IMPLEMENTATION OF EMISSION GUIDELINES FOR LARGE MWCS THE STATUS OF EMISSIONS REDUCTION

Joseph F. Puzio
HDR Engineering Inc.

ABSTRACT

Since the promulgation of the Federal Emission Guidelines for large Municipal Waste Combustors (MWCs), owners and operators of MWCs have been implementing air pollution control (APC) technologies and initiatives that can meet the emissions limits that will be in effect on or before December 19, 2000. Depending on when the MWC was constructed and the combustion technology used, the scope of the APC retrofit can vary widely. For example, at the BRESCO Waste-to-Energy Facility in Baltimore, MD, Scrubber Dry Adsorber (SDA), SNCR and Mercury APC systems were added to the existing Electrostatic Precipitators (ESPs). Other facilities have chosen to replace aging ESPs with new Fabric Filter technology (Baghouse).

Most large MWCs have to install a Mercury Control system to meet the Federal Emission Guidelines. New Jersey and Florida have developed more stringent mercury standards than the federal limits and several New England states are in various stages of promulgating potentially more stringent mercury emissions standards. These standards have prompted the following initiatives: Reduction of Mercury in Manufactured Products; Source Separation of Batteries; Demanufacturing of Electronics and Florescent Lamps; and Addition of Carbon Injection or Sorbalime Systems to existing MWCs. The above initiatives greatly reduced the emissions from the MWCs and provided an environmentally sound solution to solid waste disposal and the generation of power from renewable sources.

BACKGROUND

Approximately 112 Waste-to-Energy (WTE) facilities in 31 states process nearly 32 million tons of municipal solid waste (MSW) annually. This MSW is delivered from 1,703 communities and represents almost 15% of the total generated in the United States. WTE facilities have the advantage of reducing the volume of waste disposed in a landfill by 90%. In fact, many landfills use the ash residue from WTE facilities, such as the Adirondack Resource Recovery Facility in Hudson Falls, New York and the BRESCO Facility in Baltimore, Maryland use the ash residue from the WTE facilities as daily cover material. Thus the actual life of the landfill is not reduced.

In the past, air emissions were the major public concerns of WTE facilities. Since the 1970's, major improvements in air pollution control technology and source reduction of key pollutants in the waste stream by manufacturers have significantly reduced air emissions from WTE facilities. This paper has been prepared to show the improvements in emission through both air pollution control (APC) retrofit initiatives of WTE facility owners/operators and by manufacturers of consumer goods that generate emissions. Examples include the reduction of mercury content in drycell batteries and certain florescent bulbs.

MAJOR REDUCTIONS IN AIR EMISSIONS

Through the successful implementation of advances in APC technology and source reduction by manufacturers, WTE facilities have reduced mercury emissions by 50% over the period of 1990 to 1995. An additional 90% reduction in mercury emissions is expected by the end of 2000. In addition, dioxin emissions from WTE facilities have dropped at least 99% since 1995. Acid gases have dropped by about 80%.

ADVANCES IN AIR POLLUTION CONTROL TECHNOLOGY

The combustion of MSW prior to the 1970's was not a controlled process and APC systems were not widely used. These systems generally did not have energy recovery systems. In the 1970's, WTE facility used temperature and combustion controls to obtain complete combustion and reduce emissions.

In the 1980's new WTE facilities were constructed with electrostatic precipitators (ESP) to control particulate emissions and opacity. In the second half of the 1980's, dry lime "in duct" injection or spray dryer adsorber (SDA) systems were added to new WTE facilities to reduce the emissions of acid gases, sulfur dioxide (SO_2) and hydrogen chloride (HCl). These acid gas control systems were installed along with either ESP or Fabric Filter technology (Baghouse).

By 1990, the SDA and Baghouse combination was determined Best Available Control Technology (BACT) and was the preferred air pollution control (APC) system for most new WTE facilities. In addition, Selective Non-catalytic Reduction (SNCR) technology was also determined as BACT for controlling nitrogen oxide (NO_x) emissions based on the data from the SNCR system installed at the WTE in Commerce, California, the first WTE to install SNCR in the United States. Though early SNCR systems used anhydrous ammonia as an active reagent, most WTE facilities are using or planning to use either aqueous ammonia systems or urea based systems, such as NO_x Out. Aqueous ammonia (19%) and urea systems are safer alternatives and do not need meet stringent USEPA 112r requirements.

In February 1991, Municipal Waste Combustor (MWC) Emissions Guideline (Emissions Guideline) for promulgation by the United States Environmental Protection Agency (USEPA) established emission limits that required SDA, Baghouse and SNCR APC systems for new WTE facilities. In addition, the Emissions Guideline required continuous emissions monitoring systems (CEMS) to measure and record the CO, SO_2 and NO_x emissions and continuous opacity monitoring systems (COMS) for new WTE facilities.

By the mid 1990's, mercury in the environmental was a key issue. Both New Jersey and Florida developed mercury emissions standards for WTE facilities. WTE facilities in these states installed systems that feed powdered activated carbon into the flue gas stream, usually upstream of the SDA to adsorb mercury on the carbon that is removed by the Baghouse or ESP. The powdered activated carbon system has been selected over other removal technologies such the sodium sulfate system because of its simplicity and effectiveness.

Sorbalime technology, a lime and carbon mixture that is fed directly into the SDA, is also commercially available, but is not widely used.

On December 19, 1995, the USEPA promulgated a new MWC Emissions Guideline (New Emissions Guideline) for both new (40 CFR 60 Eb) and existing (40 CFR 60 Cb) sources based on the requirements of the Clean Air Act Amendment of 1990. These regulations were revised in 1997 to include a new definition of a large MWC based on the Davis County Supreme Court challenge decision. Under the revised New Emissions Guideline, large, new and existing MWCs were required to meet the Maximum Achievable Control (MACT) standards presented in Table 1 and either add or update a CEMS/COMS. MACT was defined as the following APC systems:

- SDA
- Baghouse or ESP
- Mercury Controls
- SNCR

As shown in the table, the emission limits for facilities constructed after September 20, 1994 are more stringent. No existing mass-burn WTE facilities are regulated under Subpart Eb at this time. Existing large MWCs are required to meet the New Emissions Guideline by December 19, 2000. Thus, most of the existing MWCs are required to both install new APC equipment and CEMS to meet the New Emissions Guideline or shutdown operations.

Most large MWCs have to install a Mercury Control system to meet the New Emission Guidelines. New Jersey and Florida have developed more stringent. mercury standards than the federal limits and several New England states are in various stages of promulgating potentially more stringent mercury emissions standards. These standards have prompted the following additional initiatives:

- Reduction of Mercury In Manufactured Products Such as Batteries and Fluorescent Lamps
- Source Separation of Batteries and Demanufacturing of Electronics and Florescent Lamps

These initiatives are currently being practiced in Union County, New Jersey under a pilot grant from the New Jersey Department of Environmental Protection.

IMPLEMENTING MACT

Since the promulgation of the New Emissions Guideline for Large MWCs, owners and operators of MWCs have been implementing APC technologies and initiatives that can meet the emissions limits that will be in effect on or before December 19, 2000. Depending on when the MWC was constructed and the combustion technology used, the scope of the APC retrofit can vary widely. Many facilities constructed prior to the mid 1980s are implementing major retrofits that include addition of SDA, SNCR, mercury controls, CEMS and either Baghouses or upgraded ESP systems. Major APC retrofits are being successfully implemented at WTE facilities such as the Pinellas County, BRESO, City of Tulsa, Alexandria/Arlington County, Westchester County, North Andover and Hillsboro County facilities. Other WTE facilities constructed after the mid 1980s require minor retrofits such as mercury controls and/or SNCR. Figure 1 provides examples of various APC systems that are currently being constructed at large WTE facilities to meet the new Emission Guidelines.

TABLE 1

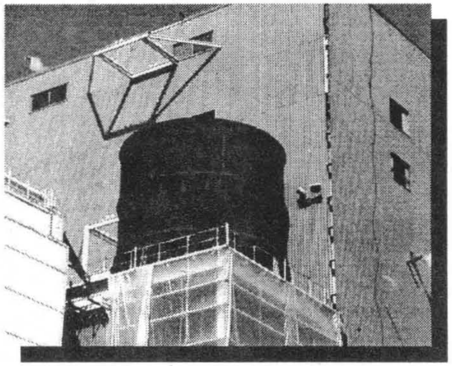
EMISSION LIMITS SPECIFIED IN 40 CFR 60 SUBPART Cb AND SUBPART Eb

Pollutant	Existing Facilities 40 CFR 60 Cb	New Facilities 40 CFR 60 Eb
Particulate Matter	27 mg/dscm	24 mg/dscm
HCl	29 ppm or 95% reduction	25 ppm or 95% reduction
SO_2	29 ppm or 75% reduction	30 ppm or 80% reduction
NO_x Mass-burn Waterwall Rotary Waterwall RDF Stoker Fluidized Bed	 205 ppm 250 ppm 250 ppm 240 ppm	 180 ppm for the first year and 150 ppm after the first year
CO Fluidized Bed Mass-burn Waterwall Mass-burn Refractory Mass-burn Rotary **Refractory** Mass-burn Rotary **Waterwall** Modular Starved Air Modular Excess Air RDF Stoker	 100 ppm 100 ppm 100 ppm 100 ppm 250 ppm 50 ppm 50 ppm 200 ppm	 100 ppm 100 ppm 100 ppm 100 ppm 50 ppm 50 ppm 150 ppm
PCDD/PCDF ESP Facilities Fabric Filter Facilities	 60 ng/dscm 30 ng/dscm	 30 ng/dscm for the first three years after start-up and 13 ng/dscm after three years
Cd	0.04 mg/dscm	0.02 mg/dscm
Hg	0.08 mg/dscm or 85% reduction	0.08 mg/dscm or 85% reduction
Pb	0.44 mg/dscm	0.2 mg/dscm

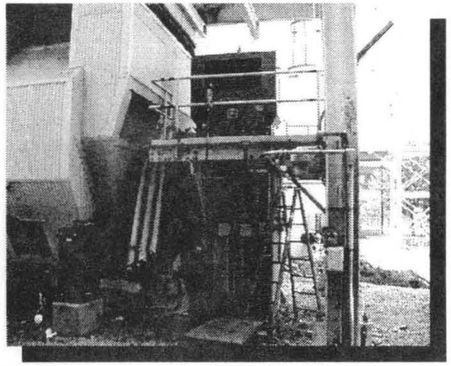
Abbreviations:
gr/dscf – grains per dry standard cubic foot
lb/hr – pounds per hour
mg/dscm – milligrams per dry standard cubic meter
ng/dscm – nanogram per dry standard cubic meter
ppm – parts per million dry volume
Notes:
[1]Emission limits corrected to 7% O_2, dry basis unless otherwise specified.

Major retrofits can cost over thirty million dollars and require increased operating and APC reagent costs. Thus, the implementation of these retrofits included an evaluation of the WTE facility's existing environmental performance, capabilities and physical condition of the existing equipment. For example at the BRESCO Waste-to-Energy Facility in Baltimore, MD, Scrubber Dry Adsorber (SDA), SNCR and Mercury Control systems were added to the existing Electrostatic Precipitators (ESPs) after it was determined that the four field ESP was in good condition and had the capabilities to meet the New Emission Guidelines with upgrades of electrical controls, rappers and improved insulation systems. In this case, keeping the ESP units in service

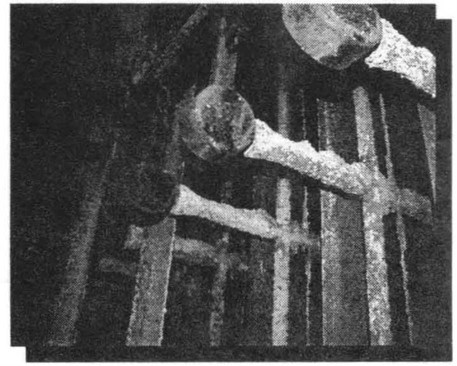
Figure 1
Large Waste-to-Energy Facilities: MACT Retrofits



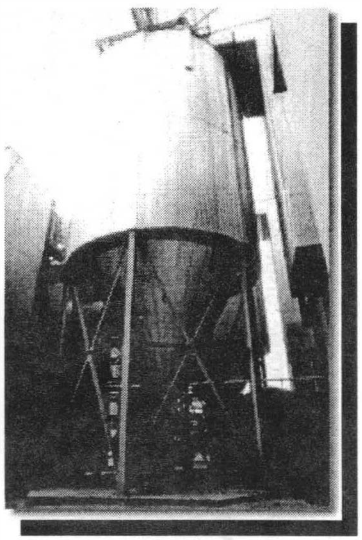
Acid Gas Scrubber



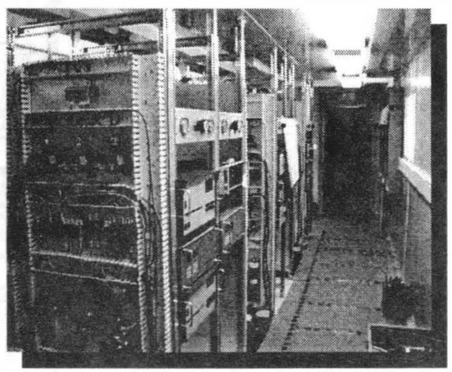
ID Fan Modification



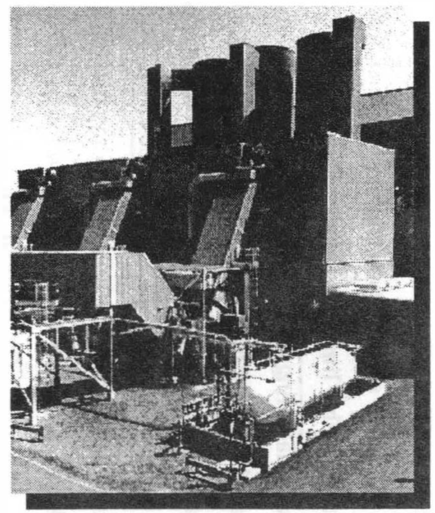
ESP Modifications



Mercury Controls



CEMS



NO_x / Scrubber & Baghouse

reduced the cost of the retrofit. Other facilities have chosen to replace aging ESPs with new Baghouses.

Several WTE facilities requiring major retrofits were constructed on small sites where existing equipment was located with limited room to spare. At the Alexandria/Arlington County WTE facility in Alexandria, Virginia, the SDA/Baghouse system was elevated over the old scalehouse road and the scalehouse had to be relocated at an additional cost. At BRESCO, the new SDA units were installed on the roof of the old ash building. The SDA's were supported by the existing roof structure that required only limited additional structural improvements. This approach reduced the length of ductwork, piping and electrical conduit required and was a very cost-effective design.

All of the major retrofits mentioned above are under construction and some facilities such as Pinellas County, Florida and Alexandria/Arlington County, Virginia have already completed some or all of the emissions testing that demonstrate compliance. Once all the major and minor retrofits are complete and compliance testing has been conducted on these facilities, a good database of emission from WTE facilities should be available to confirm the expected reductions in air pollution emissions.

The above initiatives greatly reduced the emissions from WTE facilities and provide an environmentally sound solution to solid waste disposal and the generation of power from renewable resources.

Joseph F. Puzio, PE

Mr. Puzio is a Vice President with 31 years of experience in execution and project management of various phases of environmental engineering projects including site evaluation, permitting, implementation, design and economic analysis. Mr. Puzio is currently Section Manager of Environmental Services in HDR's White Plains office. Mr. Puzio has obtained the following degrees:

- Degree of Engineer, New Jersey Institute of Technology, 1982 (Doctoral Equivalent)
- M.S., Management, Newark College of Engineering (N.J.I.T.), 1973
- B.S., Chemical Engineering, Newark College of Engineering (N.J.I.T.), 1969