TESTING EXPERIENCES IN NEW ENGLAND

by

James E. Thibault, Jr., P. E.
CE Maguire, Inc.
Providence, Rhode Island

Introduction

In New England, stack tests of municipal scale (1) refuse incinerator emissions have shown our technological response to the air pollutant emission laws of the early 1970's to be grossly inadequate. Fifteen incinerators have been either retrofitted or constructed with air pollution control equipment to comply with post-1970 Federal and State emission standards, but to date only seven have satisfactorily demonstrated compliance, and one remains as yet untested. A 50 percent compliance record is cause for concern, and indeed alarm.

Of the six New England states, testing experiences have thus far been limited to Connecticut and Massachusetts, as each of these states has seven incinerators with post-1970 air pollution controls. Maine and Vermont have no municipal scale incinerators; New Hampshire has a single pre-1970 facility without upgraded controls; and Rhode Island's single remaining incinerator, recently retrofitted with control equipment, is as yet untested. In Connecticut and Massachusetts experiences have been dissimilar since compliance is based upon different standards for maximum allowable particulate emissions and, until recently, different sampling trains have been used.

Emission Standards

Table 1 depicts the variations in standards for municipal scale incinerators between each New England state.

TABLE 1

PARTICULATE MASS EMISSION STANDARDS
FOR MUNICIPAL SCALE INCINERATORS

STATE	"EXISTING" SOURCES*	"NEW" SOURCES (2)*
Massachusetts	0.1 gr/scfd @ 12% CO_2	0.05 gr/scfd @ 12% CO_2
Rhode Island	0.08 gr/scfd @ 12% CO_2	0.08 gr/scfd @ 12% CO_2
Connecticut	0.4 #/1000 # @ 50% x -s air	0.08 gr/scfd @ 12% CO_2

(1) Incinerators having a capacity in excess of 45 metric tons (50 U.S. tons) per day.
(2) Sources for which construction or modification began after August 17, 1971.
* See following page.

New Hampshire	0.2 gr/scfd @ 12% CO_2	0.08 gr/scfd @ 12% CO_2
Vermont	0.1 lb/100 lb refuse	0.08 gr/scfd @ 12% CO_2
Maine	0.08 gr/scfd @ 12% CO_2	0.08 gr/scfd @ 12% CO_2

*Conversion factors: (grain/scfd) = 2.3 (g/m3)
(lb/100 lb) = 1 (kg/100kg)
(lb/1000 lb) = 1 (kg/1000kg)

In Massachusetts, standards for both "new" and "existing" sources are more stringent than those adopted by Connecticut. These standards have been a major contributing factor to the closing of all pre-1970 incinerators in the Commonwealth, leaving seven post-1970 facilities currently in operation. The Connecticut code on the other hand has allowed five pre-1970 facilities to continue operation following relatively modest financial investments in air pollution control equipment, and only two incinerators have been constructed with air pollution controls after 1970. Consequently, the greatest impact of compliance difficulties has been experienced in Massachusetts since failures encountered have been on new plants less than five years old.

Stack Test Results

Particulate mass emission test results for New England municipal scale incinerators are shown in Table 2 for the seven Massachusetts and two Connecticut incinerators brought on line since 1970, and Table 3 for the five Connecticut pre-1970 incinerators retrofitted with air pollution controls since 1970. As previously mentioned, seven of these facilities have not satisfactorily demonstrated compliance with design emission standards. Plant Nos. A1, A3 and A4, on line since 1970, have not tested in compliance at start-up; while a fourth, Plant No. A8, although tested in compliance at start-up, has since deteriorated to a status of noncompliance that has resulted in its closing. Two Connecticut pre-1970 incinerators retrofitted with controls, Plant Nos. B1 and B2, have demonstrated compliance via the ASME sampling train; however, retests using the EPA train now mandated by October 1, 1976, are expected to indicate noncompliance. A third Connecticut incinerator, Plant No. B3, was found to be in noncompliance when tested even using the ASME train.

The different results obtained from testing with the EPA and ASME trains was demonstrated at Plant A2 which tested at 0.067 kg/1000 kgs (0.067 lb/1000 lbs.) @ 50% excess air in 1971 with the ASME train, and 0.348 kg/1000 kgs (0.348 lb/1000 lbs.) @ 50% excess air in 1975 with the EPA train. During the four-year interval, other factors such as scrubber equipment deterioration, changes in plant operation, refuse quantity and composition, sampling techniques, etc., may have also contributed to the increased particulate concentration measured.

Emission Control Equipment

Of the fourteen incinerators under discussion, eight are controlled by wet scrubbers, five by electrostatic precipitators, and one by fabric

filter. Of these three types of control equipment, all electrostatic precipitators applied to incinerators brought on-line since 1970 and the fabric filter have tested in compliance at start-up with emissions of less than 0.115 g/m^3 (0.05 gr/scfd)@ 12% CO_2. However, long-term continued compliance with standards has not been demonstrated by re-testing. Plant No. A8, the longest running electrostatic precipitator in the region, has deteriorated to noncompliance status within five years of operation and is now closed for repair. Another precipitator installation, Plant No. A5, has operated for about four years with minimum maintenance requirements, but stack tests have not been performed since start-up to verify continued compliance with standards. The remaining three precipitator installations have been on-line for less than two years only.

Test results have shown the discharge from the fabric filter controlling Plant No. A9 to contain the least particulate concentration when corrected to 12% CO_2. This equipment is still at the prototype stage of development and has experienced high maintenance requirements to date.

It has been those installations controlled by wet scrubbers which have had the highest record of noncompliance in New England. Six of the eight scrubbers tested to date have not satisfactorily demonstrated compliance with standards for which they were designed, and none have met the 0.184 g/m^3 (0.08 gr/scfd) @ 12% CO_2 Federal new source performance standard. Three facilities in noncompliance are post-1970 construction, costing over $12-million, and are equipped with medium to high pressure drop scrubbers. Plant No. A3 has already been closed. Additionally, three incinerators retrofitted with low pressure scrubbers designed for less than 0.4 kg/1000 kgs (0.4 lb/1000 lbs.) flue gas at 50% excess air, have either tested in noncompliance or are expected to do so when, and if, retested using the EPA train.

Although the cause for noncompliance of the electrostatic precipitator is equipment deterioration, the cause(s) of medium to high pressure drop scrubber failures are not entirely known. The problem regarding these scrubbers has been their trial-and-error development due largely to the lack of sufficient test data upon which improvements can be made leading to successful compliance with standards. After all, compliance testing has thus far been concerned only with measurement of those parameters necessary to determine particulate mass emissions corrected for percent excess air or CO_2 and, therefore, does not reveal system weaknesses.

Determining the specific cause(s) of scrubber failure is a critical need in New England. This need applies immediately to existing incinerators recently closed or threatened with closure. Also, bearing in mind that electrostatic precipitation and fabric filtration have not as yet demonstrated long-term satisfactory control of incinerator emissions here in New England, our <u>future</u> thermal processing systems will benefit from knowledge of wet scrubbing failures. This is particularly true since

this method of control in many applications is less expensive than electrostatic precipitation or fabric filtration.

In conclusion, a fundamental testing and development program, dedicated to the determination of corrective action, is required now to improve our 50% compliance record. Such a program can best be applied to full-scale incinerator/scrubber systems already constructed. What is needed are the financial resources which municipalities and private concerns do not possess individually and the authorization to continue incinerator operation during the interim.

TABLE 2
EMISSION TEST RESULTS OF NEW ENGLAND MUNICIPAL SCALE INCINERATORS BROUGHT ON-LINE SINCE 1970[1]

Plant No.	Incinerator Grate Type	Capacity (TPD) (U.S. TPD)*	Air Pollution Control Equipment	Maximum Emission Allowed By Regs. (gr/scfd @ 12% CO_2)*	Average Measured Emissions (gr/scfd @ 12% CO_2)*	Sampling Train Used	Current Official Status
A1	Rotary Kiln	100	28"±ΔP VS	0.05	0.107	EPA	NIC
A2	Reciprocating	125	12" ΔP VS	0.23[2]	0.171	EPA	IC
A3	Reciprocating	600	6" ΔP IPS	0.1	0.273	EPA	NIC (Closed)
A4	Rotary Kiln	500	5" ΔP IPS	0.1	0.420	EPA	NIC
A5	Inertia	144	ESP	0.1	0.036	EPA	IC
A6	Reciprocating	1500	ESP	0.05	0.045	EPA	IC
A7	Int. Rocking	360	ESP	0.08	0.048	EPA	IC
A8	Traveling	240	ESP	0.1	0.043[3]	ASME	NIC (Closed)
A9	Reciprocating	300	FF	0.05	~ 0.025	EPA	IC

Abbreviations: VS=Venturi Scrubber, IPS=Impingement Plate Scrubber, ESP=Electrostatic Precipitator, FF=Fabric Filter, NIC=Not in Compliance, IC=In Compliance

(1) Approximately coincident with effective date of Clean Air Act Amendments of December, 1970.
(2) Converted from actual regulation units of measurement assuming 4450 BTU/lb HHV and refuse composition after A.D. Little, 1970. For purposes of comparison only.
(3) Converted from other units using actual test data. Tested @ start-up in 1971.

*Conversion factors: (U.S. tons/day) = 0.9072 (metric tons/day)
(gr/scfd) = 2.3 (g/m^3)
(Btu/lb) = 2.31(Kj/Kg)

TABLE 3
EMISSION TEST RESULTS OF NEW ENGLAND MUNICIPAL SCALE INCINERATORS RETROFITTED WITH APCE SINCE 1970[1]

Plant No.	Incinerator Grate Type	Capacity (TPD)	Air Pollution Control Equipment	Maximum Emissions Allowed by Regs. gr/scfd* @ 12% CO_2	Maximum Emissions Allowed by Regs. #/1000# @ 50% X-S	Average Measured Emissions gr/scfd* @ 12% CO_2	Average Measured Emissions #/1000# @ 50% X-S	Sampling Train Used	Current Official Status
B1	Int. Rocking	(U.S. TPD)* 200	0.5"ΔP WBS	0.23[2]	0.4	0.159[3]	0.301	ASME	CQ[4]
B2	Batch Rocking	350	low ΔP WBS	0.23[2]	0.4	0.095[2]	0.164	ASME	CQ[4]
B3	Batch Rocking	250	low ΔP WBS	0.23[2]	0.4	0.358[5]	0.414[5]	ASME	NIC
B4	Reciprocating	360	low ΔP TIS	0.23[2]	0.4	0.227	0.369	EPA	IC
B5	Batch Rocking	150	ESP	0.23[2]	0.4	0.095	0.214	EPA	IC

Abbreviations: APCE=Air Pollution Control Equipment, VS=Venturi Scrubber, WBS=Wet Baffle Scrubber, TIS=Tube Impingement Scrubber, ESP=Electrostatic Precipitator, IC=In Compliance, CQ=Compliance Questionable, NIC=Not in Compliance

(1) Approximately coincident with effective date of Clean Air Act Amendments of December, 1970.
(2) Converted from other units of measurement assuming 4450 BTU/lb HVV and refuse composition after A.D. Little, 1970. For purposes of comparison only.
(3) Converted from other units of measurement using actual test data.
(4) Must stack test by October 1, 1976 using EPA train demonstrating compliance or close down.
(5) Average of six tests. Excluding one of six tests obtains five test average of 0.171 lbs/1000 lb @ 50% x-s (0.121 gr/scfd @ 12% CO_2), which is in compliance with applicable standards.

*Conversion factors: (U.S. tons/day) = 0.9072 (metric tons/day)
(gr/scfd) = 2.3 g/m^3)
(Btu/lb) = 2.31 (Kj/kg)