CORRESPONDENCE/MEMORANDUM

A-89-08
II-D-186

DATE: February 24, 1987 FILE REF: 4530-3

TO: Files

FROM: Joseph Perez - AM/3 JP

SUBJECT: Review of Stack Test Performed at Barron County Incinerator

I. SOURCE DESCRIPTION

Barron County Resource Recovery Incinerator Facility
County Highway P
Almena, WI 54805

Test Date: November 5, 1986

Source FID #603049040, Stack #S10, Process #I40 & I41.

Plant Contact: Mr. Jeff Taillon (715) 357-6566

II. SOURCE

The source tested was a general refuse incineration facility. The facility consists of two Consumat Model #CS-1600 incinerators. These are dual chambered incinerators capable of burning 50 tons per day (TPD) each. There are natural gas burners in each chamber that are used for ignition and shutdown. The burners are also used to maintain the temperature of the secondary chamber above 1500°F. During the test, the incinerators were firing about 87 TPD. Each incinerator is equipped with a heat recovery boiler. The boilers are watertube boilers and are equipped with economizers. Each boiler is rated at 10,000 pounds of saturated steam per hour at a steam pressure of 600 PSI. During the test, the boilers were producing about 17,000 pounds steam/hour at a steam pressure of 500 PSI. The emissions are controlled by a 2 chamber, 2 stage electrostatic precipitator. During the test, the first stage was energized with about 38 KV and the second stage was energized with about 28 KV. The steam is used to drive a 200 KV turbine generator. The low pressure steam from the turbine is sold to a cheese plant.

ESP
PPC Model 6400;
Total Plate Area = 2991 ft²

III. SAMPLING OPERATION

A. Purpose of Test

The purpose of the test was to show compliance with the emission limits in Permit #85-SJK-008 issued to this source in July, 1985 and the federal NSPS limits.

B. Sampling Firm

Environmental Technology & Engineering Corporation
13020 West Bluemound Road
Elm Grove, WI 53122
Crew Chief: Mr. Bill Dick (414) 784-2434

C. Date of Test

The test was performed on November 5, 1986. The weather on this date was cloudy with an ambient temperature of 35°F.

D. Test Method

The test method for particulates was EPA Method 5 as stated in the Federal Register, Vol. 42, #160, August 18, 1977. ET&E analyzed the impinger portion of the sampling train for chlorides with a specific ion probe. The Method 5 filters and probe washes were analyzed by atomic absorption for lead, chromium, nickel, arsenic, and cadmium. The test site was on the round (dia. = 36") steel butlet stack about 28 feet above the breeching and 48 feet from the top of the stack. ET&E performed a 6 point sampling traverse of the stack diameter through each of 2 ports per run. Each point was sampled for 5 minutes. The test consisted of 3 one-hour runs.

E. Test Witness

Mr. Jim Ross was the Department's representative at this test.

IV. SUMMARY OF RESULTS

The emission concentrations shown below are corrected to 12% CO_2.

Run Number	Emission Rate (lb/hr)	Emission Conc. (Gr/DSCF @ 12% CO_2)	Isokinetic Ratio (%)
1	0.80	0.011	109
2	0.67	0.010	108
3	0.67	0.010	106
Ave.	0.71	0.010	108

* Average CO Emission Rate = 0.115 lb/hr
Average Lead Emission Rate = 0.007 lb/hr
Average HCl Emission Rate = 20.53 lb/hr
For other metals, see Table 1.

V. APPLICABLE EMISSION LIMIT

Pollutant	Limit	
Particulates	0.08 Gr/DSCF	Permit
Carbon Monoxide	5.21 lb/hr	Permit
Lead	0.41 lb/hr	Permit
Hydrogen Chloride	34.54 lb/hr	Permit

VI. DISCUSSION OF RESULTS

During the test, the facility was operating at about 87% of capacity. The stack opacity averaged about 5%. The incinerators appeared to be operating normally during the test.

The average particulate emission concentration during the test was 0.010 grains per dry standard cubic foot corrected to 12% CO_2 which is under the limit of 0.08 Gr/DSCF. The average isokinetic ratio was 108% which is within the limits of 90% to 110% set by the Department to judge the validity of stack test data. The average lead emissions of 0.007 lb/hr were under the limit of 0.41 lb/hr. The average HCl emissions of 20.53 lb/hr were under the limit of 34.54 lb/hr. The average CO emissions of 0.115 lb/hr were under the emission limit of 5.21 lb/hr.

ET&E calculates the emissions in the same way the Department does. I checked over all the input data and some of the output data and found it to be correct. The report contained calibration data for the sampling equipment. Most of the plant production data was taken from the witnessing form.

JP:pl/7972R

cc: Jim Ross - NWD
U.S. EPA - Region V

TABLE 1

Report to

BARRON COUNTY WASTE-TO-ENERGY FACILITY
Almena, Wisconsin

for

HAZARDOUS EMISSION STACK TEST
Refuse Incinerator

The chromium, nickel, arsenic, and cadmium emissions from the new refuse incinerator at the Barron County Waste-to-Energy facility in Almena, Wisconsin were measured on November 5, 1986 in conjunction with a scheduled compliance particulate emission test. The following table summarizes the emissions measured during this test:

	TEST 1	TEST 2	TEST 3
Chromium			
mg/m3	<0.0017	0.0025	0.0025
lb/hr	<0.0001	0.0001	0.0001
Nickel			
mg/m3	<0.0017	<0.0017	<0.0017
lb/hr	<0.0001	<0.0001	<0.0001
Arsenic			
mg/m3	0.0108	0.0127	0.0126
lb/hr	0.0005	0.0006	0.0006
Cadmium			
mg/m3	0.0108	0.0140	0.0138
lb/hr	0.0005	0.0007	0.0007

2.2 Lead Emissions

The particulate captured in the EPA Method 5 sample train was then analyzed using standard atomic absorption techniques. The detailed results are also shown in the computer printouts. The lead (Pb) emissions were also well below the permit limit of 0.410 lb/hr set by the DNR. The following table presents the numerical results:

Test	Emissions	% of Allowable
1	0.006	1
2	0.008	2
3	0.008	2
AVG	0.007 lb/hr	2

2.3 Hydrogen Chloride Emissions

The hydrogen chloride emissions were determined by analyzing the impinger portion of the sampling train for total chloride. These detailed results are also included in the computer printouts. The hydrogen chloride (HCl) emissions were well below the permit limit of 34.54 lb/hr set by the DNR. presents the numerical results:

Test	Emissions	% of Allowable
1	19.87	57
2	19.74	57
3	21.97	64
AVG	20.53 lb/hr	59

2.4 Carbon Monoxide Concentrations

The integrated bag samples collected during each test and analyzed on-site with the Orsat apparatus were returned to the laboratory and analyzed the same night with an Horiba non-dispersive infrared carbon monoxide (CO) analyzer. The CO results are summarized below:

Test	Concentration
1	2
2	2
3	2
AVG	2 ppm

BARRON COUNTY INCINERATOR TEST 1 11-5-86

TABLE 2-1

BAROMETRIC PRESSURE, in Hg = 28.700
TIP DIAMETER, in .2550
STACK AREA, sq ft = 7.069
SAMPLING TIME PER POINT, min = 5.00
NUMBER OF POINTS = 12
STACK PRESSURE, in Hg = 28.678
GAS METER VOLUME, acf = 44.11
WATER COLLECTED, ml = 115.00
PARTICULATE COLLECTED, grams = 0.0191
HYDROGEN CHLORIDE COLLECTED, grams = 0.4721
LEAD COLLECTED, grams = 0.000155
WET MOLECULAR WT = 28.48
ORSAT RESULTS
CO2 = 7.40 O2 = 13.00 CO = 0.00 N2 = 79.60

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	385	0.600	1.45	37	57.25
2	390	0.560	1.40	38	55.47
3	395	0.640	1.55	39	59.48
4	395	0.560	1.40	39	55.64
5	400	0.640	1.55	40	59.65
6	405	0.460	1.15	41	50.72
7	395	0.520	1.30	45	53.61
8	395	0.600	1.45	47	57.59
9	400	0.580	1.42	49	56.79
10	400	0.600	1.45	50	57.76
11	400	0.660	1.65	51	60.58
12	400	0.500	1.25	52	52.72
AVG VALUES	397		1.418	44	56.44

DRY GAS WITHDRAWN, scf = 41.06
WATER VAPOR WITHDRAWN, scf = 5.41
PERCENT WATER VAPOR = 11.65
ACTUAL WET FLOW RATE, acfm = 23,937.50
STANDARD DRY FLOW RATE, scfm = 12,494.06
PARTICULATE CONCENTRATION, grains/dscf = 0.007
GRAINS/DSCF @ 12 % CO2 = 0.012
EMISSION RATE, lb/hr = 0.80
LB PER 1000 LB GAS = 0.013
LB/MMBTU = 0.026
HYDROGEN CHLORIDE CONCENTRATION, mg/m3 = 406.01
PPM @ 12 % CO2 = 447.16
EMISSION RATE, lb/hr = 19.87
LEAD CONCENTRATION, mg/m3 = 0.1333
EMISSION RATE, lb/hr = 0.0065
PERCENT OF ISOKINETIC SAMPLING = 109.19

BARRON COUNTY INCINERATOR TEST 3 11-5-86

TABLE 2-3

BAROMETRIC PRESSURE, in Hg = 28.700
TIP DIAMETER, in .2550
STACK AREA, sq ft = 7.069
SAMPLING TIME PER POINT, min = 5.00
NUMBER OF POINTS = 12
STACK PRESSURE, in Hg = 28.678
GAS METER VOLUME, acf = 45.22
WATER COLLECTED, ml = 106.00
PARTICULATE COLLECTED, grams = 0.0157
HYDROGEN CHLORIDE COLLECTED, grams = 0.5158
LEAD COLLECTED, grams = 0.000195
WET MOLECULAR WT = 28.58
ORSAT RESULTS
CO2 = 7.20 O2 = 13.00 CO = 0.00 N2 = 79.80

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	405	0.680	1.65	52	61.56
2	405	0.680	1.65	52	61.56
3	410	0.640	1.55	53	59.89
4	405	0.580	1.42	54	56.85
5	410	0.700	1.70	55	62.64
6	415	0.580	1.42	56	57.18
7	405	0.600	1.45	58	57.82
8	410	0.660	1.65	59	60.82
9	410	0.660	1.65	59	60.82
10	415	0.620	1.50	60	59.12
11	405	0.620	1.50	60	58.78
12	405	0.580	1.42	60	56.85
AVG VALUES	408		1.547	57	59.49

DRY GAS WITHDRAWN, scf = 42.17
WATER VAPOR WITHDRAWN, scf = 4.99
PERCENT WATER VAPOR = 10.58
ACTUAL WET FLOW RATE, acfm = 25,232.99
STANDARD DRY FLOW RATE, scfm = 13,150.40
PARTICULATE CONCENTRATION, grains/dscf = 0.006
GRAINS/DSCF @ 12 % CO2 = 0.010
EMISSION RATE, lb/hr = 0.67
LB PER 1000 LB GAS = 0.010
LB/MMBTU = 0.021
HYDROGEN CHLORIDE CONCENTRATION, mg/m3 = 431.89
PPM @ 12 % CO2 = 488.88
EMISSION RATE, lb/hr = 21.97
LEAD CONCENTRATION, mg/m3 = 0.1633
EMISSION RATE, lb/hr = 0.0083
PERCENT OF ISOKINETIC SAMPLING = 106.55

ELECTROSTATIC PRECIPITATOR SPECIFICATIONS

Standard design DC-6400 Unit

PRECIPITATOR DESIGN DATA (each chamber):

Volume - CFM @ operating conditions	12500
Temperature - deg F. @ operating conditions	525
Inlet loading - grains/CF @ operating conditions	See Proposal
Dust bulk density - lbs./CF	
Guaranteed efficiency - percent	See Proposal
Guaranteed outlet loading - gr/CF @ oper. cond.	See Proposal
Pressure drop across precipitator including gas distribution - "W.C.	0.50 Maximum
Gas velocity - ft/sec	4.12
Treatment time - seconds	5.9
Treatment length - feet	24.1

PRECIPITATOR HOUSING (Each chamber):

Casing material and thickness (inches)	A-36, 3/16
Casing design pressure ("W.C. pos or neg)	+/- 20
Number of hoppers/precipitator	1
Hopper material and thickness (inches)	A-36, 3/16
Minimum hopper valley angle	55 Deg.
Total hopper capacity (cubic feet)/precipitator	375
Insulator compartment material and thickness (inches)	A-36, 3/16

COLLECTING SYSTEM (Each chamber):

Number of gas passages	6
Nominal spacing of gas passages (inches)	9.75
Collecting surface material and thickness	A-36,16 ga.
Collecting surface effective length (feet)	24.1
Total collecting surface area (Sq Ft)	2991
Specific collecting area (Sq Ft/1000 CFM)	239.3
Aspect ratio	2.32
Number of fields	2

HIGH VOLTAGE SYSTEM (E(chamber):

10

Discharge electrode - type, material and thickness (inches)..... Rigid,A-36,.25 sq.
Total lineal feet of effective discharge electrode per precipitator..... 1494
Total number of discharge electrodes..... 144
Lineal feet of discharge electrode per field..... 747
Number of electrode cleaning devices..... 2
Power density (Watts/sq ft)..... 2.23

HIGH VOLTAGE TRANSFORMER RECTIFIER (Total):

Quantity and type..... 2, Silicon Diode
Input voltage and amperage..... 480 VAC x 25.3
Output voltage KV (DC) Avg..... 50
Output current Milliamps (DC) Avg..... 150
Maximum ambient temperature..... 45 deg. C

HIGH VOLTAGE CONTROLLER (Total):

Quantity and type..... 2, SCR
Style enclosure..... NEMA 12 (Modified)
Maximum ambient temperature..... 45 Deg. C

KEY INTERLOCKS:

Type..... CASTELL or equal
Control cabinet protection..... Yes
Transformer-rectifier protection..... Yes
Access door protection..... Yes

INLET TRANSITION (Each chamber):

Type..... Pyramid
Material and thickness..... A-36, 3/16
Type distribution device..... perforated plate/vanes
Duct connection size (W x H)..... 18" x 18"

OUTLET TRANSITION (Each chamber):

Type..... Pyramid
Material and thickness..... A-36, 3/16
Duct connection size (W x H)..... 18" x 18"

STACK:

Type	Not Required
Material and thickness	" " "
Height	" " "
Sample ports	" " "
Sampling platform	" " "

HEAT INSULATION:

Type, thickness and covering for roof	8# MW,6",1/4" tplte
Type, thickness and covering for sides and ends	8# MW,4",0.032 Alum
Type, thickness and covering for hoppers	8# MW,4",0.032 Alum
Type, thickness and covering for inlet transition	8# MW,4",0.032 Alum
Type, thickness and covering for outlet transition	8# MW,4",0.032 Alum
Other	

POWER REQUIREMENTS KVA/PRECIPITATOR (Total):

	Connected/Actual	
Transformer-rectifier	23.2	
Rappers	.5	
Insulator housing blower (positive pressure only)	2	
Insulator housing heater	N/R	N/R
Hopper heaters		
Lights		
Other		
Both chambers total:	25.7	

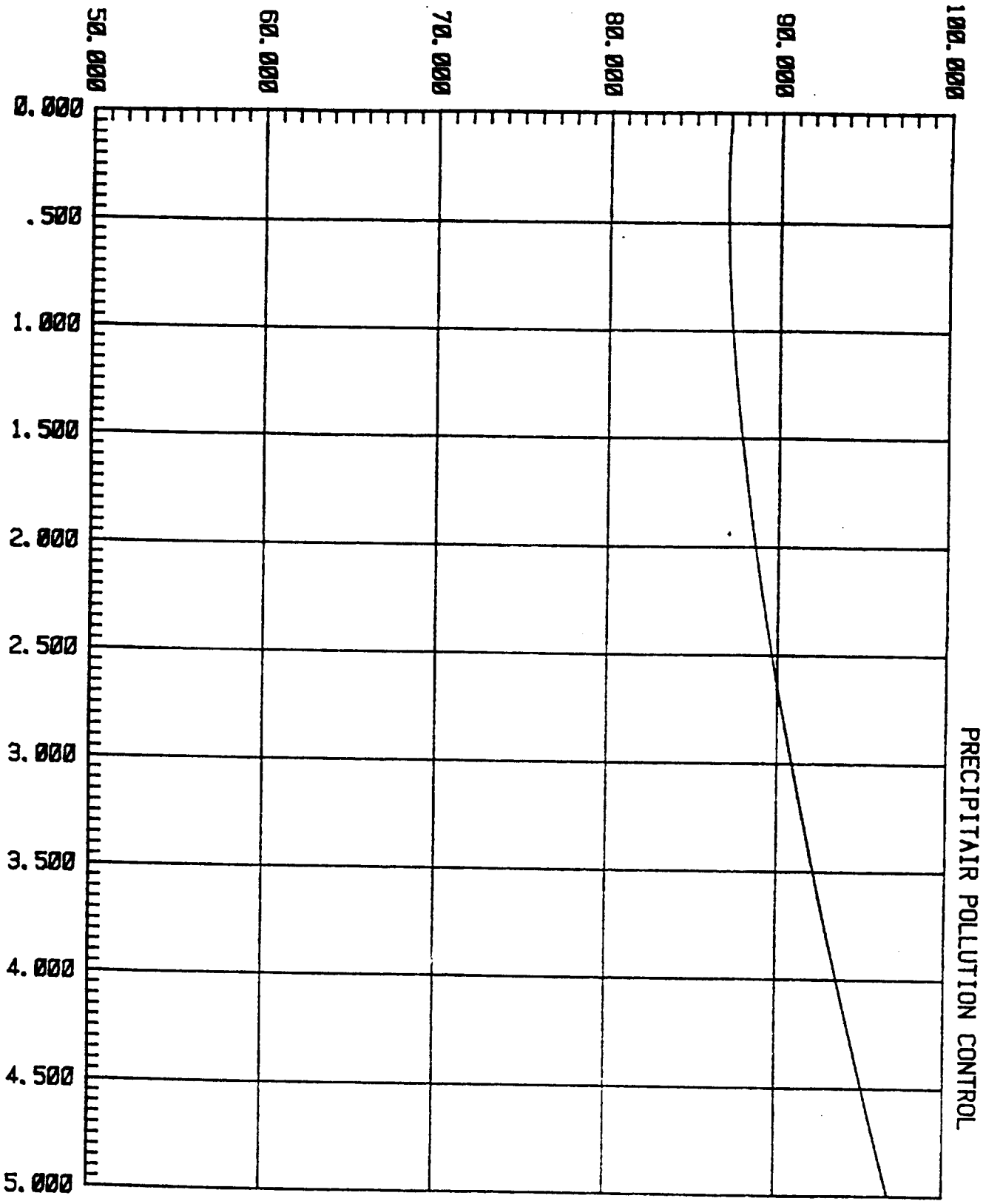
Electrical service requirement ___ Amps @ 480 VAC

WEIGHTS:

Total precipitator weight including electrical Equipment but excluding dust load	52,216 Lbs. (Both)

DIMENSIONAL DATA: (BOTH CHAMBERS)

Overall width (Precipitator Box)	11'-7 1/4"
Overall length (incl. transitions)	31'-7 1/2"
Overall height (hopper disch. elev to roof elev)	16'-7 3/16"
Flue centerline (from hopper discharge elev)	8'-10 1/2"
Hopper opening size	18" x 23'-5 1/2"


EFFICIENCY - %
50.000
60.000
70.000
80.000
90.000
100.000
0.000
.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
PARTICLE SIZE - microns
PRECIPITAIR POLLUTION CONTROL