MSW management market. Although the majority of waste still is managed in landfills, recent growth in all of the other segments (i.e., recycling, composting, and WTE) slowly has eroded the landfill segment's market share. In 1992, landfills managed approximately 211 million tons of MSW and non-MSW (see Appendix III-E).

Number of Landfills

Several sources have estimated the number of MSW landfills in the U.S. Exhibit III-37 charts estimates from four different sources: National Solid Wastes Management Association (NSWMA), *BioCycle*, EPA, and the Government Accounting Office (GAO). The differing estimates from these sources can be explained in part by continuous landfill closures and openings; changing State definitions of landfills (e.g., revisions to exclude open dumps, inclusion of C&D or industrial landfills); different survey mechanisms; or lack of formal tracking mechanisms in some States.

Although the estimates tend to vary (with annual discrepancies among sources ranging from 100 to over 1,000 landfills), all estimates indicate a substantial, constant decline in the number of landfills over the past decade. For example, *BioCycle* reported 8,000 landfills nationwide in 1988; five years later, nearly 50 percent of these landfills were closed. Two

[68] Mr. Mark Ryan, Standard & Poor's, and Mr. Michael Decker, Public Securities Association.

main reasons for this decline are: (1) facilities reaching capacity and closing; or (2) facilities closing due to failure to meet environmental standards. For instance, to avoid new RCRA Subtitle D regulations mandating stricter liner and site management standards (although not fully implemented as yet), over 900 landfills are

EXHIBIT III-37

Estimated Number of U.S. Municipal Solid Waste Landfills

Contains Data for

Postscript Only.

believed to have closed between 1992 and 1993 alone, according to *BioCycle*.[69] Moreover, this observation is consistent across the nation, as 36 States reported a decline in the number of landfills in 1993.

Landfill Capacity

In the 1980s, the landfill capacity situation often was characterized as a disposal crisis. The substantial decline in the total number of landfills, however, has not significantly affected total landfill capacity. Exhibit III-38 presents the results of two surveys conducted by NSWMA. In 1986, NSWMA identified eight States with less than five years of remaining landfill capacity. The 1991 NSWMA survey, however, found that five of these States were still reporting less than five years of remaining capacity, two were reporting five to 10 years of capacity, and one was reporting more than 10 years of capacity. Also, two States, reporting five to 10 years of remaining capacity in 1986,

EXHIBIT III-38

Estimated Remaining Landfill Capacity In Selected States

States in 1986	States in 1991
<5 years remaining	
Connecticut Kentucky Massachusetts New Jersey Ohio Pennsylvania Virginia West Virginia	Connecticut Kentucky New Jersey Virginia West Virginia
5 to 10 years remaining	
Colorado Oklahoma	Massachusetts Ohio
>10 years remaining	
	Colorado Oklahoma Pennsylvania

Source: NSWMA, "Landfill Capacity in North America: 1991 Update"

[69] Robert Steuteville, "The State of Garbage in America," *BioCycle*, May 1994.

reported more than 10 years remaining capacity in 1991. These data show that some combination of expanded landfill capacity and growth in other market segments, causing a decrease in demand for landfill capacity, has either stabilized or increased remaining capacity in States that had reported imminent shortfalls in 1986.

BioCycle's surveys of remaining capacity in 21 States conducted in 1990 and 1993 found that, although the number of landfills declined between those years, capacity in these States actually increased by 68 percent from 9.5 years to 16 years. Only two (Indiana and Missouri) of the 21 States showed a net decline in remaining capacity. More significantly, all reporting States showed increases in recycling and composting, which closely corresponded to increased or stabilized landfill capacity over this period. (See Appendix III-E for more detail on this comparison.)

Another NSWMA study (summarized in Exhibit III-39) compares the change in the number of landfills with remaining capacity in 8 States. This study found that the decline in the number of landfills did not result in a decline in capacity; rather, capacity increased in many of the States. This increase in capacity is due to the fact that newer and expanded facilities are much larger in size than facilities that are closing.

A review of the largest private companies in the industry confirms this general trend toward opening large new landfills, expanding existing facilities, and acquiring smaller facilities with expansion potential, for example:

EXHIBIT III-39

State Estimates for Landfill Closings, Openings, and Expansions 1986-1991

State	Number of Landfill:			Net Change in	
	Closings	Openings	Expansions	# LFs	Capacity (million tons)
California	46	5	Unknown	(41)	5
Delaware	0	0	7	0	3.6
Massachusetts	43	3	72	(40)	0.4
Nevada	1	0	1	(1)	0.13
New Hampshire	22	5	0	(17)	0.03*
Rhode Island	4	0	0	(4)	(0.2)*
Texas	191	60	29	(131)	n/a
Wisconsin	850	9	12	(841)	n/a

Source: "Landfill Capacity in North America: 1991 Update," 1992, NSWMA; * Volume in tons per year, rather than total tonnage.

- Waste Management Services reported in 1992 that it was developing 30 new sites and expanding approximately 50 other sites.[70]
- In 1992, Mid-American Waste Systems obtained permits to expand 8 facilities and was seeking permits to expand another 9. The company reported a projected expansion of more than 100 million tons of landfill space.[71]
- Chambers Development Company reported in 1992 that it was opening 3 new landfills, expanding operations at 2 sites, and beginning development for several others.[72]
- Sanifill reported in 1992 that it replaced more than 5 times the amount of landfill space it used and achieved an additional 21 percent expansion in permitted capacity.[73]

The continuing expansion of landfill capacity by large waste management firms indicates that these firms will account for an increasing share of the landfill market segment.

E.2 MARKET SUBSEGMENTS

[70] *Waste Management Services, Inc., 1992 Annual Report*, page 23.

[71] Securities and Exchange Commission, Form 10K, Mid-American Waste Systems, 1992, page 13.

[72] Securities and Exchange Commission, Form 10K, Chambers Development Company, Inc., 1992, pages 6, 7.

[73] *Sanifill 1992 Annual Report*, page 8.

MSW landfills existing in 1992 can be classified in 3 categories:

1. **Large private landfills owned by publicly-held companies**. The landfills generally range from 500 to 1,500 tons per day capacity, with a few facilities having capacities greater than 2,000 tons per day. Landfills owned by large, publicly-held corporations accounted for 30 percent of the landfill market segment, based on EPA's analysis of available data on MSW landfill capacity for 13 large waste management firms (see Appendix III-E).

2. **Smaller, independently-owned private landfills**. These landfills tend to have less than 500 tons per day capacity and probably have an average disposal rate of less than 100 tons per day.

3. **Government-owned landfills**. These facilities generally have less than 500 tons per day capacity and probably have an average disposal rate of less than 100 tons per day.

There are no verifiable data on the amount of waste managed by small private landfills and government landfills, but one large waste management firm estimated that large firms account for 30 percent of landfill revenues, small firms 25 percent, and government landfills 45 percent.[74] The 30 percent revenue estimate for large firms is consistent with EPA's analysis of the share of landfilled waste managed by large firms. In general, landfill revenue share should be proportional to the share of waste received, because tipping fees produce revenues on a dollar per ton basis. Therefore, in the absence of more definitive data, EPA estimates that large firms account for 30 percent of the landfill market; small firms, 25 percent; and government landfills, 45 percent.

Also, there is no available data detailing the number of large and small government-owned landfills. However, EPA's review of landfill disposal in 14 States (see Appendix III-E) found that large landfills have the capacity, on average, to dispose of 41 percent of all waste landfilled in these States. If all large landfills account for 41 percent of this market segment, and large private landfills account for 30 percent of the market, then large government-owned landfills must account for the remaining 11 percent of the landfill market. If all government landfills account for 45 percent of this market segment, and large government landfills account for 11 percent, then small government landfills must account for 34 percent. Exhibit III-40 presents landfill market share estimates based on this analysis of limited available data.

EXHIBIT III-40

Landfill Market Share

[74] *Sanifill 1992 Annual Report*, Page 8. Sanifill cites "EPA estimates," but does not indicate where these estimates were found.

Contains Data for

Postscript Only.

E.3 MARKET SEGMENT COMPETITIVE STRUCTURE

This section discusses the competitive economics of the landfill market, capital requirements and scale of operations, the availability of investment capital, and the role of flow controls in guaranteeing waste for landfills.

Competitive Economics

Financial reports from large waste management firms indicate that the landfill market segment has been highly competitive in recent years. For example, one company reported experiencing intense price competition largely due to the rapid use of existing capacity by many older landfills seeking to fill capacity and close rather than comply with EPA revised MSWLF criteria.[75] Another firm noted that the recession caused some competitors to accept lower profit margins to maintain market share.[76] Another source noted that the continued decline in disposal rates, coupled with increases in capacity within the industry, could result in "further softening of disposal rates . . . and increased competitive pressure."[77] Finally, independent financial analysts confirm that waste minimization and recycling ". . . are altering the supply-demand side of the landfill business. This situation has intensified competitive price pressures."[78]

Capital Requirements and Scale of Operations

Although estimates vary depending on location and facility type, landfill development and expansion involves substantial capital requirements. For example, one company estimated that start-up costs, including site preparation, excavation, and installation for a liner system at the base elevation, require significant capital expenditures - often exceeding $200,000 per acre.[79] However, unlike WTE facilities, landfills do not incur all of their capital costs "upfront" before any waste is received. Large landfills operate in cells (i.e., opening one section of the landfill as another section is closed), allowing some capital expenditures to be incurred over the life of the entire landfill.

Exhibit III-41 shows that there are substantial economies of scale associated with the development and operation of modern landfills ranging from 100 to 1,500 tons per day. Although multiple factors cause costs to vary, Exhibit III-41 provides an example of the costs for modern

[75] Securities and Exchange Commission, Form 10K, Chambers Development Company, Inc., 1992, page 9.

[76] Securities and Exchange Commission, Form 10K, Browning-Ferris Industries, 1993, page 14.

[77] *American Waste Services 1992 Annual Report*, page 16.

[78] *Value Line*, March 25, 1994, p. 339.

[79] *Chambers Development Company, Inc., 1991 Annual Report*, page 3.

EXHIBIT III-41
Economies of Scale at Landfills

Contains Data for
Postscript Only.

landfills. These costs reflect site development, operating costs, closure and post-closure care costs for meeting EPA revised MSWLF criteria, as well as profit and corporate overhead costs.

As shown in Exhibit III-41, landfills with capacity less than 250 tons per day cost twice as much per ton as those facilities with capacity of 750 tons per day. The cost triples for 100 ton per day facilities. The economies of scale begin to level out for facilities between 750 and 1,500 tons per day.

The economies of scale realized by regional landfills may encourage some amount of inter-State and intra-State waste transport. This does not mean that a few, extremely large landfills will dominate this market segment in the future. Because additional economies of scale are minimal for facilities exceeding 750 tons per day, transportation costs and transfer facility costs would eventually render long-distance waste hauling non-competitive.[80] Therefore, it appears that landfills with capacity between 500 and 1,500 tons per day will remain competitive in the waste disposal sector.

The economies of scale demonstrated above support the conclusion that regional (often privately owned and operated) landfills potentially are more cost-effective for small communities than smaller, closer landfills. Other analyses have found that

[80] One source provides a rough estimate of $4 per ton for transfer facility costs, and $4 and $7 per ton for every 100 miles for rail and truck hauling, respectively. Konheim and Ketcham, "Exporting Waste: A Report on Locations, Quantities, and Costs of Out-of-City/State Disposal of New York City Commercial Waste," April 1991.

regional landfills use land more efficiently, lowering the risk of adverse environmental impacts, and are supported by a larger tax base than local landfills; private companies also are able to buy materials and equipment in bulk at lower cost.[81]

Tipping Fees

Exhibit III-42 compares tipping fees of larger landfills (greater than 500 ton per day capacity) with those of all landfills. Although the previous sections demonstrate economies of scale for larger landfills, tipping fees nationwide are slightly higher for larger landfills than for all landfills. This is likely due to the fact that large landfills tend to be newer and designed to spread the fixed costs of new environmental requirements. Small landfills, on the other hand, tend to be older, having been established when the lack of rigorous environmental requirements encouraged small towns to have their own landfills to minimize waste transport costs. Many older landfills have lower tipping fees, which do not recover their full costs of operation; for example, they may not cover costs such as proper closure and post-closure care. Also, older landfills have lower costs due to lower historical land acquisition and site development costs compared to newer landfills. Finally, some older landfills facing imminent closure have lowered tipping fees in order to attract customers and use up remaining capacity.

EXHIBIT III-42

Comparison of 1992 Tipping Fees at Large Facilities and All Facilities ($/ton)

Region	Larger Facilities (>500 TPD)	All Facilities
Northeast	59.81	51.63
South	25.34	22.71
MidWest	26.92	23.13
West	28.58	23.45
National	**31.51**	**29.00**

Sources: Larger facility fees from Solid Waste Digest, October 1992; all facility fees reported in "The State of Garbage in America," *BioCycle*, May 1993.

[81] James Powell, "Regionalization of Landfills: A Solution for 21st Century Solid Waste Disposal," Florida League of Cities, January 1993.

Flow Controls

Although quantitative data on the use of flow controls in the landfill segment are unavailable, the private sector has demonstrated its ability to raise investment capital through issuance of common stock to expand landfill capacity nationwide without site-specific flow control guarantees. Public stock offerings raised substantial equity capital for both well-established and relatively new landfill disposal firms in recent years. This ability to raise capital quickly in response to the closure of many small landfills allowed the private sector to significantly expand its share of the landfill market segment.

An examination of recent (1990-92) financing activities of major publicly-held firms in the industry documents substantial cash flows raised through issuance of common stock. Exhibit III-43 shows the nearly $1.25 billion equity capital raised by selected landfill companies. These landfill firms also raised substantial capital through debt issues and retained earnings. Companies have been able to raise this investment capital on the basis of their general business acumen and prospects, not on the basis of specific proposed developments supported by flow controls.

EXHIBIT III-43

Equity Raised Through Issuance of Common Stock ($ million)

Company	1990	1991	1992
American	60.2*	0.2	0.5
Chambers		164.7	
Eastern	5.3	10.7	0
Laidlaw	448.8	42.2	217.2
Mid-American	75.5*	93.4	20.6
Republic	13.5*	30.5	11.5
Sanifill	9.6*	2.0	
USA	4.2	2.8	0
Western	27.9	1.0	1.3
Total	**645.0**	**347.5**	**251.1**

* Year of initial public offering.
Information obtained through company 10K reports filed with the Securities and Exchange Commission.

Financial experts familiar with municipal solid waste bonds also have stated that flow controls are not as significant in the financing of landfills as they are for WTE facilities.[82]

Furthermore, municipal waste contracts cited in *Solid Waste Digest* and *Value Line*[83] report major landfill contracts with 6 and 3-year terms, as opposed to the 20-year commitments common in the WTE segment. Landfills can operate under shorter term contracts, because they incur many fixed costs in increments as they open new cells. WTE facilities, by contrast, must operate at high utilization rates over 20 years to spread the cost of large up-front capital investments.

E.4 MARKET SEGMENT POTENTIAL

As discussed above, the landfill market segment share has shrunk over the past decade. The continued growth projected in the recycling segment and potentially dramatic growth in composting will continue to erode the landfill market

[82] Telephone conversations with Mr. Mark Ryan, formerly Director of Municipal Finance for Standard & Poor's, and Mr. Michael Decker, Director of Policy Analysis at the Public Securities Association (May 13, 1994).

[83] *Value Line*, March 25, 1994, p. 343 and *Solid Waste Digest*, September 1993, p. 3.

segment share. Although growth in the WTE segment is slowing, this segment is not expected to drop the way that landfills have. Also, the relatively high capital costs (and debt service needs) of WTE facilities mean that these facilities are likely to "bid" aggressively for new garbage to maintain capacity utilization (and energy output), forcing landfills to absorb market losses to recycling and composting. This reduced flow of waste to landfills will be compounded each year and could result in a significant extension in the operating life and remaining capacity at existing landfills.

Also, there is significant growth potential for the recycling and composting of non-MSW that competes for management capacity at MSW landfills. For example, regional data indicate that 6 New England States increased their sewage sludge composting from 150 dry tons per day in 1990 to 250 dry tons per day in 1993.[84] The State of New York reported that sludge composting increased from 24,715 tons in 1991 to 85,783 tons in 1992. Further expansion of sewage sludge composting will reduce the amount of sewage sludge received by MSW landfills, extending landfill capacity.

In addition, it is technically possible to recycle a large amount of C&D wastes, and one expert estimates that 90 percent of C&D wastes could be recycled.[85] Available information reveals that a growing number of facilities throughout the country are processing C&D wastes for recycling. One source estimates approximately 150 facilities nationwide,[86] while another estimates 58 facilities in the Northeast alone.[87] Further expansion of C&D recycling could significantly reduce C&D waste disposal at MSW landfills, thus extending available MSW landfill capacity.

Although the landfill market segment will continue to shrink, MSW landfills are a necessary component of any MSW management system. Recycling and composting can divert a significant portion of MSW from landfills, but not all MSW is recyclable or compostable. Likewise, although WTE technologies can reduce the volume of MSW, all WTE facilities produce residual ash that must be landfilled. Finally, modern landfills are cost-competitive with WTE facilities and in some areas of the country may be more cost-effective for consumers.

F. ANALYSIS OF KEY ISSUES IN FLOW CONTROL DEBATE

EPA's analysis of the MSW facility market and its use of flow controls supports the following findings on issues raised by Congress:

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[84] "Compost Marketing in New England," *BioCycle*, August 1993.

[85] Gershmann, Brickner & Bratton, Inc., (GBB), "Construction Waste and Demolition Debris Recycling . . . A Primer - Draft," June 30, 1992.

[86] Robert Brickner, Gershmann, Brickner, and Bratton, August 1993.

[87] C.T. Donovan Associates, Inc., "Recycling Construction and Demolition Waste in Rhode Island," December 1992.

Findings

- *Flow controls play a limited role in the solid waste market as a whole. Flow controls are not typically utilized by landfills or composting facilities. Less than 3 percent of the recycling market is subject to flow controls; however, approximately 19 percent of the materials handled by existing MRF-based recycling programs is supported by flow controls. Flow controls play the largest role in the waste-to-energy market where at least 58 percent of the throughput is supported by flow controls.*
- *Although flow controls have provided an administratively efficient mechanism for local governments to plan for and fund their solid waste management systems, there are alternatives. Implementation of these alternatives by communities currently relying on flow controls may be disruptive and take time.*
- *Accordingly, there are no data showing that flow controls are essential either for the development of new solid waste capacity or for the long term achievement of State and local goals for source reduction, reuse and recycling.*

Evaluation of the four MSW market segments indicates that sufficient capacity exists on a national basis to manage the waste stream. Recycling and composting rates have increased substantially in recent years; WTE has grown, then leveled off; and landfill capacity has been extended due to increased recycling/composting efforts and landfill bans. This analysis also reveals that flow controls play a limited role in the solid waste management market as a whole. Only a small percentage of the waste managed by the composting, recycling, and landfill market segments is affected by flow controls. The MRF segment, currently handling 5.7 million tons of MSW, is the only one of these segments making any significant use of flow controls: about 13 percent of MRFs (with over 1 million tons of throughput) are supported by flow controls. Flow control has been used more extensively for MRFs that require substantial capital investment, with over 32 percent of the throughput of high technology facilities being flow controlled. The WTE market segment, accounting for 31 million tons of the 292 million ton MSW facility market, is the segment where flow controls play the largest role; a minimum of 58 percent (i.e., 18 million tons) of WTE throughput is supported by flow controls.

Adequate MSW management capacity, along with the increase in recycling and composting rates, results from competitive waste management markets that are increasingly intertwined with other dynamic markets (i.e., energy, recycled materials, paper, compost). Over recent years, unforeseen market developments repeatedly have altered the competitive position of different market segments and subsegments. Recent and ongoing changes in waste management market segments include the following examples:

- In the early 1980s, rising energy prices and concern about the risks of land disposal appeared to offer unlimited potential to the WTE segment of the waste management market; but the explosive growth in new WTE facilities coming online between 1985 and 1990 coincided with an unanticipated plunge in world energy prices and increasing public concerns about the risks of waste combustion.

- Landfill capacity, perceived to be in extremely short supply in the 1980s, has been unexpectedly extended by the successful diversion of waste materials to the growing recycling and composting markets. Economies of scale, successful siting of large regional landfills, competitive waste transport markets, and legal decisions removing obstacles to interstate waste transport also have expanded the geographic range of modern landfills, making their capacity available to more locations.

- The recycling segment offered tremendous growth potential in the late 1980s, relative to WTE costs and an apparent shortage of landfill capacity. However, the sudden expansion in the supply of recyclables, coinciding with depressed demand for recycled materials during the 1990-1991 recession, resulted in some calls for a critical review of recycling costs. More recently, collection vehicles and collection crew staffing specifically designed for recycling and improved MRF processing appear to be reducing the cost of recycling at a time when end-market demand is growing with the economic expansion. These factors are now serving to enhance the growth of the recycling market segment.

- Just a few years ago, the potential of the composting segment was virtually unrecognized by many waste management experts, but yard trimmings landfill bans and competitive costs in some communities now hold the potential for substantial expansion of this market segment. Also, more competitive technologies and collection strategies for composting are evolving, as mixed waste composting competes with yard trimmings composting and source-separated organics composting.

The remainder of this section addresses in more detail congressional questions concerning the role of flow controls in ensuring adequate capacity and achieving recycling goals.

F.1 ARE FLOW CONTROLS NECESSARY TO ENSURE ADEQUATE WASTE MANAGEMENT CAPACITY?

In a relatively short time period, adequate capacity for national and regional MSW management has been developed. Prospectively, the need for flow controls appears limited. As explained below, however, flow controls may be desirable to provide self-sufficient capacity for State and local political jurisdictions.

Recycling and Composting Capacity

The recycling and composting market segments have grown significantly in recent years. This growth was not primarily a direct result of the use of flow controls within these two market segments. Rather, the evaluation of these segments shows that:

- A minimum of 13 percent of MRFs, with 19 percent of total MRF throughput, are supported by flow controls. This represents 2.7 percent (about 1 million tons) of the waste managed by the recycling market and a minor fraction of all waste managed in MSW facilities.
- Flow controls have been a more important factor for MRFs requiring substantial capital investment; 32 percent of the throughput at high technology MRFs is supported by flow controls.
- Even though some of the 21 mixed MSW composting facilities may have waste guaranteed by flow controls, these facilities in total managed only 0.4 million tons in 1992, which was less than one percent of all recycled MSW and a negligible portion of all waste managed in MSW facilities.
- Although the "flow constraint" of yard trimmings landfill bans has had a positive impact on the composting segment, flow controls are not used to direct a large amount of yard trimmings to specific composting facilities.

These findings are consistent with the fact that many of the States that authorize flow controls exclude certain recyclables.

Waste-to-Energy Capacity

Approximately 58 percent (i.e., 18 million tons) of all waste managed by WTE facilities is guaranteed by flow controls and an additional 31 percent is guaranteed by contractual arrangements. Moreover, representatives from bond rating agencies (Standard and Poor's and Moody's) indicate that many WTE contracts are long-term "put-or-pay" contracts, which require local governments to provide an agreed upon amount of waste or pay for the difference. Local governments, in turn, may use flow control (or other mechanisms) to ensure that they can deliver a sufficient amount of waste to meet the terms of such contracts.

The number of new WTE facilities actually beginning operations has slowed significantly in recent years. Even with continued use of flow controls, the future growth of this market segment will slow considerably due to market forces such as:

- The decrease in energy prices in recent years is removing one of the main reasons for investment in WTE facilities; and
- Greater use of recycling and composting may remove waste from WTE waste inflows.

Although these market developments will slow the growth in WTE market share, existing facilities and those under construction will continue to supply substantial MSW management capacity.

Without flow controls, what would become of this waste management capacity? Some WTEs and local governments would use alternative mechanisms to secure needed waste flows; these mechanisms could include contracts, franchises, and subsidies (i.e., economic flow controls). Some waste no longer directed to WTEs would be managed at composting, recycling, and landfill facilities; on a national basis, all of these market segments have adequate capacity and could absorb wastes not managed by WTEs.

Landfill Capacity

Although the number of MSWLFs has decreased significantly over the past five years, several factors have contributed to maintaining a consistent level of landfill capacity:

- Most of the landfills that have closed had relatively small capacities and could not benefit from economies of scale;
- The private sector has made substantial investment in new regional landfills and landfill expansions, which have offset loss of capacity resulting from landfill closures; and
- Growth in recycling and composting activities, yard trimmings and other landfill bans, and WTE facilities have all diverted waste from landfills, thus extending capacity.

These market developments indicate that there is no national shortage of landfill capacity and no anticipated shortage in the foreseeable future.

Use of Flow Controls to Ensure Adequate In-State Capacity

Whether States and local governments consider in-State capacity to be an important goal, or how much additional waste management costs (if any) should be incurred in pursuit of such goals are issues beyond the scope of this Report. However, flow control is one of a variety of mechanisms that States and local governments can use to provide for the development of in-State or local capacity to manage MSW.

Flow controls can foster local capacity by making it easier to properly size and finance waste management facilities. Controlling the disposition of locally-generated MSW allows planners to more accurately determine how much waste must be handled and the types and sizes of facilities needed. Similarly, control of the waste ensures that waste management facilities will be amply utilized, which should result in cost-efficient operations. Finally, legal control over MSW can help assure investors that proposed projects are financially viable, thus securing financing at relatively favorable rates.

F.2 ARE FLOW CONTROLS NEEDED TO ACHIEVE STATE RECYCLING GOALS?

There are two potential ways in which flow controls might aid in achieving State recycling goals:

(1) The direct impact of flow controls explicitly requiring that recyclables be sent to specified recycling facilities (e.g., MRFs); and

(2) The indirect impact of State and local governments using higher tipping fees under flow controls as a funding mechanism to subsidize curbside recycling programs, MRFs, recycling promotion and education programs, and household hazardous waste programs. (Addressed in Section F.3 below.)

Direct Impact of Flow Control on Recycling Rates

As noted earlier, flow controls direct less than 3 percent of recycled materials to specific recycling facilities, and there is no evidence that flow controls commonly are used to direct yard trimmings to specific composting facilities. Furthermore, some of the States that authorize flow controls for mixed waste explicitly exclude recyclables from flow control restrictions. Therefore, the use of flow controls to direct recyclable and compostable materials to specific facilities does not appear to be a major factor in the future growth of the recycling and composting segments except for high technology MRFs.

F.3 INTEGRATED SOLID WASTE MANAGEMENT

Integrated solid waste management (ISWM) involves using different approaches for handling the entire MSW stream in a State or community. ISWM allows each type of waste to be managed according to the waste management hierarchy, taking into account environmental and economic considerations. The waste management hierarchy emphasizes a preferred order of solid waste management approaches: source reduction, recycling, waste combustion with energy recovery, and landfilling. ISWM can be a cost-effective MSW management approach.

Some desirable components of an ISWM program do not lend themselves to generation of their own revenues. For example, outreach and education on source reduction generally are performed at no direct charge (i.e., a separate fee) to the target audiences. Household hazardous waste programs similarly are offered at no direct charge in order to encourage participation. These activities all require sources of funding.

State and local officials indicated at the flow control meetings that revenues generated by flow controls are used by some jurisdictions to support various elements of ISWM systems. Where flow controls are used to support ISWM, costs of the various service elements of the system are built into the tipping fees of the designated facilities. As a result, these tipping usually are higher than the market level. Flow controls ensure that the MSW goes to these facilities, rather than to facilities with lower tipping fees. The revenues generated by the flow control-supported tipping fees are used to fund elements such as those noted above that comprise the ISWM system. Thus, prior to the Supreme Court *Carbone* ruling, flow controls provided an administratively efficient mechanism for local governments to fund ISWM.

G. ALTERNATIVES TO FLOW CONTROL

One of the primary purposes of flow control has been to generate revenues to finance solid waste facilities and other components of an ISWM system that cannot generate sufficient revenue to cover program costs (e.g., curbside collection programs, outreach and education, household hazardous waste collection). The Agency explored various alternatives, both in terms of organizational options and funding mechanisms, that State and local governments could or are employing to support solid waste management systems. This section describes the alternatives and discusses how solid waste managers might assess them when planning a new or modified system of fees and charges.

Organizational Alternatives

By using various organizational arrangements, municipalities can direct waste to specific facilities, an effect similar to that produced by flow control. Among the options available to local governments are:

- providing waste collection services themselves and delivering waste and discarded recyclables to selected facilities;
- hiring contractors to perform collection services and using the contracts to require delivery of wastes to selected facilities;
- awarding franchises for collection and hauling services within given collection districts; haulers agree to deliver waste to the facility designated by the community; and,
- establishing special purpose districts or utilities to manage MSW collection and delivery to designated facilities.

Financial Alternatives

Among the financial mechanisms which State and local governments can use are the following: (1) taxes, (2) uniform user fees, (3) unit-based (i.e., variable) fees, and (4) market-based tip fees. The following paragraphs describe each of these alternatives.

Taxes, which can apply to property, income, and/or sales, are the primary mechanism most State and local governments use to generate funds. Taxes serve as the basis for the issuance of general obligation bonds, which can be used to finance capital investments in facilities such as WTEs and MRFs. A number of States restrict the amount of money that can be raised through property taxes. As a result, local governments may be subject to debt limitations or restrictions on the amount of bonds that can be supported by taxes. Also, special purpose entities, such as waste management districts, may lack the authority to tax.

Uniform User Fees are commonly employed to recover the costs of public services such as waste management. These user fees are termed "uniform" because they do not vary by the amount of waste discarded. User fees are attractive for the following reasons: (1) they may not be subject to legal limitations that apply to taxes, (2) they may be better accepted by the

public than taxes, and (3) they can be set on a user basis (e.g., per person, per household), whereas taxes are tied to measures of property ownership, income, or spending. For capital investments or new facility development, a "special assessment" can be imposed to aid in raising up-front funds.

Unit-Based Pricing is a method of charging service users for the costs of waste management on the basis of how much waste is discarded. The more waste discarded means a higher charge. Also termed "pay as you throw" or "variable rate pricing", this system creates incentives to reduce the amount of waste that generators discard. Over 1,000 communities have unit pricing programs in place.

Market-Based Tip Fees mean that the fees charged are based on the facility's costs and the prices charged by its competitors. The difference between fees charged and costs incurred is profit or loss; depending on market conditions, a waste management facility may be more or less profitable. In contrast, a tip fee supported by flow controls need not be based on costs or competition but can be set at any level. As a basis for financing capital costs, the market-based tip fee can be secured through long-term contracts, negotiated between willing buyers and sellers. Local governments can use such contracts to demonstrate commitment of sufficient waste flows to convince lenders to arrange financing of proposed facilities.

Among the considerations used by solid waste managers when they weigh alternative approaches or combinations of approaches are adequacy of revenue, equity, political feasibility, administrative ease, impact on innovation, and efficiency. These criteria are described below.

- **Adequacy of revenue** means the ability of an alternative to (1) generate funds for financing up-front costs of capital-intensive facilities; (2) provide long-term funding stability (i.e., for debt-service or program costs); and (3) support source reduction education, recycling/composting, household hazardous waste, and related public services that do not directly generate their own revenues.

- **Equity** has at least two relevant aspects. First, it considers the degree to which costs or prices of MSW services are "hidden" from the parties paying the bills. For example, when MSW services are funded out of general taxes, the tax bill does not indicate how much is for MSW; in effect, the price of solid waste management is hidden from the taxpayer. Second, equity measures the degree to which the costs or prices are related to the amount of waste discarded by generators or disposed at facilities; the closer the relationship, the more equitable the alternative.

- **Political feasibility** refers to the need for legislative or regulatory authority to enact an alternative and the willingness of the public to accept a new fee system.

- **Administrative ease** reflects the burden of using an alternative, considering both the required resources and costs of designing and implementing new systems or expanding existing systems.

- **Impact of innovation** considers how use of an alternative might create barriers or incentives for the development of improved practices or technologies for waste reduction, recycling, or management.

- **Efficiency** refers to the optimum use of scarce resources to obtain the desired goods or level of service while protecting human health and the environment. For example, the use of flow control vs. open competition may impact total system costs and the level of services provided.

Taxes can provide a reliable source of funding. Although taxes may be politically unpopular, they are relatively easy to administer. Taxes can be set at levels sufficient to support integrated solid waste management programs, although potential tax caps and exemptions may limit their usefulness in financing very high capital cost facilities. Taxes have the disadvantage of masking the costs of MSW services from taxpayers and not being based directly on waste generation or services provided.

Uniform user fees also can provide local governments with a reliable source of funding, support revenue bonds to raise money for capital outlays, and fund integrated solid waste management programs. Uniform user fees may be more politically acceptable than taxes.

Unit-based user fees' greatest advantage is that they directly relate waste management charges to the number of waste units discarded by generators. However, unit-based pricing offers a less stable basis for program funding due to the potential for declining revenues over time, if waste generators respond to the waste reduction incentives this option creates. Unit-based fees have proven to be politically acceptable in many communities. However, they can pose administrative challenges, both in setting up the system and operating it over time.

The market-based tip fee may be the most feasible politically; this option entails no authorization issues and is familiar to the public. However, market-based tip fees may not be able to generate sufficient profits to fund other MSW activities and remain competitive. In general, free market systems pose the fewest obstacles to innovation.

It is important to emphasize that communities can use a combination of options to support their programs. The alternatives described need not be mutually exclusive.