US EPA ARCHIVE DOCUMENT

APPENDIX III-A

Technical Analysis: Waste Stream Estimate

A.1 USING *BIOCYCLE* DATA TO ESTIMATE THE SIZE OF WASTE STREAM RECEIVED AT MSW FACILITIES

In order to prepare this Report, EPA needed to determine the best estimate of the amount of waste <u>received</u> at MS management facilities, including the amount of non-MSW that may compete for MSW management capacity. For the follo reasons, EPA concluded that the *BioCycle* estimate of 292 million tons for 1992 appeared to be the most appropriate estima for the size of the waste stream for this market analysis of flow controls:

♦ **Measures non-MSW affecting MSW management capacity.** States reporting to *BioCycle* often measure the total amount of waste received at MSW management facilities, including such non-MSW waste types as C&D, sewage sludge, and industrial non-hazardous waste. This approach quantifies additional wastes that are relevant to the issue of adequate future capacity since it measures waste received at MSW facilities. However, *BioCycle* does not provide a complete measure of all non-MSW wastes received at MSW facilities, since States may or may not provide this data.

♦ **Measures additional waste disposal capacity needed for residuals**. Counting both materials processed at recycling and combustion facilities as well as the residues of these processes managed at landfills allows for a more accurate assessment of waste management capacity; data on recycling and combustion facility capacity and throughput are often reported on a "tons received" basis, and landfill disposal capacity is needed to manage residuals from these facilities. However, States do not consistently report this data to *BioCycle*.

A.2 RECONCILING EPA AND *BIOCYCLE* ESTIMATES

To confirm that *BioCycle* includes non-MSW amounts in State estimates for the amount of waste landfilled, EPA reviewed State reports on waste generation and management. Exhibits III-A.1 and III-A.2 show the results of this review. Exhibit III-A.1 compares *BioCycle* landfill estimates with available State data on waste received at MSW landfills (MSWLF excluding waste received at C&D and other non-MSW landfills dedicated to the disposal of these non-MSW types. Colum shows the amount of 1992 waste each State reported to *BioCycle*. Column B shows the percent of waste landfilled as reported by each State. Column C is the result of Column A multiplied by Column B. Column D shows the amount of wa disposed in MSWLFs according to State reports. Column E is the difference between the *BioCycle* landfill estimate (Colun C) and the State data for MSWLFs (Column D). Although Column E indicates some discrepancies between the *BioCycle* estimate and the reported amount of waste received by MSWLFs, the largest differences are for two States (Indiana and N York) that are major waste importers/exporters, and the net difference for the 12 States listed in the exhibit (420,050 tons) relatively small. For example:

♦ In 1992, **Arkansas** reported MSW generation to *BioCycle* of 2,154,000 tons (Column A). A review of data provided by Arkansas on the amount of waste received at MSWLFs in 1992

US EPA ARCHIVE DOCUMENT

showed a total of 2,153,532, almost exactly the same amount reported as generation.[1] This example shows that Arkansas is reporting the amount of waste received at MSWLFs and not the amount of MSW generated.

- ♦ The State of **Indiana** reported 8.4 million tons of MSW generation to *BioCycle* in 1992. Again, this number closely matches the amount of waste disposed in MSWLFs in that year, as provided in a State report.[2] However, the amount of waste received at Indiana MSWLFs includes 1.8 million tons of waste imports. Moreover, an Indiana report indicates that the waste disposed in MSWLFs includes some non-MSW, such as C&D waste and industrial process waste, although the report also indicates that a substantial amount of non-MSW is managed by non-MSW facilities, such as dedicated C&D landfills. In this example, the *BioCycle* estimate is a reasonable approximation of waste received at MSWLFs, with non-MSW that is shipped to dedicated non-MSW facilities excluded.

EPA received six other State reports that are not current and/or do not clarify whether the data they present are for landfills or just for MSWLFs. Nonetheless, Exhibit III-A.2 compares *BioCycle* reported landfill estimates for these 6 States with other relevant information provided in State reports. This exhibit illustrates the data anomalies and uncertainties inhere available State landfill disposal data. For example, one **Texas** report appears to indicate that total waste received at "MSWLFs" is 16 million tons greater than the amount reported to *BioCycle*, but another State report seems to suggest that these additional tons are non-MSW that may be managed at dedicated non-MSW facilities. The *BioCycle* estimates appear include C&D wastes in **Maine** and exclude C&D wastes in **Massachusetts** -- State reports confirm that C&D wastes generally are sent to MSWLFs in Maine and to dedicated commercial C&D facilities in Massachusetts.

US EPA ARCHIVE DOCUMENT

---

1 As reported in a printout of waste amounts received at Arkansas sanitary landfills as submitted by the State.

2 "Summary of Solid Waste Facility Data for Indiana: 1992 Annual Report," Department of Environmental Management, 1992.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-A.1

BioCycle Reported Municipal Solid Waste Landfill Disposal Versus State Reported Data

State	BioCycle Reported Waste (1992) (A)	% Land-filled (B)	*BioCycle* Landfill Estimate (C)=(A)*(B)	State Data for MSWLFs (D)	Difference (D)-(C)	Comments from State Reports Reviewed by EPA
Arkansas	2,154,000	85	1,839,900	2,153,532	322,632	• Amount reported to BioCycle is the amount of waste disposed in MSWLFs in 1992.
Florida	19,400,000	49	9,506,000	9,687,836	181,836	• Amount reported to BioCycle includes 3.3 million tons of C&D waste and 0.7 million tons of extra metals. • Amount of waste landfilled includes waste disposed in active MSWLFs in 1992. • Active Class III landfills (C&D, tires, other inert waste) received about 5 million tons in 1992.
Illinois	14,140,000	87	12,301,800	12,313,649	11,849	• Difference is statistical error (actual amount of waste disposed is 87.1 percent). • State uses average per capita MSW generation rate of 6.2 lbs/day to estimate 14.2 million tons and subtracts 100,000 tons for "net exports" and notes, "In 1992, 14.1 million tons of *non-hazardous solid waste were handled*." • Landscape wastes banned from landfills since July 1990.
Indiana	8,400,000	75	6,300,000	8,418,485	2,118,485	• Amount reported to BioCycle is the amount of waste received at MSWLFs in 1992. Approximately 1.8 million tons is out-of-State waste. • Waste received at MSWLFs includes "C&D waste, industrial process waste, sludge, ash, asbestos, and contaminated soils."
Minnesota	4,270,000	27	1,274,400	1,350,535	76,135	• Approximately 110,000 tons of industrial non-hazardous waste was co-disposed in MSWLFs in 1992.
Nevada	2,300,000	90	2,070,000	2,245,011	175,011	• Amount of waste reported to BioCycle is the amount of waste disposed in 1990. State uses an average generation rate of 10.12 lbs/person/day. • Amount of waste disposed in MSWLFs includes disposal figures from Class I MSWLFs receiving greater than 10,000 tpy.
New Jersey	7,513,000	45	3,380,850	2,895,947	-484,903	• Amount disposed in MSWLFs is from 12 of 37 MSWLFs.
New York	22,800,000	62	14,136,000	11,900,000	-2,236,000	• State reported exporting 3 million tons out-of-State in 1990. • State estimate (1990) for MSW disposal is 18,306,072 and recycling is 4,054,905. • State estimate (1990) for C&D generation is 3 million and industrial non-hazardous waste is 3.6 million. Report indicates that most industrial waste never leaves the point of generation and the management of C&D waste is difficult to track, although State has 77 known C&D landfills, with about 25 having MSWLF-type permits.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-A.1 (continued)

BioCycle Reported Municipal Solid Waste Landfill Disposal Versus State Reported Data

State	BioCycle Reported Waste (1992)	% Land-filled	*BioCycle* Landfill Estimate	State Data for MSWLFs	Difference	Comments from State Reports Reviewed by EPA
	(A)	(B)	(C)=(A)*(B)	(D)	(D)-(C)	
North Carolina	7,788,000	95	7,398,600	6,681,578	-717,022	• Difficult to determine how State arrived at estimate reported to BioCycle. • State reports (FY 1991-92) 6,681,578 tons disposed in MSWLFs, 19,859 tons in tire monofills, 121,944 in incinerators, 267,428 tons yard trimmings collection/compost, and 432,430 tons recycling. (total is 7,523,239).
Ohio	16,400,000	75	12,300,000	12,466,719	166,719	• BioCycle estimate is the amount of waste delivered to landfills and incinerators in 1991. In 1992, these facilities received 17.5 million tons of waste from the following sources: industrial waste (6.1 million tons); "exempt waste," e.g., ash, C&D (0.8 million tons); "general solid waste," defined to include MSW as well as contaminated soils, MSW treatment sludge, MSW incinerator ash. • Captive industrial landfills received 3.8 million tons and incinerators received 1.5 million tons, leaving approximately 12.2 million tons disposed in MSWLFs. This total includes 1.8 million tons of out-of-State waste. • The amount of waste disposed in MSWLFs is taken from a detailed listing of MSWLF facilities for 1992.
Utah	1,500,00	80	1,200,000	1,835,416	635,416	• Difficult to determine how State arrived at estimate reported to BioCycle. State report notes 1.9 million tons of residential and commercial waste generated in 1992. • State report indicates 1.8 million tons disposed in MSWLFs and 0.5 million tons of C&D waste disposed in dedicated C&D landfills.
Washington	5,708,000	65	3,710,200	3,889,092	178,892	• Amount of waste landfilled (1991 figure) includes demolition waste, industrial waste, sludge, and other waste (tires, petroleum contaminated soils, compost materials, ash, etc.)
		NET	**75,417,750**	**75,837,800**	**420,050**	

US EPA ARCHIVE DOCUMENT

EXHIBIT III-A.2

BioCycle Reported Municipal Solid Waste Landfill Disposal Compared to Information Obtained from State Reports

State	BioCycle Reported Waste (1992) (A)	% Land-filled (B)	*BioCycle* Landfill Estimate (C)=(A)*(B)	Comments from State Reports Reviewed by EPA Note: Landfill data for these State reports are not current (they are 1989 or 1990 data) and/or do not clarify whether data are for all landfills or just for MSWLFs.
Iowa	2,088,000	75	1,566,000	• Landfills reported receiving 2.2 million tons of solid waste in 1989.
Maine	1,246,000	33	411,180	• BioCycle estimate includes 0.4 million tons of C&D waste. "Very few licensed facilities exist for the management of these wastes."
Massachusetts	6,600,000	23	1,518,000	• In 1990, Massachusetts generated 6.65 million tons of MSW plus an additional 3.35 million tons of other waste (C&D, municipal and industrial sludge, and contaminated soils). • State reported landfilling 3.1 million tons of MSW in 1990. • It appears that very little other waste (C&D) is disposed in MSWLFs, e.g., "60-80 percent of C&D waste is managed by in-State facilities. The majority of waste is disposed at seven large commercial landfills. Most MSWLFs greatly limit C&D wastes, even from residents."
South Dakota	800,000	90	720,000	• In 1991, State reported generating 842,000 tons of solid waste: 416,000 tons of residential/commercial waste, 123,000 tons of yard trimmings, and 303,000 tons of industrial waste. • An inventory of existing solid waste disposal facilities reported receiving 1.94 million tons of solid waste. Approximately 1.5 million tons were received at one facility. Discounting this facility leaves 0.45 million tons disposed (the approximate amount of MSW generated).
Texas	14,469,000	88	12,732,720	• Texas landfills reported receiving a total of 21.7 million tons in 1992. Of this amount, about 14.5 million is household/commercial waste (the amount reported to BioCycle). The remaining was is non-MSW, including 3.6 million of C&D waste. • In a separate report, Texas reported that 29.8 million tons of waste are disposed in MSW facilities: 13.1 million tons of MSW, 0.2 million tons of municipal sludge, 13.3 million tons of industrial waste, and 3.2 million tons of C&D waste. This report also showed MSW generation of 14.5 million tons.
Wisconsin	3,352,000	72	2,413,440	• Amount of waste reported to BioCycle is based on a 1990 characterization study by Franklin Associates and includes only EPA-defined MSW. • State reports generation of an additional 6.3 million tons of non-MSW. • Of MSW generated, State reported that in 1990 2.6 million tons were landfilled. • There is no indication that non-MSW is managed in MSW facilities.

APPENDIX III-B
Technical Analysis: Compost Segment

This appendix details the basis for estimating the amount of MSW managed by the composting market segment in (9 million tons) as well as the amount of waste composted in individual States. This appendix corresponds to Section B in Chapter III.

B.1 ESTIMATE OF MIXED-WASTE COMPOSTING

Exhibit III-B.1 lists the 21 mixed-waste composting facilities in operation in 1992. Most of these facilities report mixed MSW as their only feedstock. However, five facilities process a mixture of MSW and sludge, one of these receives industrial waste (i.e., brewery waste), and another receives agricultural waste (i.e., manure). Also, the Fillmore and Swift facilities in Minnesota are actually source-separated organics composting facilities; these facilities receive a feedstock of fo other compostables separated by households and commercial waste generators (e.g., food and paper waste from grocery s

The combined design capacity of the 21 facilities listed in Exhibit III-B.1 is 4,472.6 tons per day, or approximately million tons per year based on 260 days of operation. However, the exhibit also shows that the 1992 throughput for these facilities is substantially lower than their design capacity -- 1,876 tons per day, or approximately 0.5 million tons per year b on 260 days of operation. The estimate of 0.5 million tons should be revised downward, however, for two reasons: (1) or facility in Florida, accounting for almost 30 percent of the total ton per day throughput of all mixed-waste facilities, suspen operations in late 1992; and (2) the annual throughput at several other facilities includes some amount of sewage sludge, w should be excluded from the estimate of MSW composting and included in the estimate of non-MSW composting to avoid counting. For these reasons, EPA believes that 0.4 million tons is a better approximation of the amount of MSW managed i mixed-waste composting facilities in 1992.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-B.1[3]

Mixed Waste Composting Facilities Operating in 1992

Facility	Feedstock	Design Capacity (tpd)	Percent Composted	Current Throughput (tpd)
Pinetop-Lakeside, AZ	MSW/sludge	15	75	15
New Castle, DE	MSW/sludge	1350	20	225[1]
Escambia, FL	MSW	400	95	200[2]
Pembroke Pines, FL	MSW	660	75	550[3]
Sumter County, FL	MSW	200	55	50
Buena Vista, IA	MSW	70	52	16[4]
Montgomery County, KS	MSW	300	65	50
Mackinac Island, MI	MSW/manure	1.6	45	N/A
Fillmore County, MN	source separated organics	11	43	11
Lake of the Woods, MN	MSW	10	60	5
Mora, MN	MSW	500	72	170
Pennington County, MN	MSW	80	30	8
Prairieland, MN	MSW	100	63	85
St. Cloud, MN	MSW	75	70	50
Swift County, MN	source separated organics	40	45	6
Wright County, MN	MSW	165	62	110
Sevier County, TN	MSW/sludge	225	75	150
Big Sandy, TX	MSW/brewery waste/sludge	25	85	Unavailable
Whatcom County, WA	MSW	125	60	100[5]
Columbia County, WI	MSW	80	33	55
Portage, WI	MSW/sludge	40	N/A	20
TOTAL		**4,472.6**		**1,876**

1 Composting has stopped at the Delaware Reclamation Plant pending the result of an appeal by the facility operator. It had been composting 200-225 tons/day (tpd) of MSW with biosolids.
2 No MSW composting in Escambia County since February 1993. County plans to restart (at 200 tpd) by first quarter 1994.
3 Pembroke Pines stopped composting in November, 1992. Facility repairs are nearing completion. A phased in start-up is expected to begin in early 1994. The facility had been composting 550 tpd.
4 Reported annual throughput (4,200 tons) divided by 260 days.
5 At one point, Recomp of Washington was composting 100 tpd of MSW. That portion of the facility is essentially shut down pending the issuance of composting regulations by the Washington Department of Ecology.

3 Throughput data from "Solid Waste Composting Update," *BioCycle*, November 1993; all other data from *U.S. Solid Waste Composting Facility Profiles*, Volume II, The United States Conference of Mayors, March 1993.

US EPA ARCHIVE DOCUMENT

B.2 ESTIMATE OF YARD TRIMMINGS COMPOSTING

The estimate of the amount of yard trimmings composted in 1992 is based on the convergence of two different estimates.

National Yard Trimmings Composting Estimate Based on EPA and *BioCycle* Data

BioCycle reported that the number of yard trimmings facilities grew from 1,407 in 1990 to 2,981 in 1992. In other words, the number of operating yard trimmings facilities in 1992 was 212 percent of the number of facilities in 1990 (2,98 = 2.12). Applying this percentage change to EPA's estimate of the total amount of yard trimmings composted in 1990 (4.2 million tons) suggests that a reasonable estimate of the amount of yard trimmings composted in 1992 is approximately 8.9 million tons (2.12 multiplied by 4.2 = 8.9).

Estimating the growth in yard trimmings composting based on the growth in the number of facilities implicitly assu that the average amount of yard trimmings composted per facility did not change substantially between 1990 and 1992. (N use of the average does not mean that all facilities are assumed to be of equal size in terms of quantity of yard trimmings composted.) However, *BioCycle* also reports that among those yard trimmings facilities specifying incoming feedstocks in 1990, 64 percent reported that they accepted only leaves, and 36 percent accepted all yard trimmings; in 1992, 94 percent facilities specifying feedstock reported that they accepted all yard trimmings.[4] Thus, this data suggests that yard trimmings composting is growing not only in terms of the number of facilities but also in the average amount of yard trimmings that facilities process. If the average quantity of yard trimmings composted per facility increased between 1990 and 1992, then estimate of 8.9 million tons of yard trimmings composted in 1992 may understate the actual amount of yard trimmings mar by this market subsegment.

National Yard Trimmings Composting Estimate Based on *BioCycle* and State Data

In order to estimate the average amount of yard trimmings received at yard trimmings composting facilities and to develop a second estimate of the total amount of yard trimmings composted in 1992, EPA requested available data on composting from all 50 States. A total of eight States provided data on the amount of yard trimmings composted in 1992. Because of the rapid growth in yard trimmings composting, the data reported by the eight State sample may somewhat understate the amount of yard trimmings composted by these States during calendar year 1992, because some of these Sta reports are for fiscal years ending prior to the end of the 1992 calendar year (e.g., Illinois data is for the year ending April 1 1992). If composting activity continued to grow throughout the remainder of the year, then the fiscal year data would und the amount of yard trimmings composting during the 1992 calendar year.

[4] The number of facilities specifying feedstock was 811 in 1990, or 58 percent of all 1,407 yard trimmings facilities in 1990. The number of facilities specifying feedstock in 1992 was 1,944, or 65 percent of all 2,981 yard trimmings facilities in 1992.

US EPA ARCHIVE DOCUMENT

Exhibit III.B-2 presents the yard trimmings composting tonnage reported by the eight-State sample, the number of yard trimmings composting facilities reported by *BioCycle* for each of these States, and the average quantity of yard trimmi composted per facility for each State (i.e., yard trimmings tonnage divided by number of facilities). These eight States pro reasonably good sample because they are regionally diverse, and they account for 38 percent of all the yard trimmings facili reported by *BioCycle*. On average, the yard trimmings facilities in these States receive 2,950 tons of yard trimmings per ye The average or mean throughput is statistically the best point estimate to use in extrapolating to the larger population of all composting facilities active in 1992; use of the mean does not imply that EPA assumes all composting facilities are equal in amount of yard trimmings accepted. Extrapolating the average throughput of the eight State sample to all of the 1992 facilit reported by *BioCycle* suggests that the amount of yard trimmings composted in 1992 was approximately 8.8 million tons (2,950 tons per facility times 2,981 facilities = 8.8 million tons).

Using the average throughput per facility from the eight State sample to estimate the total national tonnage of yard trimmings composted in 1992 results in an estimate that is very close to the estimate developed above using a different methodology. The convergence of these estimates enhances confidence in the estimate of 8.8 million tons of yard trimmin composted nationwide in 1992. However, statistical issues of selection and measurement bias, as well as natural variation, i that large confidence limits (e.g., error bands) may be in fact appropriate for this estimate. For example:

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

EXHIBIT III-B.2

Eight State Sample

State	State Estimates of Tons of Yard Trimmings Composted in 1992 (A)	*BioCycle* Estimate of Number of Yard Trimmings Composting Facilities in 1992 (B)	Yard Trimmings Composted Per Facility (C)=(A)/(B)
California	575,491	26	22,134
Florida	847,900	20	42,395
Illinois	418,331	96	4,358
Minnesota	328,470	397	827
North Carolina	267,428	75	3,566
New York	467,858	200	2,339
Pennsylvania	267,104	300	890
Washington	157,673	15	10,512
SAMPLE TOTAL	**3,330,255**	**1,129**	**2,950 (Average)**

- The eight States in Exhibit III-B.2 present a very wide range of average annual throughputs -- from 827 tons per facility in Minnesota to 42,395 tons per facility in Florida. Part of this variation in average throughput may be due to climatic variations among the sample States, because the highest average throughputs are reported by Florida and California where yard trimmings facilities can receive yard trimmings all year,[5] and the lowest average throughput is reported by Minnesota which has a very short yard trimmings generation season. However, because these States were not selected randomly, an element of selection bias may also justify large confidence limits around the observed mean.

- Variation in the calculated average throughputs for different States may also reflect the rapid changes in this market subsegment which can result from impositions of landfill bans on yard trimmings as well as from market forces. For example, Illinois reported that its amount of yard trimmings composted almost doubled from 221,515 tons in 1991 to 418,331 tons in 1992, while the number of Illinois facilities reported in *BioCycle* declined from 106 in 1991 to 96 in 1992, due to facility consolidations. By contrast, Pennsylvania reported the largest year-to-year increase in total facilities reported by *BioCycle*, rising from 169 facilities in 1991 to 300 facilities in 1992; Pennsylvania's low average throughput compared to Illinois may reflect a large number of new facilities that were not in operation for the entire 1992 calendar year, which would reflect an element of measurement bias.

Such natural variation and potential sources of bias mean that the error bands (confidence limits) surrounding the national composting estimate may be larger than suggested by the convergence of the results of the two different estimating methodologies.

[5] Florida's reported generation of yard trimmings per capita (0.234 tons per year) is 66 percent greater than the EPA's estimate for national per capita yard trimmings generation (.141 tons per year).

B.3 STATE-SPECIFIC COMPOSTING ESTIMATES

In the context of the market analysis of flow controls, State-specific estimates of the amount of yard trimmings composted are useful in identifying important State or regional variations in MSW management markets. Exhibit III-B.3 pr preliminary estimates of total 1992 MSW composting (mixed-waste and yard trimmings) in the 50 States and the District o Columbia. EPA undertook the following steps to develop this exhibit:

- State estimates of yard trimmings composting were used for the eight States reporting this information (Exhibit III-B.2);
- For the remaining 42 States and the District of Columbia, EPA multiplied the number of yard trimmings composting facilities reported to *BioCycle* by the average throughput calculated in Exhibit III-B.2 (2,950 tons); and
- The amount of mixed-waste composting reported in Exhibit III-B.1 was listed for those States with such facilities.[6]

As the exhibit indicates, the total amount of MSW composted nationwide was 9,181,415 tons in 1992.

Exhibit III-B.4 provides a "reality check" on State-specific composting estimates developed in Exhibit III-B.3, by comparing the preliminary State estimates with *BioCycle*'s reported estimates for State recycling and composting. Column and B, respectively, list each State's 1992 waste

[6] The aggregated tons per year of mixed-waste composting in Florida was reduced by 0.1 million to account for the November shutdown of the 550 ton per day facility in Florida, and to avoid double counting yard trimmings received at mixed waste composting facilities that might have been included in the yard trimmings composting data reported by Florida.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-B.3

Preliminary Estimate of Municipal Solid Waste Composting in Each State

State	*BioCycle* Yard Trimmings Facilities (A)	Estimated Yard Trimmings Composted (tons per year) (B)	Other MSW Composted (tons per year) (C)	Total MSW Composted (tons per year) (D)=(B)+(C)
Alabama	12	35,400	--	35,400
Alaska	0	0	--	0
Arizona	2	5,900	3,900	9,800
Arkansas	17	50,150	--	50,150
California	26	575,491	--	575,491
Colorado	5	14,750	--	14,750
Connecticut	84	247,800	--	247,800
Delaware	2	5,900	58,500	64,400
District of Columbia	1	2,950	--	2,950
Florida	20	847,900	108,000	955,900
Georgia	88	259,600	--	259,600
Hawaii	5	14,750	--	14,750
Idaho	6	17,700	--	17,700
Illinois	96	418,331	--	418,331
Indiana	128	377,600	--	377,600
Iowa	30	88,500	4,160	92,660
Kansas	30	88,500	13,000	101,500
Kentucky	26	76,700	--	76,700
Louisiana	13	38,350	--	38,350
Maine	22	64,900	--	64,900
Maryland	8	23,600	--	23,600
Massachusetts	265	781,750	--	781,750
Michigan	200	590,000	--	590,000
Minnesota	397	328,470	115,700	444,170
Mississippi	8	23,600	--	23,600
Missouri	50	147,500	--	147,500
Montana	9	26,550	--	26,550

EXHIBIT III-B.3 (continued)

Preliminary Estimate of Municipal Solid Waste Composting in Each State

US EPA ARCHIVE DOCUMENT

State	*BioCycle* Yard Trimmings Facilities (A)	Estimated Yard Trimmings Composted (tons per year) (B)	Other MSW Composted (tons per year) (C)	Total MSW Composted (tons per year) (D)=(B)+(C)
Nebraska	15	44,250	--	44,250
Nevada	1	2,950	--	2,950
New Hampshire	78	230,100	--	230,100
New Jersey	270	796,500	--	796,500
New Mexico	1	2,950	--	2,950
New York	200	467,858	--	467,858
North Carolina	75	267,428	--	267,428
North Dakota	5	14,750	--	14,750
Ohio	78	230,100	--	230,100
Oklahoma	2	5,900	--	5,900
Oregon	20	59,000	--	59,000
Pennsylvania	300	267,104	--	267,104
Rhode Island	16	47,200	--	47,200
South Carolina	25	73,750	--	73,750
South Dakota	3	8,850	--	8,850
Tennessee	4	11,800	39,000	50,800
Texas	75	221,250	--	221,250
Utah	1	2,950	--	2,950
Vermont	12	35,400	--	35,400
Virginia	19	56,050	--	56,050
Washington	15	157,673	26,000	183,673
West Virginia	N/A	0	--	0
Wisconsin	213	628,350	19,500	647,850
Wyoming	3	8,850	--	8,850
TOTAL	**2,981**	**8,793,655**	**387,760**	**9,181,415**

US EPA ARCHIVE DOCUMENT

EXHIBIT III-B.4

Revised State-Specific Composting Estimates

State	*BioCycle* 1992 Waste Generation (million tons) (A)	Reported % Composted/ Recycled (B)	Amount Composted/ Recycled (million tons) (C)=(A)*(B)	Preliminary Compost Estimate (million tons) (D)	Compost Estimate as a % of Amount Composted/ Recycled (E)=(D)/(C)	Revised Compost Estimate s (F)
Alabama	5.20	12	0.62	0.04	6	0.04
Alaska	0.50	6	0.03	0.00	0	0.00
Arizona	4.15	7	0.29	0.01	3	0.01
Arkansas	2.15	10	0.22	0.05	23	0.05
California	44.54	11	4.90	0.58	12	0.58
Colorado	3.50	26	0.91	0.01	2	0.01
Connecticut	2.90	19	0.55	0.25	45	0.25
Delaware	0.79	16	0.13	0.06	51	0.06
District of Columbia	0.92	30	0.28	0.00	1	0.00
Florida	19.40	27	5.24	0.96	18	0.96
Georgia	6.00	12	0.72	0.26	36	0.26
Hawaii	1.30	4	0.05	0.01	28	0.01
Idaho	0.85	10	0.09	0.02	21	0.02
Illinois	14.14	11	1.56	0.42	27	0.42
Indiana	8.40	8	0.67	0.38	56	0.38
Iowa	2.09	23	0.48	0.09	19	0.09
Kansas	2.40	5	0.12	0.10	85	0.10
Kentucky	4.65	15	0.70	0.08	11	0.08
Louisiana	3.48	10	0.35	0.04	11	0.04
Maine	1.25	30	0.37	0.06	17	0.21
Maryland	5.00	15	0.75	0.02	3	0.02
Massachusetts	6.60	30	1.98	0.78	39	0.78
Michigan	13.00	26	3.38	0.59	17	0.59
Minnesota	4.27	38	1.62	0.44	27	0.44
Mississippi	1.40	8	0.11	0.02	21	0.02
Missouri	7.50	13	0.98	0.15	15	0.15

EXHIBIT III-B.4 (continued)
Revised State-Specific Composting Estimates

US EPA ARCHIVE DOCUMENT

State	*BioCycle* 1992 Waste Generation (million tons) (A)	Reported % Composted/ Recycled (B)	Amount Composted/ Recycled (million tons) (C)=(A)*(B)	Preliminary Compost Estimate (million tons) (D)	Compost Estimate as a % of Amount Composted/ Recycled (E)=(D)/(C)	Revised Compost Estimates (F)
Montana	0.74	5	0.04	0.03	71	0.03
Nebraska	1.40	10	0.14	0.04	32	0.04
Nevada	2.30	10	0.23	0.00	1	0.00
New Hampshire	1.14	10	0.11	0.23	202	0.08
New Jersey	7.51	34	2.55	0.80	31	0.80
New Mexico	1.49	6	0.09	0.00	3	0.00
New York	22.80	21	4.79	0.47	10	0.47
North Carolina	7.79	4	0.31	0.27	87	0.27
North Dakota	0.47	17	0.08	0.01	19	0.01
Ohio	16.40	19	3.12	0.23	7	0.23
Oklahoma	3.00	10	0.30	0.01	2	0.01
Oregon	3.35	23	0.77	0.06	8	0.06
Pennsylvania	8.98	11	0.99	0.27	27	0.27
Rhode Island	1.20	15	0.18	0.05	26	0.05
South Carolina	5.00	10	0.50	0.07	15	0.07
South Dakota	0.80	10	0.08	0.01	11	0.01
Tennessee	5.80	10	0.58	0.05	9	0.05
Texas	14.47	11	1.59	0.22	14	0.22
Utah	1.50	13	0.20	0.00	2	0.00
Vermont	0.55	25	0.14	0.04	26	0.04
Virginia	7.60	24	1.82	0.06	3	0.06
Washington	5.71	33	1.88	0.18	10	0.18
West Virginia	1.70	10	0.17	0.00	0	0.00
Wisconsin	3.35	24	0.80	0.65	81	0.65
Wyoming	0.32	4	0.01	0.01	69	0.01
TOTAL	**291.74**	**17**	**49**	**9.18**	**19**	**9.18**

generation amount and percent of waste composted/recycled as reported to *BioCycle*. Column C multiplies the values in the first two columns to calculate the total amount of waste composted/recycled in each State. Column D shows the prelimina estimate as determined in Exhibit III-B.3. Column E divides the preliminary estimate (Column D) by the *BioCycle* estimate (Column C) to determine the percentage of the composting/recycling tonnage attributable to composting in each State.

US EPA ARCHIVE DOCUMENT

This analysis indicates that the percentage of composting/recycling that is attributable to composting varies substantially from State to State. A large part of this variation may be due to the data limitations reflected in composting estimates for individual States. However, one of the States where composting accounts for a very high percentage of composting/recycling (i.e., more than 90 percent) is Pennsylvania, and the composting estimate for this State is based on reported State data.

The percent of composting/recycling tonnage attributable to composting is greater than 100 for just one State, Nev Hampshire. This indicates that the preliminary estimate of composting in New Hampshire (Exhibit III-B.3) accounts for m than 100 percent (in fact, more than 200 percent) of *BioCycle*'s estimate of recycling and composting combined. To corre this anomaly, and retain the national estimate of waste composting, the revised estimate for New Hampshire reduces the preliminary estimate by 0.15 million tons, and increases the preliminary estimate for the neighboring State of Maine by an e amount. This adjustment also retains the regional estimate for composting in New England. The revised composting estim for Maine and New Hampshire are shown in Column F. EPA chose 0.15 million tons because it was the smallest adjustme needed to bring New Hampshire within the range of observed values of Column E; EPA could have made a larger adjustme EPA chose to assign this 0.15 million tons to Maine because, compared to the other States bordering New Hampshire, Mai had the lowest value in Column E; the adjustment could have been added, instead, to Massachusetts and/or Vermont. Thes revised estimates preserve the integrity of available reported data on regional composting markets, and minimize adjustment individual State data, while reconciling an obvious inconsistency in State data estimates (i.e., composting exceeding the sun composting and recycling in New Hampshire). These adjustments have no significant effect on the findings presented in th Report.

US EPA ARCHIVE DOCUMENT

APPENDIX III-C
Technical Analysis: Recycling Segment

This appendix details the basis for estimating (1) the amount of waste managed by the recycling market segment ir 1992 (40 million tons), (2) the amount of waste recycled in each State, and (3) the amount of waste recycled by each recy market subsegment. This appendix corresponds to Section C of Chapter III.

C.1 STATE RECYCLING ESTIMATES BASED ON *BIOCYCLE*, GAA, AND STATE DATA

Exhibit III-C.1 presents a preliminary estimate of recycling in each state as well as the national total. This estimate relies primarily upon estimates calculated for the composting market segment in Appendix III-B. For example, Column A a Column B respectively list the amount of 1992 waste generated and the percentage of waste recycled/composted as reporte each state to *BioCycle*. Column C multiplies the first two columns to calculate the total amount of waste recycled/compos in each State. Column D lists the amount of waste composted as estimated in Appendix III-B, while Column E is the result Column C minus Column D, or the State-specific recycling estimate. The sum of State-specific estimates for recycling (C E) is approximately 40 million tons.

Exhibit III-C.2 provides a "reality check" on the preliminary recycling estimate by comparing the estimated amount waste recycled to the amount of waste managed at in-State MRFs. Column A lists the amount of waste recycled/composte reported by *BioCycle* and Column B lists the preliminary State-specific estimate as determined by Exhibit III-C.1. Column lists the amount of recyclables processed at MRFs as found in the Government Advisory Associate's (GAA) *1992-93 Materials Recovery and Recycling Yearbook: Directory and Guide*. Column D shows the percentage of each State's preliminary estimate of recyclables that are processed at MRFs (i.e., Column C divided by Column B). For the nineteen States that do not have in-State MRFs, Column D reads "--." Exhibit III-C.2 lists States by U.S. Census Regions. portion of recyclables processed at MRFs ranges from 7 percent in the Mid-West to 31 percent in the Northeast.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-C.1

Preliminary Estimate of Recycling for Each State

State	*BioCycle* 1992 Waste Generation (million tons) (A)	*BioCycle* % Recycled/ Composted (B)	Amount Recycled/ Composted (million tons) (C)=(A)*(B)	Compost Estimate (million tons) (D)	Recycling Estimate (million tons) (E)=(C)-(D)
Alabama	5.20	12%	0.62	0.04	0.59
Alaska	0.50	6%	0.03	0.00	0.03
Arizona	4.15	7%	0.29	0.01	0.28
Arkansas	2.15	10%	0.22	0.05	0.17
California	44.54	11%	4.90	0.58	4.32
Colorado	3.50	26%	0.91	0.01	0.90
Connecticut	2.90	19%	0.55	0.25	0.30
Delaware	0.79	16%	0.13	0.06	0.06
District of Columbia	0.92	30%	0.28	0.00	0.27
Florida	19.40	27%	5.24	0.96	4.28
Georgia	6.00	12%	0.72	0.26	0.46
Hawaii	1.30	4%	0.05	0.01	0.04
Idaho	0.85	10%	0.09	0.02	0.07
Illinois	14.14	11%	1.56	0.42	1.14
Indiana	8.40	8%	0.67	0.38	0.29
Iowa	2.09	23%	0.48	0.09	0.39
Kansas	2.40	5%	0.12	0.10	0.02
Kentucky	4.65	15%	0.70	0.08	0.62
Louisiana	3.48	10%	0.35	0.04	0.31
Maine	1.25	30%	0.37	0.21	0.16
Maryland	5.00	15%	0.75	0.02	0.73
Massachusetts	6.60	30%	1.98	0.78	1.20
Michigan	13.00	26%	3.38	0.59	2.79
Minnesota	4.27	38%	1.62	0.44	1.18
Mississippi	1.40	8%	0.11	0.02	0.09
Missouri	7.50	13%	0.98	0.15	0.83
Montana	0.74	5%	0.04	0.03	0.01
Nebraska	1.40	10%	0.14	0.04	0.10
Nevada	2.30	10%	0.23	0.00	0.23
New Hampshire	1.14	10%	0.11	0.08	0.03
New Jersey	7.51	34%	2.55	0.80	1.76
New Mexico	1.49	6%	0.09	0.00	0.09
New York	22.80	21%	4.79	0.47	4.32

US EPA ARCHIVE DOCUMENT

EXHIBIT III-C.1 (continued)
Preliminary Estimate of Recycling for Each State

State	*BioCycle* 1992 Waste Generation (million tons) (A)	*BioCycle* % Recycled/ Composted (B)	Amount Recycled/ Composted (million tons) (C)=(A)*(B)	Compost Estimate (million tons) (D)	Recycling Estimate (million tons) (E)=(C)-(D)
North Carolina	7.79	4%	0.31	0.27	0.04
North Dakota	0.47	17%	0.08	0.01	0.06
Ohio	16.40	19%	3.12	0.23	2.89
Oklahoma	3.00	10%	0.30	0.01	0.29
Oregon	3.35	23%	0.77	0.06	0.71
Pennsylvania	8.98	11%	0.99	0.27	0.72
Rhode Island	1.20	15%	0.18	0.05	0.13
South Carolina	5.00	10%	0.50	0.07	0.43
South Dakota	0.80	10%	0.08	0.01	0.07
Tennessee	5.80	10%	0.58	0.05	0.53
Texas	14.47	11%	1.59	0.22	1.37
Utah	1.50	13%	0.20	0.00	0.19
Vermont	0.55	25%	0.14	0.04	0.10
Virginia	7.60	24%	1.82	0.06	1.77
Washington	5.71	33%	1.88	0.18	1.70
West Virginia	1.70	10%	0.17	0.00	0.17
Wisconsin	3.35	24%	0.80	0.65	0.16
Wyoming	0.32	4%	0.01	0.01	0.00
TOTAL[7]	**292.0**	**17%**	**49**	**9**	**40**

As Exhibit III-C.2 indicates, the percentage of recycled tonnage managed in MRFs is greater than 100 for three Sta Connecticut (111 percent), Nevada (111 percent), and North Carolina (214 percent). These discrepancies most likely are explained by MRFs receiving recyclables from out of State. To correct this anomaly, and retain the preliminary national est of recycling, EPA "reallocated" to neighboring States some of the waste managed in MRFs in these three States. This reallocation, shown in Exhibit III-C.3, retains the regional estimates for recycling. In reallocating recycled tonnage, EPA se the smallest amounts needed to bring the three States down to a range no greater than 90-99 percent for Column D. Tonna assigned to the bordering State with the lowest value for Column D (e.g.,

7 Numbers may not add due to rounding errors.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-C.2
Regional- and State-Specific Recycling Estimates

State	*BioCycle* Amount Recycled/Composted (million tons) (A)	Preliminary Recycling Estimate (million tons) (B)	Recyclables Processed at MRFs (million tons) (C)	Percent of Tons Recycled at MRFs (D)=(C)/(B)
Northeast				
Connecticut	0.55	0.30	0.34	**111.24 %**
Maine	0.37	0.16	0.00	0.08%
Massachusetts	1.98	1.20	0.17	14.25%
New Hampshire	0.11	0.03	0.02	59.29%
New Jersey	2.55	1.76	0.66	37.29%
New York	4.79	4.32	0.945	21.90%
Pennsylvania	0.99	0.72	0.49	67.52%
Rhode Island	0.18	0.13	0.08	62.17%
Vermont	0.14	0.10	0.02	15.77%
Region Total	11.67	8.73	2.715	31.1%
South				
Alabama	0.62	0.59	0.02	2.61%
Arkansas	0.22	0.17	--	--
Delaware	0.13	0.06	0.01	16.31%
District of Columbia	0.28	0.27	0.09	33.41%
Florida	5.24	4.28	0.43	10.16%
Georgia	0.72	0.46	0.11	24.96%
Kentucky	0.70	0.62	--	--
Louisiana	0.35	0.31	0.02	5.74%
Maryland	0.75	0.73	0.29	40.23%
Mississippi	0.11	0.09	--	--
North Carolina	0.31	0.04	0.09	**214.20 %**
Oklahoma	0.30	0.29	--	--
South Carolina	0.50	0.43	0.02	4.69%
Tennessee	0.58	0.53	0.06	10.76%
Texas	1.59	1.37	0.04	3.04%
Virginia	1.82	1.77	0.06	3.55%
West Virginia	0.17	0.17	--	--

US EPA ARCHIVE DOCUMENT

Region Total	14.38	12.18	1.25	10.22%

EXHIBIT III-C.2 (continued)

Regional- and State-Specific Recycling Estimates

State	*BioCycle* Amount Recycled/Composted (million tons) (A)	Preliminary Recycling Estimate (million tons) (B)	Recyclables Processed at MRFs (million tons) (C)	Percent of Tons Recycled at MRFs (D)=(C)/(B)
MidWest				
Illinois	1.56	1.14	0.28	24.24%
Indiana	0.67	0.29	--	--
Iowa	0.48	0.39	0.01	3.26%
Kansas	0.12	0.02	--	--
Michigan	3.38	2.79	0.14	5.05%
Minnesota	1.62	1.18	0.11	9.25%
Missouri	0.98	0.83	0.01	1.80%
Nebraska	0.14	0.10	--	--
North Dakota	0.08	0.06	--	--
Ohio	3.12	2.89	0.09	3.03%
South Dakota	0.08	0.07	--	--
Wisconsin	0.80	0.16	0.07	44.08%
Region Total	13.02	9.91	0.71	7.16%
West				
Alaska	0.03	0.03	--	--
Arizona	0.29	0.28	0.13	45.10%
California	4.90	4.32	0.49	11.3%
Colorado	0.91	0.90	--	--
Hawaii	0.05	0.04	--	--
Idaho	0.09	0.07	--	--
Montana	0.04	0.01	--	--
Nevada	0.23	0.23	0.25	**111.33 %**
New Mexico	0.09	0.09	--	--
Oregon	0.77	0.71	--	--
Utah	0.20	0.19	--	--
Washington	1.88	1.70	0.14	8.04%
Wyoming	0.01	0.00	--	--
Region Total	9.48	8.57	1.0	11.7%

US EPA ARCHIVE DOCUMENT

All States Total[8]	**49**	**40**	**5.7**	**14.3%**

US EPA ARCHIVE DOCUMENT

[8] Numbers may not add due to rounding errors.

EXHIBIT III-C.3
Revised Regional- and State-Specific Recycling Estimates

State	*BioCycle* Amount Recycled/Composted (million tons) (A)	Preliminary Recycling Estimate (million tons) (B)	Recyclables Processed at MRFs (million tons) (C)	Percent of Tons Recycled at MRFs (million tons) (D)=(C)/(B)
Northeast				
Connecticut	0.55	0.30	0.30	**98.94%**
Maine	0.37	0.16	0.00	0.08%
Massachusetts	1.98	1.20	0.21	**17.36%**
New Hampshire	0.11	0.03	0.02	59.29%
New Jersey	2.55	1.76	0.66	37.29%
New York	4.79	4.32	0.945	21.9%
Pennsylvania	0.99	0.72	0.49	67.52%
Rhode Island	0.18	0.13	0.08	62.17%
Vermont	0.14	0.10	0.02	15.77%
Region Total	11.67	8.73	2.715	31.1%
South				
Alabama	0.62	0.59	0.02	2.61%
Arkansas	0.22	0.17	--	--
Delaware	0.13	0.06	0.01	16.31%
District of Columbia	0.28	0.27	0.09	33.41%
Florida	5.24	4.28	0.43	10.16%
Georgia	0.72	0.46	0.11	24.96%
Kentucky	0.70	0.62	--	--
Louisiana	0.35	0.31	0.02	5.74%
Maryland	0.75	0.73	0.29	40.23%
Mississippi	0.11	0.09	--	--
North Carolina	0.31	0.04	0.04	**90.72%**
Oklahoma	0.30	0.29	--	--
South Carolina	0.50	0.43	0.04	**9.38%**
Tennessee	0.58	0.53	0.06	10.76%
Texas	1.59	1.37	0.04	3.04%
Virginia	1.82	1.77	0.09	**4.93%**
West Virginia	0.17	0.17	--	--

US EPA ARCHIVE DOCUMENT

Region Total	14.38	12.18	1.24	10.20%

EXHIBIT III-C.3 (continued)

Revised Regional- and State-Specific Recycling Estimates

State	*BioCycle* Amount Recycled/Composted (million tons) (A)	Preliminary Recycling Estimate (million tons) (B)	Recyclables Processed at MRFs (million tons) (C)	Percent of Tons Recycled at MRFs (million tons) (D)=(C)/(B)
MidWest				
Illinois	1.56	1.14	0.28	24.24%
Indiana	0.67	0.29	--	--
Iowa	0.48	0.39	0.01	3.26%
Kansas	0.12	0.02	--	--
Michigan	3.38	2.79	0.14	5.05%
Minnesota	1.62	1.18	0.11	9.25%
Missouri	0.98	0.83	0.01	1.80%
Nebraska	0.14	0.10	--	--
North Dakota	0.08	0.06	--	--
Ohio	3.12	2.89	0.09	3.03%
South Dakota	0.08	0.07	--	--
Wisconsin	0.80	0.16	0.07	44.08%
Region Total	13.02	9.91	0.71	7.16%
West				
Alaska	0.03	0.03	--	--
Arizona	0.29	0.28	0.16	**55.79%**
California	4.90	4.32	0.49	11.3%
Colorado	0.91	0.90	--	--
Hawaii	0.05	0.04	--	--
Idaho	0.09	0.07	--	--
Montana	0.04	0.01	--	--
Nevada	0.23	0.23	0.22	**98.12%**
New Mexico	0.09	0.09	--	--
Oregon	0.77	0.71	--	--
Utah	0.20	0.19	--	--
Washington	1.88	1.70	0.14	8.04%
Wyoming	0.01	0.00	--	--
Region Total	9.48	8.57	1.0	11.7%

US EPA ARCHIVE DOCUMENT

All States Total[9]	**49**	**40**	**5.7**	**14.3%**

US EPA ARCHIVE DOCUMENT

[9] Numbers may not add due to rounding errors.

Connecticut's tonnage was assigned to Massachusetts rather than Rhode Island or New York). These revised estimates pr the integrity of available reported data on regional recycling markets, and minimize adjustments to individual State data, whil reconciling inconsistencies in State data estimates (i.e, MRF recycling alone in a State exceeding total recycling in that State These adjustments have no significant effect on the findings presented in this Report.

C.2 NATIONAL RECYCLING ESTIMATE BASED ON EPA AND INDUSTRY DATA

The previous section relied on *BioCycle*, GAA, and State data to develop preliminary national estimates of the amount of waste managed by the recycling market segment. This section reconciles those preliminary estimates with other national estimates of materials recovery. Exhibit III-C.4 lists estimates of 1992 materials recycled provided by various trad associations and EPA population-adjusted estimates from the *Characterization of Municipal Solid Waste in the United States: 1992 Update*. These trade association and EPA data also total 40 million tons of recycling.

EXHIBIT III-C.4
National Estimates of Material Recovery

MSW Material	Estimated MSW Recycled in 1992 million tons	Source of Estimate
Paper	29.1	American Forest and Paper Association (1993)
Glass	4.1	Glass Packaging Institute (1993)
Other Plastic/Glass	0.7	American Plastics Council (1993)
Aluminum Cans	1.1	Can Manufacturer Institute (1993)
Steel or Bi-Metal Cans	1.1	Steel Can Institute (1993)
Other Metal	1.6	EPA (1992)[10]
Other Material (Wood Pallets, Tires, Textiles, Batteries)	2.3	EPA (1992)[10]
All Materials	**40.00**	

C.3 ALLOCATION OF RECYCLING ESTIMATE BY MARKET SUBSEGMENT

As discussed in Section C, the MSW recycling market consists of four subsegments:

- Independent paper recyclers, dealers, brokers, and processors;
- Various industry buy-back, drop-off, and local recycling centers;
- MRFs; and

[10] 1990 numbers reported in *1992 Characterization of Municipal Solid Waste* were adjusted to reflect population growth and increased recycling. In particular, recycling of certain materials (i.e., batteries, tires) has increased at a faster pace than other materials due to landfill bans and other disposal trends.

US EPA ARCHIVE DOCUMENT

- Mixed-waste processing facilities (MWPFs).

Estimates of Material Recovered by Independent Paper Recyclers, Dealers, and Brokers

The American Forest and Paper Association (AFPA) estimated that 33.6 million tons of paper and paperboard were recovered in 1992.[11] From this amount, EPA subtracted recovery estimates of pulp substitutes,[12] because these materials w not be counted in MSW, estimates of composted paper, and estimates of paper and paperboard processed at MRFs. The r 25 million tons, is estimated to have been processed by independent paper recyclers, dealers, and brokers (so-called "paper packers"). In order to simplify the presentation of the recycling market and to avoid double counting recycled materials, E assumes that paper packing facilities process all paper not recovered at MRFs (or MWPFs). In reality, however, some am of recycled paper and paperboard may be recovered by other recycling facilities.

Estimates of Material Recovered from Other Recycling Centers

EPA assumed that materials not managed at MRFs, MWPFs, or paper packing facilities were managed at drop-off, buy- back, or recycling centers. In general, these facilities receive source-separated recyclables from consumers. Again, simplify the presentation of the recycling market, EPA assumed that all remaining materials (except paper) were processed such facilities. Thus, EPA allocated 9 million tons of waste to these centers. This allocation methodology indicates the following:

- Approximately one half of all mixed containers are managed at other recycling centers (including recovery in bottle bill States).

- The majority of used aluminum beverage cans appear to be recovered at the more than 10,000 industry buy-back centers throughout the nation. It is reasonable to assume that consumers are more likely to return this high-value recyclable, especially given the number of can drives to raise funds for community and other organizations.

- Other recycling centers receive all other materials not commonly received at MRFs - other plastics, metals, textiles, tires, batteries, and wood pallets.

Overall, EPA's estimate of this market subsegment is consistent with other available data sources. For example, *BioCycle* reports that States estimated 1,015 facilities processing recyclables in 1992 - including MRFs, mixed waste processing facilities, and other recycling centers.[13] Removing EPA's estimate of MRFs and MWPFs (see below) from this

---

[11] *Recovered Paper Statistical Highlights 1992*, AFPA (April, 1993).

[12] *Recovered Paper Statistical Highlights 1992*, AFPA (April, 1993).

[13] Robert Steuteville and Nora Goldstein, "The State of Garbage - 1993 Nationwide Survey," *BioCycle*, May 1993, page 49.

US EPA ARCHIVE DOCUMENT

leaves 794 other facilities processing recyclables. These other facilities are likely to be small, local processing facilities witl much lower throughput than high-tech MRFs.

Estimates of Material Recovered at MRFs

GAA's *1992-93 Materials Recovery and Recycling Yearbook: Directory and Guide* provides data (e.g., throughput, costs, capacities) on MRFs located nationwide. MRFs expected to be in operation in 1992 managec approximately 5.7 million tons of material annually. This amount does not include compostable waste or C&D waste, both which are rarely processed at MRFs included in GAA's *Yearbook*. Specific material tonnages are as follows:

- Paper accounted for 3.4 million tons, or 60 percent of all materials;
- Mixed containers (and any separate glass and plastic container estimates) accounted for a little more than 1.7 million tons, or approximately 30 percent of the total;
- Steel/bi-metal cans accounted for approximately 225,000 tons, or about 4 percent of the total; and
- Aluminum cans represented about 56,000 tons, less than one percent of the total.

In addition, other materials (e.g., oil, other commercial) represented less than 4 percent of the total.

Estimates of Material Recovered by MWPFs

EPA relied upon data reported for MWPFs in existence in 1992 or planning to begin operations in 1992, as reportec the GAA *Yearbook*. The GAA *Yearbook* provided capacity and estimated material throughput for 21 such facilities. In sum, these facilities processed approximately 0.3 million tons of waste, excluding residuals. Because most facilities did not report the distribution of material types, EPA allocated the materials in the same percentages as reported by other recycling facilities.

C.4 RECYCLING NON-MSW

As discussed in Appendix III-A, some States include non-MSW (e.g., C&D waste) amounts in their estimates of M generation to *BioCycle*. However, comparing the latest EPA combined estimate of recycling and composting (33 million to in 1990) to *BioCycle*'s combined estimate (35 million tons in 1990) suggests that non-MSW composting and recycling at M facilities is negligible. (The difference could be rounding errors or minor differences in estimation methodologies, for exam EPA assumed this was the case in 1992.

C.5 MRFs AND FLOW CONTROL

Using data from the GAA *Yearbook*, Exhibit III-C.5 presents the total number of MRF facilities expected to be operating in 1992 and their respective throughput supported by flow controls, by contractual arrangements, by neither, or f which data were unavailable. The exhibit shows that 13 percent of total MRFs in 1992, with 19 percent of the total throug were supported by flow controls.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

EXHIBIT III-C.5

Use of Flow Controls by Materials Recovery Facilities (MRFs) in 1992

	#	%	Throughput	%
Flow Control	26	13%	1,081,587	19%
Contract	82	41%	2,491,170	44%
Neither	79	40%	2,034,156	36%
N/A	11	6%	97,068	2%
Total	198		5,703,981	

Exhibit III-C.6 shows the respective use of flow controls by high-technology and low-technology MRFs. As shov much higher percentage (i.e., 32 percent) of the throughput of high-technology MRFs is supported by flow controls than is case for low-technology MRFs (i.e., 7 percent of throughput). In fact, the majority of low-technology MRFs for which da available use neither flow controls nor contractual guarantees.

EXHIBIT III-C.6

Use of Flow Controls by High-Technology and Low-Technology Materials Recovery Facilities (MRFs) in 1992

	High-Technology MRFs			Low-Technology MRFs		
	#	Throughput	%	#	Throughput	%
Flow Control	17	890,426	32%	9	191,161	7%
Contract	29	1,414,590	50%	53	1,076,580	37%
Neither	14	492,868	18%	65	1,540,288	53%
N/A	1	20,222	1%	10	76,864	3%
Total	61	2,819,106		137	2,884,893	

The difference in use of flow controls by high-technology and low-technology MRFs reflects the greater capital co of the former ($4.8 million on average) compared to the latter ($1.9 million on average). Exhibit III-C.7 shows available ca cost data for both high-technology and low-technology MRFs, distinguished by use of flow controls, contracts, neither, or which such data was not reported. As shown, those facilities making use of flow controls have higher capital costs on ave than facilities not supported by flow controls; this is true for both high- and low-technology MRFs.

EXHIBIT III-C.7

Capital Costs and Use of Flow Controls by

Materials Recovery Facilities (MRFs) in 1992

	High-Technology MRFs		Low-Technology MRFs	
	#	Average Capital Costs	#	Average Capital Cost
Flow Control	13	$6,788,462	8	$3,256,250
Contract	26	4,605,769	46	1,255,602
Neither	9	2,474,444	36	2,035,889
N/A	0	0	4	2,022,500
Total	48	4,797,292	86	1,920,810

Note: Only 134 of the 198 MRFs reported capital costs; of these 134, all but 4 provided data on use of waste guarantees (e.g., flow controls). Only 21 of the 26 MRFs supported by flow controls reported capital cost information.

Exhibit III-C.8 presents data on the ownership of the 198 MRFs and their use of waste guarantees. The percentag of flow controls by privately owned and operated MRFs is much less -- in terms of facilities (8.8 percent) and throughput percent) -- than for MRFs that are publicly owned (25 percent and 42.5 percent, respectively). Use of flow controls amon publicly-owned/privately-operated category, which has the highest ratio of high-technology to low-technology MRFs, falls between the privately and publicly owned categories of MRFs.

Exhibit III-C.9 focuses on the Northeast region where 86 of the 198 MRFs (i.e., 43 percent) are located, having a throughput of 2,739,154 tons (48 percent of national MRF throughput). As shown, 20 MRFs in the Northeast are support by flow controls, which constitute 77 percent of the 26 MRFs nationwide that are reported using flow controls. The

US EPA ARCHIVE DOCUMENT

EXHIBIT III-C.8

Materials Recovery Facilities Ownership and Use of Flow Control

	Privately Owned and Operated		Publicly Owned/Privately Operated		Publicly Owned and Operated	
	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)
Facility Type						
High-Tech	38	1,664,617	17	986,011	6	168,478
Low-Tech	98	2,286,338	17	400,649	22	197,888
Total	136	3,950,955	34	1,386,660	28	366,366
Flow Control	12 (8.8%)	575,353 (14.6%)	7 (20.6%)	350,616 (25.3%)	7 (25%)	155,618 (42.5%)
Contract	53	1,531,210	20	881,802	9	78,158
Neither	61	1,747,323	6	154,242	12	132,591
N/A	10	97,068	1	0	0	0
Total	136	3,950,955	34	1,386,660	28	366,366

EXHIBIT III-C.9

Use of Flow Controls by Materials Recovery Facilities in the Northeast (n = 86 of 198)

	High-Technology		Low-Technology		Total	
	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)
Flow Control	13	764,680	7	163,661	20	928,341
Contract	19	795,716	17	334,991	36	1,130,707
Neither	8	321,451	21	338,433	29	659,884
N/A	1	20,222	0	0	1	20,222
Total	41	1,902,069	45	837,085	86	2,739,154

throughput of 928,341 tons under flow control in the Northeast equals 86 percent of the total MRF throughput nationwide is supported by flow controls (i.e., 928,341 is 86 percent of 1,081,587).

Exhibit III-C.10 shows comparable data for the 24 MRFs planned to be operational after 1992. The bulk of the additional capacity is expected to come from high-technology MRFs, with significant support from flow controls. One qua of the facilities did not report throughput data.

EXHIBIT III-C.10

US EPA ARCHIVE DOCUMENT

Use of Flow Controls by 24 Materials Recovery Facilities Planned to be Operational After 1992[1]

	High-Technology		Low-Technology		Total	
	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)	# Facilities	Throughput (tons)
Flow Control	6	255,000	1	38,500	7	293,500
Contract	4	462,000	2	50,000[2]	6	512,000[3]
Neither	1	180,000	1	50,000	2	230,000
N/A	6	521,050[4]	3	0	9	521,050[5]
Total	17	1,418,050[6]	7	138,500[7]	24	1,556,550[8]

1 Planned start-up dates: 1993 (18 facilities), 1994 (5 facilities), and 1995 (1 facility).

2 Only one facility reporting throughput.

3 Only 5 facilities reporting throughput.

4 Only 4 facilities reporting throughput.

5 Only 4 facilities reporting throughput.

6 Fifteen (15) facilities reporting throughput.

7 Only 3 facilities reporting throughput.

8 Eighteen (18) facilities reporting throughput.

US EPA ARCHIVE DOCUMENT

APPENDIX III-D
Technical Analysis: WTE Segment

This appendix summarizes data used in the analysis of the waste-to-energy market segment, Section D of Chapter The primary sources of information were the surveys of WTE facilities prepared by Government Advisory Associates, Inc entitled *Resource Recovery Yearbook: Directory & Guide*. The latest edition (1993-94) includes detailed data on all WTE facilities in the United States, whether they are operating, planned, or shutdown either temporarily or permanently 1992. The type of data collected for each facility includes: technical specifications, fuel/energy recovery, recycling and ma recovery, institutional arrangements, operating history, capital costs, operation and maintenance costs (O&M), and tipping The GAA *Yearbook* also includes narrative providing summary information on the WTE facilities. Although some of this narrative was useful in preparing the WTE analysis, it did not always reflect all of the detailed data required for this analysis For example, the GAA *Yearbook* divides WTE facilities into regions and market subsegments based on number of facilities and not by throughput. Moreover, it is not clear whether the GAA *Yearbook* uses weighted averages to determine average facility capital and O&M costs and tipping fees. To overcome these limitations, EPA used the detailed data on each facility (presented as appendices to GAA surveys) to sort facilities based on several parameters and to develop weighted averages f costs and tipping fees. The following exhibits present the results of this data analysis.

Exhibit III-D.1 lists the number of WTE facilities by State and notes whether they are existing, advanced planned/u construction, or conceptually planned. In sum, 145 facilities were in existence in 1992 (including 10 that were not operatir were temporarily shut down), 26 were advanced planned (including five that were under construction), and 27 were concep planned.

Exhibit III-D.2 lists, for each State, the amount of 1992 throughput attributed to each of the three market subsegm mass burn, modular, and RDF, comprising the 135 operating WTE facilities in 1992. The States are organized into four reg for comparison with the other market segments. Exhibit III-D.3 lists for the 135 operating WTE facilities, for each State, t amount of 1992 throughput that is guaranteed by flow control, contractual arrangements, or not guaranteed at all. Exhibit presents data on use of flow control, contracts, or neither by WTE ownership for the 135 operating WTE facilities. Finally Exhibit III-D.5 presents summary

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.1
Location of Existing Facilities by State in 1992

State	E[1]	AP/UC[2]	CP[3]	Total	State	E[1]	AP/UC[2]	CP[3]	Total
AL	2			2	MT	1			1
AK	3			3	NE				--
AZ				--	NV		1		1
AR	2			2	NH	3			3
CA	5		1	6	NJ	5	3		8
CO				--	NM				--
CT	7	1		8	NY	16	3	4	23
DE	2		1	3	NC	2	1	2	5
FL	14	1		15	ND				--
GA	1		2	3	OH	3	1	1	5
HI	1			1	OK	2			2
ID				--	OR	1			1
IL	1	3	1	5	PA	6	4		10
IN	1	1	1	3	RI		2	1	3
IA	2			2	SC	2		1	3
KS				--	SD				--
KY			1	1	TN	4			4
LA				--	TX	5			5
ME	4			4	UT	1			1
MD	3	1	1	5	VT	1			1
MA	8	2		10	VA	8	1	3	12
MI	3		4	7	WA	5	1		6
MN	14		1	15	WV				--
MS	1			1	WI	6			6
MO			1	1	WY				--

[1] Existing facilities (i.e., in operation, start-up, and temporarily shutdown). (N=145)
[2] Advanced planned/under construction. (N=26)
[3] Conceptually planned. Puerto Rico has one facility in this stage that is not listed here. (N=27)

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.2

1992 Throughput of 135 Operating Facilities by Market Subsegment, State, and Region

Region	State	Mass Burn	Modular	RDF	Total
Northeast	Connecticut	1,229,501	165,092	613,508	2,008,101
	Delaware			230,000	230,000
	Maine	229,220		445,000	674,220
	Maryland	717,773	120,269		838,042
	Massachusetts	1,870,260	190,239	872,338	2,932,837
	New Hampshire	251,850	39,420		291,270
	New Jersey	1,536,534	14,200		1,550,734
	New York	2,710,583	195,980	911,000	3,817,563
	Pennsylvania	2,157,798	12,000		2,169,798
	Region Total	**10,703,519**	**737,200**	**3,071,846**	**14,512,565**
	Region Percent of National Total	**52.%**	**48.4 %**	**35.1 %**	**46.7 %**
South	Alabama	193,925	89,422		283,347
	Arkansas		37,520		37,520
	Florida	3,603,713	51,254	1,795,000	5,449,967
	Georgia	175,200			175,200
	Mississippi		35,910		35,910
	North Carolina	71,193	102,546		173,739
	South Carolina	224,012	71,971		295,983
	Tennessee	374,221	15,752	3,900	393,873
	Texas		42,152		42,152
	Virginia	1,519,306	46,395	476,705	2,051,506
	Region Total	**6,161,570**	**492,922**	**2,275,605**	**8,930,097**
	Region Percent of National Total	**30.0 %**	**32.4 %**	**25.3 %**	**28.7 %**

EXHIBIT III-D.2 (continued)

1992 Throughput of 135 Operating Facilities by Market Subsegment, State, and Region

Region	State	Mass Burn	Modular	RDF	Total
Midwest	Illinois	355,000			355,000
	Indiana	675,048			675,048
	Iowa			63,300	63,300

US EPA ARCHIVE DOCUMENT

	Michigan	257,325		750,000	1,007,325
	Minnesota	423,619	159,936	1,050,500	1,634,055
	Ohio	93,074		853,649	946,723
	Wisconsin		61,905	124,500	186,405
	Region Total	**1,804,066**	**221,841**	**2,841,949**	**4,867,856**
	Region Percent of National Total	**8.8 %**	**14.6 %**	**31.6 %**	**15.7 %**
West	Alaska	7,174	168	9,000	16,342
	California	898,514			898,514
	Hawaii			600,000	600,000
	Montana		19,500		19,500
	Oklahoma	349,442	15,865		365,307
	Oregon	189,107			189,107
	Utah	115,048			115,048
	Washington	340,567	35,000	205,000	580,567
	Region Total	**1,899,852**	**70,533**	**814,000**	**2,784,385**
	Region Percent of National Total	**9.2 %**	**4.6 %**	**9.0 %**	**9.0 %**
GRAND TOTAL*		**20,569,004**	**1,522,497**	**9,003,400**	**31,094,901**

* Column totals may not add up exactly due to rounding errors.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.3

1992 Throughput of 135 Operating Facilities by Type of Waste Guarantee

Region	State	Total Throughput	Guaranteed by Flow Control	Percent of Total	Guaranteed by Contract	Percent of Total	No Guarantee	Percent of Total
Northeast	Connecticut	2,008,101	1,187,400	59.1	820,700	40.9	0	0.0
	Delaware	230,000	230,000	100.0	0	0.0	0	0.0
	Maine	674,220	64,240	9.5	609,980	90.5	0	0.0
	Maryland	838,042	0	0.0	717,773	85.6	120,269	14.4
	Massachusetts	2,932,837	0	0.0	2,932,837	100.0	0	0.0
	New Hampshire	291,270	39,420	13.5	251,850	86.5	0	0.0
	New Jersey	1,550,734	1,359,610	87.7	176,925	11.4	14,200	0.9
	New York	3,817,563	1,871,083	49.0	1,658,280	43.4	288,200	7.5
	Pennsylvania	2,169,798	2,157,798	99.4	12,000	0.6	0	0.0
	Region Total	**14,512,565**	**6,909,551**	**47.6**	**7,180,345**	**49.5**	**422,669**	**3.4**
South	Alabama	283,347	193,925	68.4	0	0.0	89,422	31.6
	Arkansas	37,520	0	0.0	0	0.0	37,520	100.0
	Florida	5,449,967	4,121,073	75.6	166,022	3.0	1,162,872	21.3
	Georgia	175,200	175,200	100.0	0	0.0	0	0.0
	Mississippi	35,910	0	0.0	35,910	100.0	0	0.0
	North Carolina	173,739	173,739	100.0	0	0.0	0	0.0
	South Carolina	295,983	0	0.0	295,983	100.0	0	0.0
	Tennessee	393,873	378,121	96.0	0	0.0	15,752	4.0
	Texas	42,152	0	0.0	0	0.0	42,152	100.0
	Virginia	2,042,406	1,899,439	93.0	0	0.0	142,968	7.0

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.3 (continued)

1992 Throughput of 135 Operating Facilities by Type of Waste Guarantee

Region	State	Total Throughput	Guaranteed by Flow Control	Percent of Total	Guaranteed by Contract	Percent of Total	No Guarantee	Percent of Total
	Region Total	**8,930,097**	**6,941,497**	**77.7**	**497,915**	**5.6**	**1,490,686**	**16.7**
Midwest	Illinois	355,000	0	0.0	0	0.0	355,000	100.0
	Indiana	675,048	675,048	100.0	0	0.0	0	0.0
	Iowa	63,300	0	0.0	20,800	32.9	42,500	67.1
	Michigan	1,007,325	257,325	25.5	750,000	74.5	0	0.0
	Minnesota	1,634,055	883,619	54.1	668,625	40.9	81,812	5.0
	Ohio	946,723	308,074	32.5	0	0.0	638,649	67.5
	Wisconsin	186,405	154,897	83.3	0	0.0	31,508	16.7
	Region Total	**4,867,856**	**2,278,963**	**46.8**	**1,439,425**	**29.6**	**1,149,469**	**23.6**
West	Alaska	16,342	168	1.0	0	0.0	16,174	99.0
	California	898,514	406,097	45.2	492,417	54.8	0	0.0
	Hawaii	600,000	600,000	100.0	0	0.0	0	0.0
	Montana	19,500	0	0.0	0	0.0	19,500	100.0
	Oklahoma	365,307	349,442	95.7	0	0.0	15,865	4.3
	Oregon	189,107	189,107	100.0	0	0.0	0	0.0
	Utah	115,048	115,048	100.0	0	0.0	0	0.0
	Washington	580,567	340,567	58.7	35,000	6.0	205,000	35.3

US EPA ARCHIVE DOCUMENT

	Region Total	**2,784,385**	**2,000,429**	**71.8**	**527,417**	**18.9**	**256,539**	**9.2**
GRAND TOTAL[*]		**31,094,901**	**18,129,988**	**58.3**	**9,645,551**	**31.0**	**3,319,362**	**10.7**

[*] Column totals may not add up exactly due to rounding errors.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.4
Waste-to-Energy Ownership and Use of Flow Controls

	Flow Control		Contract		Neither		Total	
	#	Total Throughput (average)	#	Total Throughput (average)	#	Total Throughput (average)	#	Total Throughput (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 (241,139)	34	3,319,362 (97,628)	135	31,094,901 (230,333)

EXHIBIT III-D.5
Throughput Projections for 1995 and 2000

Status	1995	2000
Throughput of Existing, Operational Facilities in 1992 (n=135)	31,094,901	31,094,901
Throughput of Existing Facilities Temporarily Shutdown in 1992 (n=10)[14]	627,542	627,542
Throughput of Facilities Currently Under Construction (n=5)	1,308,310 (n=4)	1,603,310 (n=5)
Throughput of Facilities Currently Advanced Planned (n=21)	618,466 (n=3)	6,526,441 (n=21)
PROJECTED THROUGHPUT	33,649,219	39,852,194

[14] Six facilities were expected to start up by 1995, while the start up dates for the other four were listed as "unknown." This exhibit assumes that all ten facilities will start up by 1995.

US EPA ARCHIVE DOCUMENT

data used to develop projections of WTE throughput for the years 1995 and 2000. For these exhibits, row and column tota may not always add up precisely, due to rounding.

Exhibit III-D.6 presents data on capital costs of WTEs operational in 1992. Mass burn and RDF facilities entail ve high capital costs, $87 million and $80.9 million on average, respectively; median capital costs are somewhat lower, particu for RDFs, which include smaller facilities that only produce RDF as well as larger facilities that both produce and combust Modular facilities entail capital costs an order of magnitude smaller, on average.

EXHIBIT III-D.6

Capital Costs of Waste-to-Energy Facilities Operational in 1992

Facility Type	# Facilities	Total Throughput (tons)	Capital Cost/Facility	
			Average (millions)	Median (millions)
Mass Burn	65	20,569,004	$87.0	$70.0
RDF	32	9,003,400	$80.9	$51.5
Modular	38	1,522,497	$8.3	$5.7
	135	31,094,901		

Exhibit III-D.7 and III-D.8 present comparable data for two subsets of WTEs: (1) those supported by flow contr and (2) those supported by neither flow controls nor contracts, respectively. The 61 WTEs supported by flow controls ha higher mean and median capital costs, regardless of facility type. The 34 WTEs supported by neither flow controls nor contracts have lower mean and median capital costs, with the exception of RDF mean capital costs. As noted above, there two very different configurations of RDF facilities that can skew the statistics, given the small number of RDFs involved (These exhibits confirm an association between magnitude of WTE capital costs and use of flow controls.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.7

Capital Costs of Waste-to-Energy Facilities Operational in 1992 and Supported by Flow Controls

Facility Type	# Facilities	% Facilities with Flow Controls	Total Throughput (tons)	% Throughput of Facility Type	Capital Cost/Facility Average (millions)	Capital Cost/Facility Median (millions)
Mass Burn	44	67.7	14,365,752	69.9	$90.6	$78.0
RDF	11	34.4	3,426,933	38.1	$81.9	$54.5
Modular	6	15.8	337,623	22.2	$12.6	$7.8
			18,129,988			

EXHIBIT III-D.8

Capital Costs of Waste-to-Energy Facilities Operational in 1992 and Supported Neither by Flow Controls Nor Contracts

Facility Type	# Facilities	% Facilities with Flow Controls	Total Throughput (tons)	% Throughput of Facility Type	Capital Cost/Facility Average (millions)	Capital Cost/Facility Median (millions)
Mass Burn	6	9.2	826,886	4.0	$13.8	$7.7
RDF	8	25.0	1,901,149	21.1	$92.7	$44.0
Modular	20	52.6	591,327	38.8	$5.3	$3.0

Exhibit III-D.9 shows that the types of waste guarantees, if any, associated with WTEs differ across the three diff types of WTE facilities. Most mass burn facilities are supported by flow controls; most RDF facilities rely on either flow controls or contracts; most modular facilities are not supported by flow controls, instead they operate either with contracts form of waste guarantee.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-D.9

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
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

US EPA ARCHIVE DOCUMENT

APPENDIX III-E
Technical Analysis: Landfill Segment

This appendix summarizes data used in preparing Section E of Chapter III. The estimated amount of waste landfill in 1992, 211 million tons, is derived by subtracting the amount of waste managed in the other market segments from *BioCycle's* estimate of 292 million tons. For example, the composting market segment managed 9 million tons, the recyclin segment 40 million tons, and the WTE segment 32 million tons.[15] Subtracting 81 million tons from 292 million leaves approximately 211 million tons as managed in landfills.

Exhibit III-E.1 presents remaining landfill capacity in years for 21 States reporting this information to *BioCycle* for 1990 and 1992. The average estimated remaining capacities (9.5 in 1990 and 15.9 in 1993) is the mean of the 21 State sam For States that reported a range estimate, EPA used the mid-point of that range. Exhibit III-E.1 includes a third column no the percentage change in recycling/composting rates over this same time period; States with major increases in recycling/ composting (e.g., Alabama, New Mexico, Oklahoma, Pennsylvania, South Carolina, and South Dakota) generally showed n increases in remaining landfill capacity, while States with less remaining landfill capacity during this period (e.g., Delaware, Indiana, Ohio) tended to have lower rates of increase in recycling/composting.

Exhibit III-E.2 compares the capacity of large landfills in 14 States with the amount of waste disposed in these Sta annually. Fourteen (14) States provided information on the total tonnage disposed annually in landfills. We derived in-state landfill (i.e., greater than 500 tons per day) capacity estimates from ranges of capacity reported in the *Solid Waste Price Index* (November, 1992). For the purposes of this analysis, we used average values of the ranges. We used 750 tons per as an average value for the range of 500 to 1000 tons per day, and used 1250 tons per day as an average value for landfills 1000 tons per day or greater capacity. This exhibit illustrates that large private landfills provide enough capacity to meet between 23 and 62 percent of the 14 State sample's annual disposal needs. The total annual capacity for large landfills (i.e. greater than 500 tons per day) in this 14 State sample is equal to 41 percent of the total amount disposed.

[15] The WTE segment includes one million tons managed by incinerators without energy recovery.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-E.1

Remaining State Landfill Capacity

State	Years of Remaining Capacity (1990)	Years of Remaining Capacity (1993)	Percentage Change in Recycling/ Composting Rate
Alabama	4	9	200
Delaware	20+	20	45
Georgia	3-4	9	20
Hawaii	5	10	175
Indiana	7	5	60
Iowa	10	10	60
Kentucky	3	14	50
Maryland	7	10	130
Minnesota	5-10	9	86
Missouri	9	8	80
New Mexico	2-5	50	700
New York	9	9	53
Ohio	8-10	8	122
Oklahoma	12-15	30	400
Oregon	20+	23	8
Pennsylvania	5+	15	260
Rhode Island	4	15	11
South Carolina	10	10	275
South Dakota	10-15	25	900
Texas	15	20	50
Utah	20	25	30
Average Estimated Remaining Capacity	**9.5**	**15.9**	

Source: Jim Glenn and David Riggle, "The State of Garbage," Biocycle, April 1991; Robert Steuteville, "The State of Garbage," Biocycle, April 1994.

US EPA ARCHIVE DOCUMENT

EXHIBIT III-E.2

Large Facility Capacity Compared to Total Waste Disposed in 1992
(million tons)

State	Tons Disposed in Landfill Annually	Annual Ton Capacity of Large Landfills
Arkansas	2.2	.8
Florida	9.7	5.9
Illinois	12.3	5.8
Indiana	8.3	3.4
Minnesota	1.3	.8
New Jersey	2.9	1.8
New York	11.9	3.0
Nebraska	1.3	.5
Nevada	2.2	.5
North Carolina	6.7	2.0
Ohio	12.5	4.7
Texas	21.7	9.2
Utah	1.8	.5
Washington	3.9	1.3
Total	98.7	40.2

Sources: State reports, and Solid Waste Price Index, November 1992.

US EPA ARCHIVE DOCUMENT

Extrapolating this sample to the nation suggests that large landfills, both public and private, account for 41 percent of all lan capacity.

Correspondingly, Exhibit III-E.3 provides an overview of the largest private companies in the landfill segment, including the number of landfills they own and operate, the median ton per day capacity of these landfills, and total annual t per year capacity of the firms. The total annual capacity of these firms is equal to 64.7 million tons. This capacity represe approximately 31 percent of our prior estimate of 211 million tons for the entire landfill market segment. By subtracting the percent from the 41 percent of the total landfill market segment that large landfills represent (obtained in Exhibit III-E.2), w estimate that the remaining 10 percent of the large landfill segment is comprised of large government landfills. (Note that 5 percent of the **total** landfill segment must be attributed to small landfills.)

US EPA ARCHIVE DOCUMENT

EXHIBIT III-E.3

Overview of Largest Companies in Landfill Market

Firm	Number of Landfills in 1992	Median TPD Capacity	Total TPY Capacity (millions)[16]
Waste Management	133[1]	750	25.9
Browning-Ferris	99	750	19.3
Laidlaw	26	750	5.1
Mid-American[a]	21[2]	750	4.1
Chambers[a]	15[3]	750	2.9
Western[a]	4	750	0.8
Attwoods	1	750	0.2
Sanifill[a]	14	375	1.4
Republic	8	750	1.6
Eastern	2	750	0.4
USA Waste	6	750	1.2
American	3	375	0.3
Norcal[a]	16	350	1.5
Total	348	NA	64.70

Notes:
1. Thirteen sites opened or acquired in 1992.
2. Two MSW landfill projects under development.
3. One landfill under construction.
4. A fifth landfill for non-hazardous industrial wastes exists.

a. Company also operates other non-MSW landfills (e.g., C&D, industrial, dry waste, and special waste landfills.)

[16] Total TPY capacity equals the number of landfills multiplied by median capacity times 260 operating days per year.

US EPA ARCHIVE DOCUMENT