AIR EMISSION TEST RESULTS FROM THE DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

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ABSTRACT

This paper presents the results of air emission compliance tests conducted from February through May 1989 at the Dutchess County Resource Recovery Facility (RRF) Center in Poughkeepsie, New York, and observed by the New York State Department of Environmental Conservation engineers. The tests were conducted to measure the concentration of particulate matter, SO_2, NO_x, CO, O_2, nonmethane hydrocarbon (NMHC), lead, beryllium, mercury, flourides, HCl, dioxins, and furans.

The Dutchess County facility is a 400 ton per day (TPD), or 363 metric TPD, plant using two Westinghouse O'Connor combustor/boiler trains to burn municipal solid waste (MSW) and produces approximately 8 MW of electricity. Each train is equipped with a dry lime injection system to remove acid gases and a baghouse to remove particulate matter. Westinghouse has been operating the plant since September, 1988.

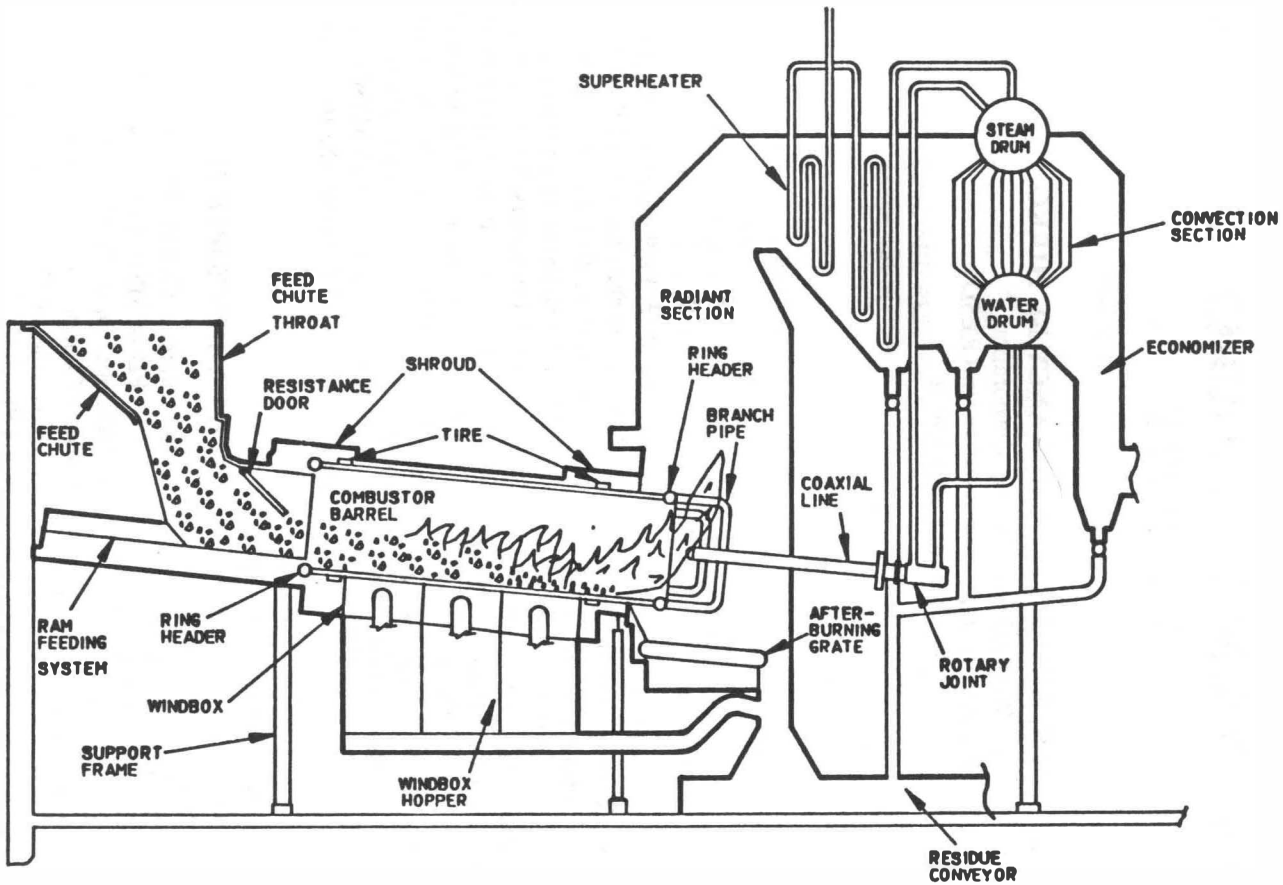
INTRODUCTION

The emission compliance tests were conducted at the Dutchess RRF as part of the Acceptance Test from January 31 through February 17, 1989 and May 24 and 25, 1989. Additional testing was conducted on March 15 and 16, 1989. Stack sampling was performed by ETS, Inc. at the direction of Westinghouse RESD engineers. All compliance tests were observed by New York State Department of Environmental Conservation (NYSDEC) engineers. Tests conducted on March 15 and 16 are included as supplementary test data. Tests were conducted according to the prepared test protocol that was approved by the NYSDEC. Each combustor/boiler was operated to burn approximately 8.33 TPH (7.57 metric TPH) MSW or a daily plant average of 400 TPD during the test program.

FACILITY DESCRIPTION

The Dutchess County RRF is designed to burn up to 510 TPD of MSW (having a higher heating value of 4500 btu/lb, or 2500 cal/g) using two Westinghouse-O'Connor water-walled rotary combustors. However, the facility is currently permitted to burn 400 TPD; 200 TPD for each combustor. Heat generated from the combustion of waste produces steam to drive a turbine generator and produces process steam for the adjacent IBM facility. The process flow diagram is shown in Fig. 1.

The plant consists of two combustor/boiler units, a turbine generator, a truck scale, a tipping floor, MSW storage pit, two overhead cranes for feeding MSW into



WESTINGHOUSE-O'CONNOR WATER-COOLED ROTARY COMBUSTOR AND BOILER

FIG. 1 DUTCHESS COUNTY FACILITY PROCESS FLOW DIAGRAM

the combustors, dry injection acid gas removal systems, baghouses, a stack, ash handling equipment, a control room, and all required ancillary equipment. The facility also has administration offices, change rooms, parking areas, roadways, and security fencing.

The heat released from the combustion process is recovered through the rotary combustor walls, boiler water walls and tubes, primary and secondary superheater, and the economizer. To expedite combustion of high-moisture waste, the incoming combustion air is preheated to approximately 400°F (204°C) by steam air heaters.

The air pollution control (APC) system consists of a dry injection venturi system used to remove HCl and SO_2, followed by a baghouse to remove particulate matter, acid gas reaction products, and unused sorbent. (See Fig. 2). A spark arrestor is located before the dry injection system to prevent hot sparks from entering the baghouse. Each combustor/boiler train has its own APC system. Flue gas is drawn from the APC system by an induced draft fan before being discharged to the atmosphere through a separate flue in the common stack. The stack is 200 ft (61 m) tall and has emission test ports located 52 ft (15.8 m) from the stack base.

PERMIT LIMITS

The facility permit limits, shown in Table 1, are based on each combustor burning 8.33 TPH of MSW having a higher heating value (HHV) of 4500 Btu/lb. During the test program, each train was charged at the rate of 8.33 TPH in order to verify compliance with the regulations.

SAMPLING AND ANALYTICAL PROCEDURES

All sampling and analytical procedures were performed according to established EPA test methods or other acceptable test methods as required by the NYSDEC. Complete descriptions of all EPA reference methods are given in 40 Code of Federal Regulations Part 60, Appendix A. Testing methods used are given in detail in a protocol approved by NYSDEC January 1989. Table 2 summarizes the test methods used in the test program.

DISCUSSION OF TEST RESULTS

Tables 3 and 4 show the MSW charging feed rates for both units. Tables 5 through 15 list the summary of the test results showing the permit limits and the average for each unit. The data presented in Tables 5–15 are given as the hourly averages for each measured pollutant or the required test period as in the case of some metals and dioxins and furans.

TABLE 1 PERMIT LIMITS FOR THE DUTCHESS COUNTY RRF AT THE MAXIMUM FEED RATE 8.33 TPH @ 4500 Btu/lb

Pollutant	Permitted Limits Per Train (Hourly Average)
Particulate Matter	2.5 lbs/hr
SO_2	105 ton/year (25 lbs/hr)
NOx	25 lbs/hr
CO	170 ppm (actual emissions)*
Lead	0.42 lbs/hr
Mercury	0.08 lbs/hr
Beryllium	0.29×10^{-4} lb/hr
Hydrogen Flouride	0.83 lbs/hr
Hydrocarbons	4.0 lbs/hr
Hydrogen Chloride	33.0 lbs/hr
TCDD	7.77×10^{-7} lb/hr
2,3,7,8-TCDD	7.77×10^{-8} lb/hr

* 8 hour running average; approximately equal to 240 ppm corrected to 7% O_2

As can be seen in Table 5, five separate tests showed noncompliance with the permit limits for particulate matter on Unit 2. The particulate emissions from Unit 2 averaged 5.9 lb/hr (2.68 kg/h) during the tests conducted on January 31 and February 1 and 2. The baghouse on Unit 2 had a number of operational problems that occurred mainly because of the "increased cleaning cycle time" that was set to attempt to increase reduction of SO_2 emissions. Three hoppers were completely full of ash and a number of broken bags were located in one compartment. The baghouse compartments were taken off-line, one-by-one, to determine and fix the problem and bring the compartment back on-line. The ash buildup problems that occurred were most likely because of one or more of the following:

(a) Ash bridging in the hopper.

(b) Ash plugging in the screw conveyor located below the three hoppers.

(c) Ash plugging on the transfer screw conveyor.

(d) Ash plugging in the rotary valve that feeds into the drag conveyor.

The plant maintenance engineers thoroughly inspected Unit 2 baghouse on February 13 and 14, and again in early March to make sure that all hoppers and conveyors were free of ash, that bags were attached to the thimbles, and that no broken bags existed in the unit. At the request of the Dutchess County Agency, additional testing was conducted in March to verify compliance with the permit conditions. These results are also presented in Table 5.

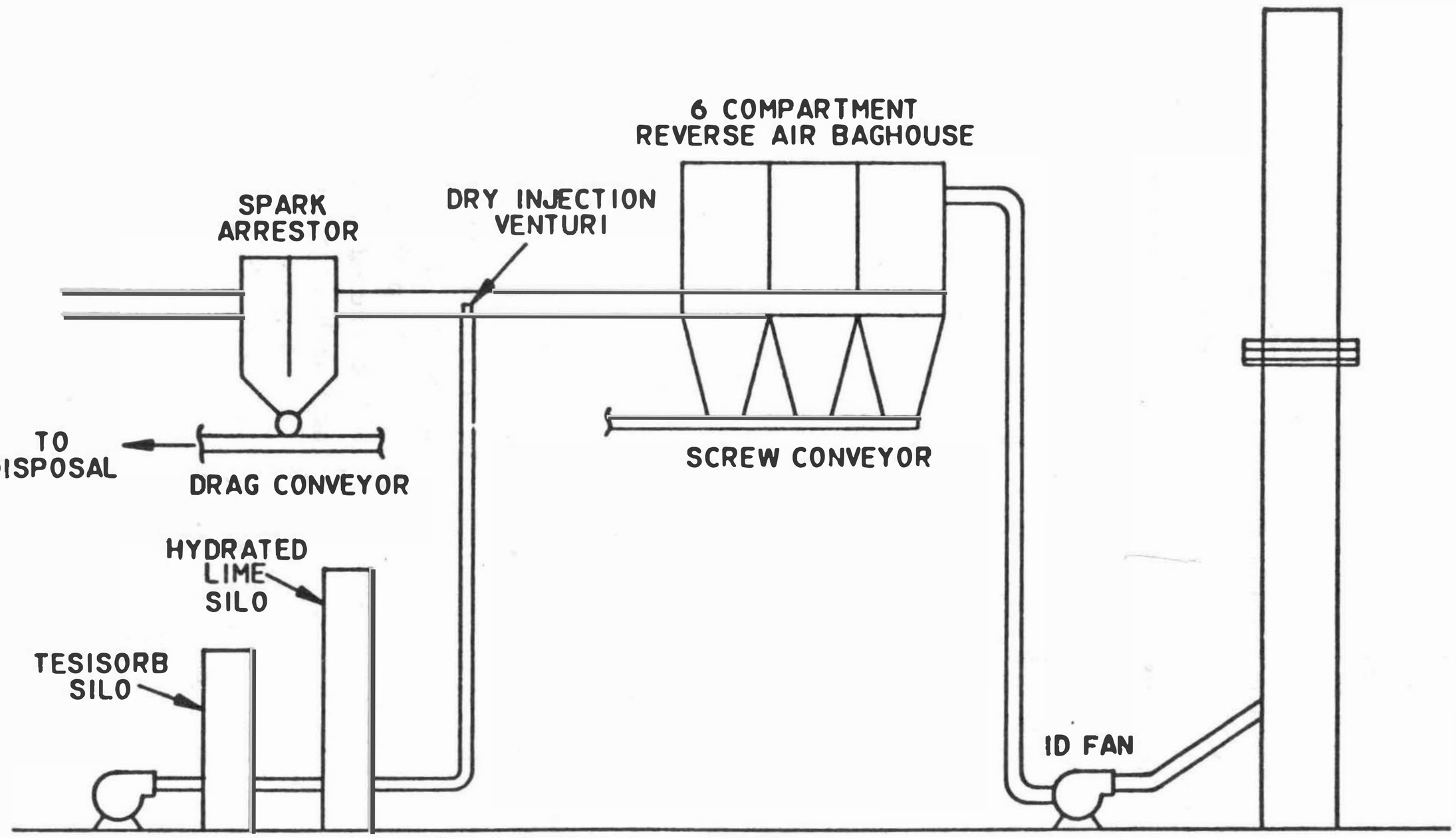


FIG. 2 SCHEMATIC OF THE APC SYSTEM AT DUTCHESS COUNTY RRF

TABLE 2 SAMPLING AND ANALYTICAL METHODS

Pollutant	Sampling Method	Analysis Method	Number of Tests
Particulate Matter	EPA RM 5	EPA RM 5	3 on each train
SO_2	EPA RM 6C	CEM (Pulsed Fluorescence)	CEM installed on each train for 8 hours
NOx	EPA RM 7E	CEM Instrument (Chemiluminescence)	CEM installed on each train for 8 hours
CO	EPA RM10	CEM (NDIR)	Plant CEM on each train
Visible (opacity)	EPA RM 9		3 on each train, simultaneously with RM 5 runs
HCl	Modified RM 5 0.1 N NaOH in impingers	Ion Chromotography	3 on each train, part of RM 5 runs
HF	EPA RM 13	Ion Selective Electrode	3 on each train
HC	EPA RM 25A	Flame Ionization Detector	CEM installed on each train for 8 hours
Lead	Multi Metals Train	ICP Analysis	3 on each train
Mercury	Multi Metals Train	Cold Vapor Atomic Adsorption	3 on each train
Beryllium	EPA Method 104	ICP Analysis	3 on each train
Dioxins/Furans PCDD/PCDF 2, 3, 7, 8 TCDD	Modified Method 5 Train	SW846-8290	3 on each train
Other organics: PAH, CP, CB, PCBs	Modified Method 5 Train	SW846-8270 PCBs by EPA 680	3 on each train (same train use for dioxin/furan sampling)

TABLE 3 DUTCHESS COUNTY RRF MSW THROUGHPUT SUMMARY — UNIT 1

Date	Test Time	Daily Amount Burned Tons	Hourly Rate (TPH)
01/31	19:30 - 20:45	192	8.00
02/01	10:00 - 17:10	187	7.79
02/02	14:33 - 20:16	203	8.46
02/03	09:10 - 10:10	210	8.75
02/04	12:57 - 18:36	214	8.91
02/05	09:28 - 16:11	199	8.29
02/06	09:09 - 19:22	N/A	N/A
02/07	09:31 - 11:45	N/A	N/A
02/16	09:55 - 13:55	217	9.04
02/17	09:12 - 21:25	237	9.89
03/16	10:00 - 12:59	182	8.26
05/24	10:17 - 14:25	189	7.88
	Average:	203	8.53

N/A - Not Available

TABLE 4 DUTCHESS COUNTY RRF MSW THROUGHPUT SUMMARY — UNIT 2

Date	Test Time	Daily Amount Burned Tons	Hourly Rate (TPH)
01/31	10:20 - 17:27	204	8.5
02/01	08:16 - 19:20	189	7.88
02/02	08:39 - 20:29	208	8.67
02/03	No Testing	210	8.75
02/04	10:00 - 19:05	215	8.96
02/05	09:19 - 16:30	204	8.5
02/06	09:58 - 12:14	N/A	N/A
02/16	09:20 - 13:30	228	9.48
02/17	08:43 - 21:11	230	9.59
03/15	10:52 - 19:59	193	7.97
03/16	8:20 - 17:38	186	7.67
05/25	08:32 - 17:20	226	9.41
	Average:	208	8.67

N/A - Not Available

TABLE 5 SUMMARY OF PARTICULATE EMISSIONS DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Unit	Gas Flow Rate dscfm	Concentration gr/dscf @ 7% O2	Mass Rate lb/hr	Permit Limit lb/hr
2/1	1	21400	0.0157	2.37	2.5
2/1	1	23560	0.0108	1.85	2.5
2/1	1	24030	0.0041	0.667	2.5
5/11	1	27766	0.0073	1.438	2.5
5/11	1	25435	0.0056	1.024	2.5
5/11	1	26406	0.0088	1.422	2.5
	Average Unit 1 :		0.0087	1.462	2.5
1/31	2	23740	0.0386*	6.38	2.5
1/31	2	23360	0.0392*	5.98	2.5
2/1	2	24510	0.0309*	5.32	2.5
2/2	2	24480	0.0357*	6.08	2.5
3/15	2	24100	0.0081	1.37	2.5
3/15	2	23272	0.0306*	5.10	2.5
3/15	2	20682	0.0131	2.00	2.5
3/16	2	23950	0.0057	0.967	2.5
3/16	2	23174	0.0084	1.46	2.5
3/16	2	22953	0.0079	1.25	2.5
5/12	2	25153	0.0048	0.97	2.5
5/12	2	26127	0.0048	0.95	2.5
5/12	2	26765	0.0053	1.07	2.5
5/15	2	26461	0.0102	1.77	2.5
5/15	2	25511	0.0095	2.11	2.5
5/15	2	22407	0.0111	1.97	2.5
5/23	2	24422	0.0113	1.92	2.5
5/23	2	24040	0.0088	1.41	2.5
5/25	2	26070	0.0093	1.69	2.5
5/25	2	25548	0.0090	1.51	2.5
5/25	2	25302	0.0098	1.89	2.5
	Average Unit 2 : (excluding 1/31 - 2/2 tests)		0.0098	1.73	2.5

* High particulate emissions because of baghouse operational problems.

TABLE 6 SUMMARY OF SULFUR DIOXIDE EMISSIONS — UNIT 1 (1 hr AVERAGES) DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Gas Flow Rate dscfm	Concentration ppmdv @ 7% O2	Mass Rate lb/hr	Permit Limit lb/hr
1/31	22604	66	8.2	25
1/31	22604	94	11.8	25
1/31	20242	100	14.6	25
1/31	20153	85	12.6	25
1/31	20153	113	13.0	25
1/31	20153	69	9.3	25
1/31	21700	151	21.9	25
1/31	21700	137	18.9	25
1/31	21700	126	17.0	25
1/31	21700	158	23.5	25
1/31	21700	118	19.3	25
2/1	21700	81	10.4	25
2/2	24032	198	36.6	25
2/2	24032	27	10.5	25
2/2	24032	26	6.1	25
2/2	24215	169	36.3	25
2/3	22874	75	17.0	25
3/16	25805	83	14.8	25
3/16	25805	129	23.8	25
3/16	25805	104	23.7	25
3/16	21535	101	18.5	25
5/11	N/A	54	N/A	25
5/11	N/A	65	N/A	25
5/11	N/A	58	N/A	25
5/11	N/A	63	N/A	25
5/11	N/A	127	N/A	25
5/11	N/A	74	N/A	25
5/16	N/A	95	N/A	25
5/16	N/A	72	N/A	25
5/16	N/A	63	N/A	25
5/16	N/A	72	N/A	25
5/17	N/A	44	N/A	25
5/17	N/A	44	N/A	25
5/17	N/A	67	N/A	25
5/17	N/A	64	N/A	25
5/24	N/A	58	N/A	25
5/24	N/A	76	N/A	25
5/24	N/A	54	N/A	25
5/24	N/A	55	N/A	25
5/24	N/A	61	N/A	25
5/24	N/A	50	N/A	25
5/24	N/A	56	N/A	25
	Average :	85	17.5	25

N/A = Not Available

TABLE 7 SUMMARY OF SULFUR DIOXIDE EMISSIONS — UNIT 2 (1 hr AVERAGES) DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Gas Flow Rate dscfm	Concentration ppmdv @ 7% O2	Mass Rate lb/hr	Permit Limit lb/hr
2/1	23032	81	15.3	25
2/1	23032	62	8.9	25
2/1	26550	86	19.2	25
2/1	26550	161	34.3	25
2/1	26550	184	38.3	25
2/2	24482	207	41.2	25
2/2	24482	120	23.9	25
2/5	23193	175	37.8	25
2/5	23193	118	25.4	25
2/5	23193	103	20.7	25
2/5	23757	94	19.6	25
2/5	23757	133	28.9	25
2/5	23757	151	32.0	25
2/6	24644	128	22.1	25
2/6	24644	85	14.9	25
2/6	24644	94	18.1	25
2/7	22004	145	23.8	25
2/7	22004	122	23.0	25
3/15	20682	49	7.9	25
3/15	20682	106	19.2	25
3/15	20682	128	24.4	25
3/16	23174	144	29.1	25
3/16	23174	109	20.4	25
5/12	N/A	79	N/A	25
5/12	N/A	72	N/A	25
5/12	N/A	83	N/A	25
5/12	N/A	72	N/A	25
5/12	N/A	66	N/A	25
5/12	N/A	57	N/A	25
5/15	N/A	58	N/A	25
5/15	N/A	56	N/A	25
5/15	N/A	50	N/A	25
5/15	N/A	84	N/A	25
5/15	N/A	104	N/A	25
5/15	N/A	76	N/A	25
5/16	N/A	77	N/A	25
5/16	N/A	74	N/A	25
5/16	N/A	91	N/A	25
5/16	N/A	72	N/A	25
5/17	N/A	115	N/A	25
5/17	N/A	72	N/A	25
5/17	N/A	100	N/A	25
5/17	N/A	119	N/A	25
	Average :	101	23.8	25

N/A = Not Available

Since the February test program, a number of changes have been made to the plant to remedy the problems that existed in the baghouse on Unit 2. The baghouse cleaning cycle controls have been modified so that cleaning is initiated on a pressure drop demand of 5 in. of water (1.24 kPa) for each compartment. If the pressure drop does not reach 5 in. of water within 2 hr of the previous cleaning cycle, cleaning is automatically initiated. Westinghouse believes that these changes will enable the baghouse to operate without causing a hopper to become overloaded with dust.

The dry injection system was designed to reduce acid gas (mainly HCl) to protect downstream equipment such as the ductwork, ID fan and flue lining from corrosion problems. In addition to removing HCl, some SO_2, HF and sulfuric acid mist are also removed from the flue gas. A number of tests were conducted to characterize the SO_2 emissions at the inlet of the dry injection system. The inlet SO_2 emissions were typically in the range of 100–200 ppm, @ 7% O_2. As shown by the data presented in Tables 6 and 7, the

TABLE 8 SUMMARY OF CO EMISSIONS — UNIT 1 (1hr AVERAGES) DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Gas Flow Rate dscfm	Actual Concentration ppmdv	Permit Limit ppmdv*
1/31	22604	101	170
1/31	20242	100	170
1/31	20153	127	170
1/31	21700	46	170
1/31	21700	51	170
2/1	22268	93	170
2/2	24032	128	170
2/2	24032	144	170
2/2	24215	126	170
2/3	22874	309	170
2/16	23070	130	170
2/17	24286	131	170
3/16	25805	238	170
3/16	25805	51	170
3/16	25805	214	170
3/16	21535	67	170
5/24	N/A	74	170
5/24	N/A	48	170
5/24	N/A	138	170
	Average Unit 1 :	122	170

* Equals approximately 240 ppm corrected to 7% O_2.

N/A = Available

TABLE 9 SUMMARY OF CO EMISSIONS — UNIT 2 (1hr AVERAGES) DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Gas Flow Rate dscfm	Actual Concentration ppmdv	Permit Limit ppmdv*
2/1	26550	157	170
2/1	26550	102	170
2/2	24481	150	170
2/2	24481	128	170
2/5	23193	278	170
2/16	20460	142	170
2/16	20460	153	170
2/17	27540	174	170
2/17	27540	259	170
2/17	27540	103	170
2/17	29590	228	170
3/15	20682	64	170
3/15	20682	52	170
3/15	20682	55	170
3/16	23174	51	170
3/16	23174	30	170
3/16	22953	45	170
5/24	N/A	170	170
5/25	N/A	106	170
5/25	N/A	73	170
5/25	N/A	103	170
	Average Unit 2 :	125	170

* Equals approximately 240 ppm corrected to 7% O_2.

N/A = Not Available

SO_2 was reduced by approximately 35–50%. The uncontrolled HCl levels were not determined during the test program. However, based on test data accumulated from similar WTE plants, the HCl removal efficiency is estimated to be in the range of 50–75%. (HCl data are shown in Tables 14 and 15.)

A program is currently being developed to fine-tune the dry injection and baghouse system. A continuous emission monitor to measure SO_2 emissions at the baghouse outlet from both units has been installed. The lime and Tesisorb feed rates will be adjusted and the corresponding SO_2 emissions will be recorded. Test program data are expected to be available in early 1990.

Carbon monoxide emission levels averaged 124 ppmdv, ranging from 46 to 309 ppmdv from both units during the January/February compliance test program, as shown in Tables 8 and 9. During April 1989, two changes were made to improve combustion and reduce CO emission levels. First, the axial seals, used to seal the individual windbox sections on the combustor, were replaced with an improved-design seal. Second, a deflector plate to cause ash to be spread evenly across the after burning grate was installed. Both of these changes improved combustion conditions and lowered the CO emission levels. CO emission levels ranged from 48 to 170 ppmdv during the May Compliance test program. Recent CO emission levels from Unit 1 measured by the installed continuous monitor are shown in Fig. 3 (daily averages).

TABLE 10 DIOXIN EMISSION COMPLIANCE TEST RESULTS — SUMMARY

Date	Time	2378-TCDD lb/hr	Total TCDD lb/hr	Permit Values 2378-TCDD lb/hr	Permit Values Total TCDD lb/hr
Unit 1					
2/16	9:55-13:55	0	2.40E-08	7.77E-08	7.77E-07
2/17	9:12-13:16	0	6.60E-09	7.77E-08	7.77E-07
2/17	16:46-21:25	0	2.50E-08	7.77E-08	7.77E-07
Average:		0	1.85E-08		
Unit 2					
2/16	9:20-13:30	0	4.76E-08	7.77E-08	7.77E-07
2/17	8:43-13:09	0	5.53E-08	7.77E-08	7.77E-07
2/17	15:50-20:11	3.77E-09	9.05E-08	7.77E-08	7.77E-07
Average:		1.26E-09	6.45E-08		

Dioxin and furan emissions were measured on February 16 and 17, 1989 and are reported in Tables 10–12. Dioxin and furan emissions are reported as

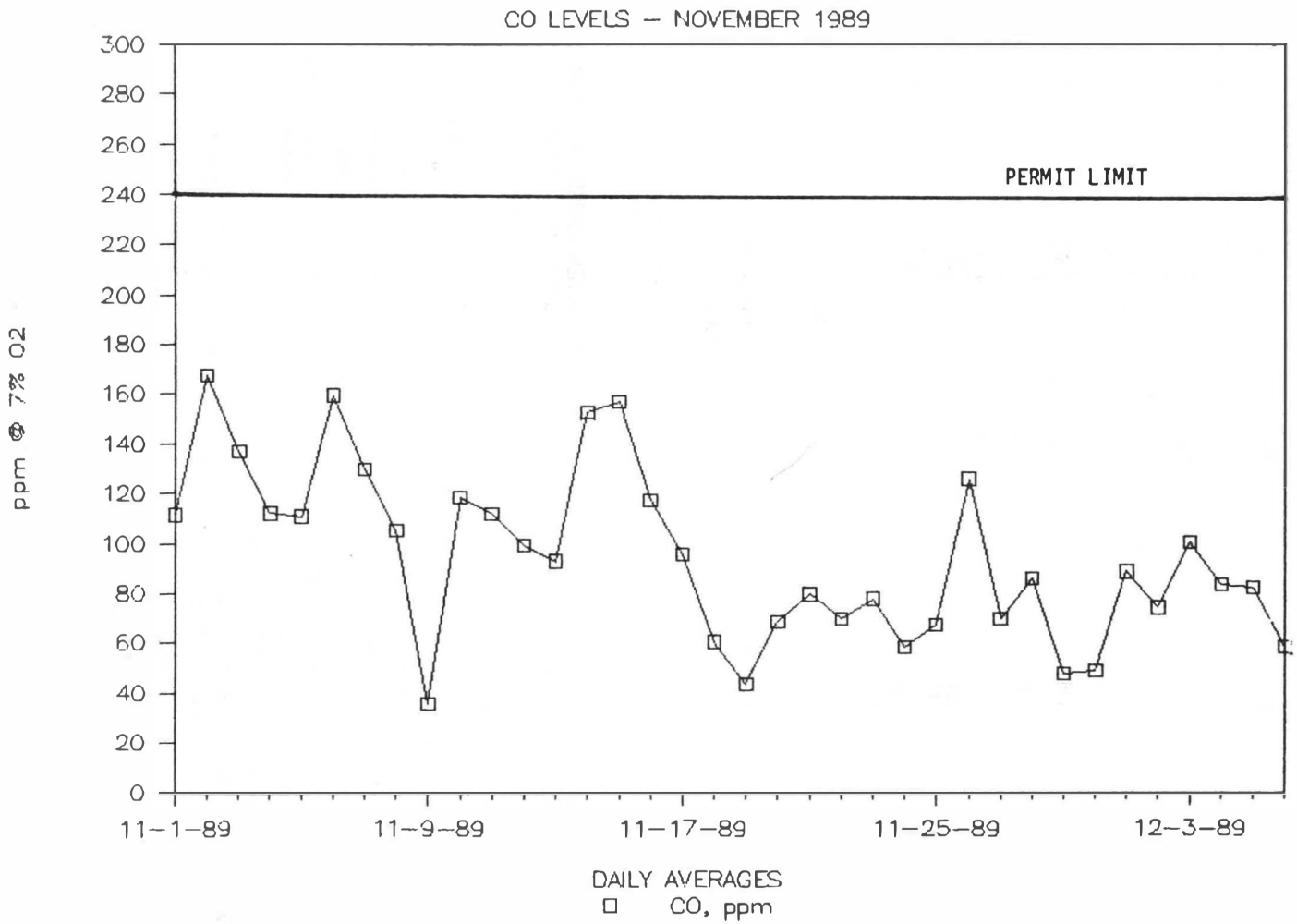


FIG. 3 DUTCHESS COUNTY FACILITY — UNIT 1

TABLE 11 PCDD/PCDF EMISSIONS FOR UNIT 1

	CONCENTRATION (ng/Nm3, adjusted to 7 percent O2)				2378-TCDD TOXIC EQUIVALENCY FACTOR	2378-TCDD TOXIC EQUIVALENCIES CONCENTRATION (ng/Nm3, adjusted to 7 percent O2)			
	RUN 1	RUN 2	RUN 3	AVERAGE		RUN 1	RUN 2	RUN 3	AVERAGE
DIOXINS									
2378-TCDD	0.000	0.000	0.000	0.000	1	0.0000	0.0000	0.0000	0.0000
Other TCDD	0.349	0.088	0.339	0.258	0.01	0.0035	0.0009	0.0034	0.0026
12378-PCDD	0.000	0.000	0.020	0.007	0.5	0.0000	0.0000	0.0099	0.0033
Other PCDD	0.857	0.483	0.200	0.513	0.005	0.0043	0.0024	0.0010	0.0026
123478-HxCDD	0.000	0.000	0.000	0.000	0.04	0.0000	0.0000	0.0000	0.0000
123678-HxCDD	0.089	0.057	0.000	0.049	0.04	0.0036	0.0023	0.0000	0.0019
123789-HxCDD	0.000	0.048	0.000	0.016	0.04	0.0000	0.0019	0.0000	0.0006
Other HxCDD	1.055	0.756	0.513	0.775	0.0004	0.0004	0.0003	0.0002	0.0003
1234678-HpCDD	0.562	0.408	0.259	0.410	0.001	0.0006	0.0004	0.0003	0.0004
Other HpCDD	0.000	0.441	0.000	0.147	0.00001	0.0000	0.0000	0.0000	0.0000
OCDD	0.441	0.403	0.000	0.281	0	0.0000	0.0000	0.0000	0.0000
TOTAL PCDD	3.354	2.683	1.331	2.456		0.0123	0.0082	0.0148	0.0118
FURANS									
2378-TCDF	0.086	0.033	0.042	0.054	0.1	0.0086	0.0033	0.0042	0.0054
Other TCDF	1.896	0.875	0.635	1.136	0.001	0.0019	0.0009	0.0006	0.0011
12378-PCDF	0.000	0.053	0.046	0.033	0.1	0.0000	0.0053	0.0046	0.0033
23478-PCDF	0.102	0.084	0.000	0.062	0.1	0.0102	0.0084	0.0000	0.0062
Other PCDF	0.543	0.724	0.429	0.565	0.001	0.0005	0.0007	0.0004	0.0006
123478-HxCDF	0.073	0.000	0.048	0.040	0.01	0.0007	0.0000	0.0005	0.0004
123678-HxCDF	0.055	0.000	0.036	0.030	0.01	0.0005	0.0000	0.0004	0.0003
234678-HxCDF	0.045	0.000	0.000	0.015	0.01	0.0005	0.0000	0.0000	0.0002
123789-HxCDF	0.000	0.000	0.000	0.000	0.01	0.0000	0.0000	0.0000	0.0000
Other HxCDF	0.233	0.113	0.118	0.155	0.0001	0.0000	0.0000	0.0000	0.0000
1234678-HpCDF	0.000	0.086	0.086	0.057	0.001	0.0000	0.0001	0.0001	0.0001
1234789-HpCDF	0.000	0.000	0.000	0.000	0.001	0.0000	0.0000	0.0000	0.0000
Other HpCDF	0.000	0.030	0.030	0.020	0.00001	0.0000	0.0000	0.0000	0.0000
OCDF	0.000	0.000	0.000	0.000	0	0.0000	0.0000	0.0000	0.0000
TOTAL PCDF	3.033	1.998	1.470	2.167		0.023	0.019	0.011	0.017
TOTAL PCDD+PCDF	6.387	4.682	2.801	4.623		0.0353	0.0269	0.0255	0.0292

MASS EMISSIONS RATES - LB/HR

	RUN 1	RUN 2	RUN 3	AVERAGE
2378-TCDD	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL TCDD	2.40E-08	6.60E-09	2.50E-08	1.85E-08
TOTAL TCDD AS 2378-TCDD EQUIVALENT	2.40E-10	6.60E-11	2.50E-10	1.85E-10

TABLE 12 PCDD/PCDF EMISSIONS FOR UNIT 2

	CONCENTRATION (ng/Nm3, adjusted to 7 percent O2)				2378-TCDD TOXIC EQUIVALENCY FACTOR	2378-TCDD TOXIC EQUIVALENCIES CONCENTRATION (ng/Nm3, adjusted to 7 percent O2)			
	RUN 1	RUN 2	RUN 3	AVERAGE		RUN 1	RUN 2	RUN 3	AVERAGE
DIOXINS									
2378-TCDD	0.000	0.000	0.042	0.014	1	0.0000	0.0000	0.0423	0.0141
Other TCDD	0.806	0.673	0.972	0.817	0.01	0.0081	0.0067	0.0097	0.0082
12378-PCDD	0.086	0.129	0.000	0.072	0.5	0.0429	0.0644	0.0000	0.0358
Other PCDD	0.658	1.158	0.826	0.881	0.005	0.0033	0.0058	0.0041	0.0044
123478-HxCDD	0.044	0.036	0.043	0.041	0.04	0.0018	0.0014	0.0017	0.0016
123678-HxCDD	0.118	0.000	0.098	0.072	0.04	0.0047	0.0000	0.0039	0.0029
123789-HxCDD	0.000	0.137	0.155	0.097	0.04	0.0000	0.0055	0.0062	0.0039
Other HxCDD	0.905	1.120	1.112	1.045	0.0004	0.0004	0.0004	0.0004	0.0004
1234678-HpCDD	0.701	0.494	0.512	0.569	0.001	0.0007	0.0005	0.0005	0.0006
Other HpCDD	0.617	0.531	0.476	0.542	0.00001	0.0000	0.0000	0.0000	0.0000
OCDD	0.764	0.000	0.572	0.445	0	0.0000	0.0000	0.0000	0.0000
TOTAL PCDD	4.699	4.278	4.807	4.595		0.0618	0.0848	0.0690	0.0719
FURANS									
2378-TCDF	0.341	0.382	0.284	0.336	0.1	0.0341	0.0382	0.0284	0.0336
Other TCDF	3.036	1.911	6.811	3.919	0.001	0.0030	0.0019	0.0068	0.0039
12378-PCDF	0.279	0.298	0.272	0.283	0.1	0.0279	0.0298	0.0272	0.0283
23478-PCDF	0.441	0.393	0.375	0.403	0.1	0.0441	0.0393	0.0375	0.0403
Other PCDF	3.108	3.014	2.837	2.986	0.001	0.0031	0.0030	0.0028	0.0030
123478-HxCDF	0.295	0.284	0.295	0.291	0.01	0.0029	0.0028	0.0030	0.0029
123678-HxCDF	0.211	0.000	0.180	0.130	0.01	0.0021	0.0000	0.0018	0.0013
234678-HxCDF	0.214	0.190	0.199	0.201	0.01	0.0021	0.0019	0.0020	0.0020
123789-HxCDF	0.000	0.000	0.017	0.006	0.01	0.0000	0.0000	0.0002	0.0001
Other HxCDF	1.025	1.077	0.978	1.027	0.0001	0.0001	0.0001	0.0001	0.0001
1234678-HpCDF	0.415	0.342	0.336	0.364	0.001	0.0004	0.0003	0.0003	0.0004
1234789-HpCDF	0.000	0.000	0.062	0.021	0.001	0.0000	0.0000	0.0001	0.0000
Other HpCDF	0.380	0.118	0.263	0.254	0.00001	0.0000	0.0000	0.0000	0.0000
OCDF	0.220	0.000	0.112	0.111	0	0.0000	0.0000	0.0000	0.0000
TOTAL PCDF	9.965	8.008	13.021	10.331		0.120	0.117	0.110	0.116
TOTAL PCDD+PCDF	14.664	12.286	17.828	14.926		0.1818	0.2022	0.1791	0.1877

MASS EMISSIONS RATES - LB/HR

	RUN 1	RUN 2	RUN 3	AVERAGE
2378-TCDD	0.00E+00	0.00E+00	3.77E-09	1.26E-09
TOTAL TCDD	4.76E-08	5.53E-08	9.05E-08	6.45E-08
TOTAL TCDD AS 2378-TCDD EQUIVALENT	4.76E-10	5.53E-10	4.64E-09	1.89E-09

TABLE 13 SUMMARY OF NO_x EMISSIONS (1 hr AVERAGES) DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Date	Unit	Gas Flow Rate dscfm	Concentration ppmdv @ 7% O2	Mass Rate lb/hr	Permit Limit lb/hr
1/31	1	22604	114	10.2	25
1/31	1	22604	127	11.5	25
1/31	1	20242	67	7.0	25
1/31	1	20153	87	7.1	25
1/31	1	20153	96	9.2	25
1/31	1	21700	92	9.4	25
1/31	1	21700	88	8.7	25
1/31	1	21700	101	9.8	25
1/31	1	21700	97	10.3	25
1/31	1	21700	58	6.8	25
2/1	1	22268	108	10.4	25
2/2	1	24032	105	14.1	25
2/2	1	24032	94	13.4	25
2/2	1	24215	97	14.2	25
2/3	1	22874	79	12.8	25
	Average Unit 1 :		94	10.3	25
2/1	2	23032	88	13.7	25
2/1	2	23032	91	9.5	25
2/1	2	26550	100	15.6	25
2/1	2	26550	101	15.8	25
2/1	2	26550	101	15.1	25
2/2	2	24482	107	15.2	25
2/2	2	24482	109	15.5	25
2/5	2	23193	88	13.7	25
2/5	2	23193	90	14.0	25
2/5	2	23193	109	15.6	25
2/5	2	23757	107	16.0	25
2/5	2	23757	96	15.0	25
2/5	2	23757	91	13.8	25
2/6	2	24644	108	13.2	25
2/6	2	24644	113	14.1	25
2/6	2	24644	104	14.6	25
2/6	2	24644	90	12.8	25
2/7	2	22004	113	13.2	25
2/7	2	22004	112	15.2	25
	Average Unit 2 :		101	14.3	25

TABLE 14 SUMMARY OF OTHER EMISSIONS — UNIT 1 DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Pollutant	Date	Gas Flow Rate dscfm	Mass Rate lb/hr	Permit Limit lb/hr	Concentration ppmdv @ 7% O2
HF	1/31	21700	0.026	0.83	0.397
	2/1	22268	0.006	0.83	0.106
	2/2	24398	0.005	0.83	0.079
		Average :	0.012	0.83	0.194
HCl	2/1	21400	7.2	33	70.0
	2/1	23560	2.0	33	17.7
	2/2	24030	0.25	33	2.4
	5/11	27766	19.55	33	151.0
	5/11	25435	24.79	33	203.9
	5/11	26406	20.82	33	192.9
		Average :	12.44	33	106.3
HC*	2/4	22960	2.4	4	16
	2/4	22700	3.3	4	21
	2/4	24727	3.2	4	21
		Average :	3.0	4	19
Beryllium	2/6	20620	ND	2.9x10-5	
	2/6	23371	ND	2.9x10-5	
	2/7	22959	ND	2.9x10-5	
		Average :		2.9x10-5	
Lead	2/5	21716	0.00245	0.42	
	2/5	23231	0.00311	0.42	
	2/6	21269	0.00294	0.42	
		Average :	0.00283	0.42	
Mercury	2/5	21716	0.0665	0.08	
	2/5	23231	0.0925	0.08	
	2/6	21269	0.0774	0.08	
		Average :	0.0788	0.08	

* Note - Hydrocarbon mass emissions are expressed in terms of n-propane.

ND = Not Detected; Detection limit = 3.8x10-8 lb/hr (0.001 ug/ml).

TABLE 15 SUMMARY OF OTHER EMISSIONS — UNIT 2 DUTCHESS COUNTY RESOURCE RECOVERY FACILITY

Pollutant	Date	Gas Flow Rate dscfm	Mass Rate lb/hr	Permit Limit lb/hr	Concentration ppmdv @ 7% O2
HF	1/31	24705	0.004	0.83	0.071
	1/31	23534	0.004	0.83	0.060
	1/31	24738	0.003	0.83	0.051
		Average :	0.004	0.83	0.061
HCl	1/31	23740	23.0	33	209
	1/31	23360	42.7	33	422
	2/1	24510	8.9	33	78
	2/2	24480	2.7	33	23
	3/15	24100	14.0	33	124
	3/15	23272	7.6	33	70
	3/15	20682	8.1	33	80
	5/15	26461	20.6	33	180
	5/15	25511	22.9	33	157
	5/15	22407	23.6	33	200
		Average :	17.4	33	154
HC*	2/16	20460	2.1	4	16
	2/16	20460	3.4	4	29
	2/17	29590	2.4	4	13
		Average :	2.6	4	19
Beryllium	2/5	23193	ND	2.9x10-5	
	2/5	23757	ND	2.9x10-5	
	2/6	24644	ND	2.9x10-5	
		Average :		2.9x10-5	
Lead	2/2	22639	0.00158	0.42	
	2/4	23718	0.00578	0.42	
	2/4	23014	0.00352	0.42	
		Average :	0.00363	0.42	
Mercury	2/2	22639	0.00243	0.08	
	2/4	23718	0.00733	0.08	
	2/4	23014	0.00889	0.08	
		Average :	0.00622	0.08	

* Note - Hydrocarbon mass emissions are expressed in terms of n-propane.

ND = Not Detected; Detection limit = 3.8x10-8 lb/hr (0.001 ug/ml).

2,3,7,8—TCDD toxic equivalents, combining both PCDD and PCDF total emissions. The emissions measured were extremely low and averaged 0.0292 ng/Nm^3 @ 7% O_2 for Unit 1 and 0.1877 ng/Nm^3 @ 7% O_2 for Unit 2.

These values are similar to dioxin and furan emission rates reported at other well-operated, modern WTE facilities.

Other emission data reported—including NO_x, lead, beryllium, mercury, hydrogen chloride, hydrogen flouride, and hydrocarbons—show that the facility is in compliance with permit limits for these pollutants (see Tables 13–15).

CONCLUSION

The Dutchess County Resource Recovery Facility has passed all of the emission compliance tests as required by the NYSDEC. A continuous emission mon-

itor is currently being installed to continuously measure SO_2 emissions to verify that the facility does not emit more than 210 tons of SO_2 per year, which is the facility annual emission limit. After installation of the SO_2 monitor is completed, certification tests will be conducted on the SO_2, NO_x, O_2 and opacity analyzers according to 40 CFR Part 60 Appendix B. Annual compliance for SO_2 emissions will then be determined by the continuous monitor. The CO analyzers have been installed and calibrated in conformance with the manufacturer's recommendations as required by the permit.

Key Words: Air Quality; Emissions; Incineration; Performance; Permits; Testing