"WTE OVERVIEW: CURRENT & FUTURE DIRECTIONS"

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Introduction

As a nation we are beginning to recognize the growing need to properly manage the 196 million tons of municipal solid waste (MSW) generated each day. Many communities are assessing which options are best suited to meet their needs, and recycling and composting are receiving a tremendous amount of attention and endorsement. Yet even with the most aggressive recycling programs there is still a definite need for other complementary management technologies. One clear option to help properly manage the remaining wastes is combustion.

To determine the role that combustion plays in the management of our MSW, a survey of all municipal waste combustor (MWC) projects was first undertaken during the Fall of 1990. MWC project managers were subsequently contacted in late 1991, and most recently in the fall of 1992. Recent data bases maintained by the U.S. EPA and others have also been reviewed, and the major vendors comprising the waste combustion industry also contributed updates for this report.

For purposes of this report, MWC plants include waste-to-energy (WTE) facilities (i.e., those that generate energy) and incinerators (i.e., those that do not).

Survey Highlights

Summary highlights of select survey findings are provided below for MWC facilities now operating, under construction, and in the planning stage.

MWCs Now Operating

* Number of Facilities: 142 WTE plants
  34 Incinerators

* Design WTE Processing Capacity: 101,277 tons per day (TPD)

* Quantity of MSW Combusted:

  - By WTE Plants: 31.4 million tons annually
  - By Incinerators: 2.2 million tons annually

* WTE Power Generation: Equivalent of 2,300 megawatts of electricity

* Number of Homes Supplied: Equivalent to meet electricity needs of 1.3 million homes

* Fossil Fuel Equivalency: An energy savings of 31 million barrels of crude oil annually

Plants Under Construction

* Number of Facilities: 3 WTE plants

* Additional Quantity Combusted: 0.9 million tons annually

Plants In The Planning Stage

* Number of Facilities: 46 MWC plants (including inactive projects)

* Additional Quantity Combusted: 13.1 million tons annually

Technology Definitions

A summary of the primary MWC technology types, along with a definition for each, is provided below:

Incinerator: waste combustor with no energy recovery

Mass Burn (MB): waste combustor typically with a single combustion chamber, constructed on-site, and with energy recovery

Modular (MOD): waste combustor typically with two stage combustion, shop fabrication, field erection, and with energy recovery

Refuse-Derived Fuel (RDF): facility with extensive front-end waste processing and dedicated boiler for combusting prepared fuel on-site

RDF Processing: waste processing facility generating a prepared fuel for off-site combustion

RDF Combustion: combustion facility typically capable of burning more than one fuel (e.g., RDF and coal)

Technology Breakdown

A breakdown of MWC technologies currently operating in the U.S., along with the associated design and yearly processing capacities, is provided in Table 1. Table 2 provides the same for U.S. MWC plants currently under construction, in the early and advanced planning stage, and those that are currently inactive.

Table 1 reveals that there are 190 MWC plants now in operation processing and combusting MSW. The total number of facilities actually combusting MSW is 176. These facilities process 33.6 million tons annually, which represents 17 percent of the estimated 196 million tons generated in the U.S. in 1990. The total number of WTE combustors now operating in the U.S. is 142. These facilities have a rated MSW processing capacity exceeding 101,000 tpd.

Table 2 shows that there are currently 3 WTE facilities under construction in the U.S. with a rated design capacity of nearly 3,200 tpd. In addition, there are currently an estimated 37 MWC facilities in the planning stage and nine inactive projects in the U.S. with a combined rated design capacity exceeding 40,000 tpd. If all of these facilities become operational, they will increase the quantity of MSW handled at MWC plants to 21 percent of the 222 million tons forecasted by U.S. EPA to be generated in the U.S. by the turn of the century.

Energy Production

In terms of the power generation and energy saving potential from existing WTE plants in the U.S., operating facilities have an energy generating capacity equivalent to 2,300 megawatts of electricity. This translates into an equivalent of 17.3 million megawatt-hours of exportable energy. The power generating potential of operating WTE plants is also the equivalent of meeting the electricity needs of 1.3 million homes. Viewed in other terms, this is enough exportable power to supply electricity to 440 Empire State Buildings. This also represents the annual equivalent of displacing 31 million barrels of foreign oil. This is based on the conversion of crude oil into electrical energy, using a conversion factor provided by the U.S. Department of Energy.

Ownership and Operation

With regard to WTE ownership and operation trends for operating and planned projects, IWSA's most recent assessment indicates that among existing plants, 61 percent are owned by public entities, while 39 percent are privately owned. The opposite is true in terms of operation, with 65 percent of existing WTE plants being operated by the private sector.

Focussing on planned WTE facilities, there is a shift toward more private ownership (e.g., 49 percent public versus 51 percent private) and a clear trend toward private operation (e.g., 93 percent).

Air Pollution Control

With regard to what type of air pollution control (APC) equipment is found on existing WTE facilities, acid gas scrubber/fabric filter combinations and electrostatic precipitators are now the two most common APC systems. 34 percent of the WTE operations are equipped with each type of system. In addition, 50 percent of the facilities are reported to also be equipped with continuous emissions monitoring (CEM) equipment, and 6 percent have nitrogen oxide (NOx) control.

For those WTE plants under construction and in the planning stage, there is a clear trend toward the use of a scrubber/fabric filter combination. In addition, continuous emissions monitoring, NOx, and mercury control are expected to be installed at many of these plants.

Controlling Mercury

Over the past few years, a debate has emerged relating to whether mercury emissions from MWC facilities pose a serious threat to human health and the

environment. Some citizen groups are calling for a moratorium on both new facilities and the expansion of existing facilities until the federal EPA can ensure zero discharge. Industry sources maintain that the results of MWC environmental health risk assessments have shown maximum mercury exposures that are ten to 100 times less than established regulatory thresholds.

Mercury in the environment is a complex issue, since it is introduced by both natural and man-made sources and is subject to continuous cycling. Natural sources include dust storms, volcanoes, out-gassing from soils, and forest fires. Man-made sources include chemical and industrial processes, metal smelting, the combustion of fossil fuels, agriculture, and MWC plants. Oak Ridge National Laboratory research (S. E. Linberg) indicates that natural sources contribute about 3,000 tons of mercury into the environment annually, while man-made sources contribute about 4,500 tons.

In an effort to determine how much mercury is emitted from MWC plants in the United States, relative to all man-made sources, Kiser and Sussman (see "Municipal Waste Combustion & Mercury: The Real Story," Waste Age, November 1991) examined factors including the number of MWC plants, quantity of MSW processed, type of APC equipment, APC efficiency, MSW characteristic trends, and regulatory developments. The conclusion reached is that operating MWC plants in the U.S. contribute about 44 tons of mercury into the atmosphere annually. This represents less than one percent of the total being released by man-made sources worldwide. Further, by the mid-1990s U.S. plants will contribute less than one-half a percent (13 tons) as a direct result of Clean Air Act requirements, the reduction of mercury content in products entering the MSW stream, and other factors..

In response to the Clean Air Act Amendments of 1990, U. S. EPA is in the process of developing MWC regulations which are expected to include mercury emission standards. At the state level, Florida and New Jersey have taken the lead on this issue and are now in the process of developing MWC mercury regulations.

Tipping Fees

The MWC tipping fee is the price charged to those who dispose of MSW at the facility. Tipping fees are typically determined based on a formula consisting of a multitude of factors. These may include: the type of ownership, project financing structure, permit requirements, environmental regulations, etc. Other factors impacting the tipping fee include: plant location, facility age, whether and what type of energy is generated, rate received for the energy, etc.

Tipping fees at modern WTE plants (i.e., MB and RDF) fall in the range of from less than $20/ton to more than $100/ton (including ash management). The lower range is reflective of tax benefits that are no longer available since the passage of the Tax Reform Act of 1986. Facilities built today can be expected to have tipping fees in the $40 to $100+/ton range, regardless of whether they rely upon the free market for waste supply, provide service to many jurisdictions, or are local operations. Modular facilities can be expected to have a tipping fee in the $25 to $50/ton range.

Some WTE host communities may receive preferential treatment and not be charged anything to dispose of their wastes. It is also typical for there to be different tipping fee rates charged at the same facility, depending upon factors such as at what

period in the project development a disposal contract was signed, the origin of the wastes, current spot market prices, etc. It is also important to note that a $60 tip fee may be considered a bargain in one community and too expensive in another, depending upon the availability and cost of other waste management options.

Rising tip fee costs associated with some WTE operations often reflect requirements to comply with increasingly strict environmental regulations. Operator training, continuous emissions monitoring, additional air pollution control equipment, all add to the cost of doing business. Higher tip fees may also reflect the cost of other waste management services such as operating recycling programs, transfer station, and landfills (i.e., some municipalities find it convenient to include these charges in the WTE tip fee). These costs are passed on to those using the facility to dispose of their solid wastes.

Ash Management

With the combustion process typically reducing MSW up to 90 percent by volume and between 70 to 75 percent by weight (i.e., depending upon the system), the annual quantity of ash now being generated by MWC plants is more than 8.5 million tons.

In terms of ash management, an important policy clarification was issued by U. S. EPA in September 1992. In a memorandum to all regional administrators, then Administrator William Reilly stated that ash from nonhazardous MSW combustion shall be considered exempt from the hazardous waste regulations under RCRA Subtitle C. Additional points made by Administrator Reilly included that the statuatory goals embodied in Section 3001(i) of RCRA -- environmental protection and promoting resource recovery -- were best served by exempting ash from Subtitle C. Also, the MWC ash regulation identified under EPA's 1991 municipal landfill criteria is sufficient to ensure full protection of human health and the environment. Finally, Reilly encouraged that impediments to resource recovery should be eliminated where practicable since it is a form of MSW treatment (not disposal) and provides the benefit of energy recovery.

Recycling and WTE

Materials recycling and WTE combustion appear to work better together than they do apart, according to a recent survey conducted by the IWSA among nearly 70 communities across the country. The participating communities currently rely on or are planning to build a WTE plant as a component in their integrated waste management program.

Key survey findings include: 1) A majority of the communities serviced and planning to be serviced by WTE have recycling rates above the national average -- some nearly three times; 2) Recycling programs are expanding in all of the responding communities serviced and planning to be serviced by WTE; 3) On-site recycling is occurring or will occur at 92 percent of the WTE plant projects polled; 4) All of the WTE facility projects are currently or will be linked to off-site recycling programs; and 5) When asked if WTE and materials recycling are compatible, every municipal official, recycling coordinator, and other waste management professional contacted responded yes and provided supporting evidence.

TABLE 1

OPERATING MWC PLANTS IN THE U.S.
TECHNOLOGY BREAKDOWN

TECHNOLOGY	# OF OPERATING PLANTS	DAILY DESIGN CAPACITY (TPD)	ANNUAL CAPACITY (MILLION TONS)(1)	
Incinerator	34	6,957	2.2	
Modular	48	5,283	1.6	
Mass Burn	65	65,534		20.3
RDF	16	25,310		7.9
RDF-Processing	14	6,105	1.9	
RDF-Combustion	13	5,150	1.6	
Total U.S. Plants (2)	190	114,339		35.5
MWC Facilities (3)	176	108,234		33.6
WTE Facilities (4)	142	101,277		31.4

(1) Annual total assumes that plants operate at 85 percent of design capacity
(2) Includes incinerators, waste-to-energy plants, and all types of RDF plants
(3) Does not include RDF-processing plants
(4) Does not include RDF-processing plants or incinerators

Source: Integrated Waste Services Association, 1992

TABLE 2

MWC FACILITIES UNDER CONSTRUCTION, PLANNED, AND INACTIVE IN THE U.S.

UNDER CONSTRUCTION

TECHNOLOGY	# OF PLANTS	DAILY DESIGN CAPACITY (TPD)	ANNUAL CAPACITY (MILLION TONS) (1)
Modular (2)	1	120	<0.1
Mass Burn	2	3,040	0.9
Subtotal	3	3,160	0.9

PLANNED

TECHNOLOGY	# OF PLANTS	DAILY DESIGN CAPACITY (TPD)	ANNUAL CAPACITY (MILLION TONS) (1)
Modular (3)	3	220	0.7
Mass Burn (4)	27	29,735	9.2
RDF (5)	5	6,400	1.9
RDF-Processing	1	N/A	N/A
RDF-Combustion	1	N/A	N/A
N/A (2)	1	550	0.2
Subtotal (6)	37	36,905	12.0

INACTIVE

TECHNOLOGY	# OF PLANTS	DAILY DESIGN CAPACITY (TPD)	ANNUAL CAPACITY (MILLION TONS) (1)
Incinerator	2	1,250	0.4
Modular	4	777	0.2
Mass Burn	2	435	0.1
RDF-Processing	1	1,200	0.4
Subtotal	9	3,662	1.1

TABLE 2 (Continued)

MWC FACILITIES UNDER CONSTRUCTION, PLANNED, AND INACTIVE IN THE U.S.

TOTALS

TECHNOLOGY	# OF PLANTS	DAILY DESIGN CAPACITY (TPD)	ANNUAL CAPACITY (MILLION TONS) (1)
All Types	49	43,727	13.6

(1) Annual total assumes that plants operate at 85 percent of design capacity.
(2) Project currently on hold.
(3) Includes two projects currently on hold (including one expansion project).
(4) Includes seven projects currently on hold (including two expansion projects), plus one project located in Puerto Rico.
(5) Includes two expansion projects.
(6) The number of projects does not include RDF-processing facilities to avoid double counting.

Source: Integrated Waste Services Association, 1992