Minnesota Pollution Control Agency
Air Quality Division
PERFORMANCE TEST EVALUATION REPORT

REV/YH/93

. Description

Source Metropolitan Council Wastewater

File 879-90-OT-3

Location St. Paul

Region Metro

Unit Engineer C. A. Enforcement HWP Test Reviewer CDA

Test Date(s) June 5, 1995

Emission Point(s) Incinerator #10 (Emission pt. #6)

Process Unit Description Wastewater Treatment Plant

II. Test Report Validity

Is the test report valid? Yes

List any Deficiencies in report below, and any possible reasons for Non-compliance if applicable:

III. Compliance Demonstration

A. Summary of operating conditions during test (please include maximum design or allowable capacities):

Permit Conditions	Test Conditions	T_1	T_2	T_3
BSP Envirotech multiple hearth	Sludge feed rate	2.91	3.30	2.97
Sludge feed rate : ~3.0 dtph				
Nat. Gas consumption : ~ 7000 cu ft/hr				
	PM lb/dry ton = ~~sludge feed~~ x uomia x .0376 g/dscf x 24272 / Sludge feed rate (tons per hour) x 7000 gcs			
After burner temp ~1200°F				
residence time 2.5 sec				
Quad cyclone Ash Collector Δp - 5" H_2O		4.3-5.0	6.0-5.5	5.4-6.5
Dry Cooler water flow rate 220 gpm		260	260	260
Inlet gas temp 460°F		2495	2515	2520
outlet 160°F		2162	2162	2164
Venturi Scrubber water flow rate 220 gpm		2264	2263	2263
Δp = 30" H_2O		28.8	29.0	27.4
Inlet gas temp = 160°F Outlet = 120°F		2165	2165	2148
Wet Cooler water flow rate 1500 gpm		21440	21467	21455
Δp = 4.0" H_2O		76.0	76.9	76.8
Inlet 120°F outlet 70°F				

B. Analysis of the performance test indicates that the following has been demonstrated: REV/YH/93

Pollutant

PM

Limitation Basis or Applicable Rule: Mn. Rule 7011.0310 & 40 CFR 60. Subpart O

Limit: 1.3 lbs/dry ton sludge charged

Measured Emissions (Units of measurement lbs / dry ton):

Run 1 1.079 Run 2 2.145 Run 3 2.635

Average 1.953 => 1.9

Compliance (circle one): YES (NO) CANNOT DETERMINE

Opacity

Limitation Basis or Applicable Rule: Minn Rule 7011.1310 40 CFR Subpart O

Limit: 20%

Measured Emissions (Units of measurement % opacity):

Run 1 Max 10% Highest 6-min Aver 7.3 Run 2 Run 3

Average Highest 6-min Aver => 7.3%

Compliance (circle one): (YES) NO CANNOT DETERMINE

CO

Limitation Basis or Applicable Rule: NA

Limit:

Measured Emissions (Units of measurement):

Run 1 Run 2 Run 3

Average

~~Compliance (circle one):~~ YES NO ~~CANNOT DETERMINE~~ NA

Limitation Basis or Applicable Rule:

Limit:

Measured Emissions (Units of measurement):

Run 1 Run 2 Run 3

Average

Compliance (circle one): YES NO CANNOT DETERMINE

Limitation Basis or Applicable Rule:

Limit:

Measured Emissions (Units of measurement):

Run 1 Run 2 Run 3

Average

Compliance (circle one): YES NO CANNOT DETERMINE

Limitation Basis or Applicable Rule:

Limit:

Measured Emissions (Units of measurement):

Run 1 Run 2 Run 3

Average

Compliance (circle one): YES NO CANNOT DETERMINE

PARTICULATE MASS EMISSIONS (lb/dry ton charged)

Permit Limit = 1.30 lb/dry ton (using front catch gr/dscf)

Run 1:

$$\frac{\text{Pm lb}}{\text{dry ton}} \left| \frac{1\text{ hr}}{2.91\text{ tons}} \right| \frac{60\text{ min}}{1\text{ hr}} \left| \frac{0.0161\text{ gr}}{\text{dscf}} \right| \frac{\text{lb}}{7000\text{ gr}} \left| \frac{22114\text{ dscf}}{\text{min}} \right.$$

$\Rightarrow$ 1.027 lb/dry ton

Run 2:

$$\text{Pm lb/dry ton} = \frac{1\text{ hr}}{3.30\text{ tons}} \left| \frac{60\text{ min}}{1\text{ hr}} \right| \frac{0.0341\text{ gr}}{\text{dscf}} \left| \frac{1\text{ lb}}{7000\text{ gr}} \right| \frac{22857\text{ dscf}}{\text{min}}$$

$\Rightarrow$ 2.02 lb/dry ton

Run 3

$$\text{Pm lb/dry ton} = \frac{1\text{ hr}}{2.97\text{ tons}} \left| \frac{60\text{ min}}{\text{hr}} \right| \frac{0.0362\text{ gr}}{\text{dscf}} \left| \frac{\text{lb}}{7000\text{ gr}} \right| \frac{24272\text{ dscf}}{\text{min}}$$

$\Rightarrow$ 2.53 lb/dry ton

Average = 1.86 lb/dry ton

From: MNPCA::AVERMAN_C 3-AUG-1994 11:11:47.59
To: SMITH_D
CC: AVERMAN_C
Subj.: Clean Soils

I received a call from David Kress of Clean Soils here in St. Paul. He said he tried contacting Bernadette Halverson, only to discover she is no longer at the Agency. His voice message said his permit either needs amending or reissuing, but when he asked who could assist, he was transferred and unable to resolve. He called me asking who would be permit contact. His number is 639-8811. You can either have assigned permit engineer contact him and let me know or let me know and I can contact him.

CORRECTING CO ppm from actual $\%O_2$ to 7% O_2

$$PPM_{\substack{actual \\ O_2}} = PPM_{\substack{corrected \\ O_2}} \left[\frac{20.9 - actual}{20.9 - corrected} \right]$$

CO ppm

Run 1 485
Run 2 483
Run 3 592

average = 520 ppm

$$PPM_{\substack{corrected \\ O_2}} = 520\ ppm_{(actual)} \left[\frac{20.9 - 7\%\ O_2}{20.9 - 13.3\%\ O_2} \right]$$

CO ppm corrected to 7% O_2 = 284.3 ppm

From: MNPCA::AVERMAN_C 8-JUN-1994 09:57:09.20
To: HALVERSON_B
CC: AVERMAN_C
Subj: Clean Soils

Update on Clean Soils test. MMT is having a heat shield manufactured today and plan is to test tomorrow. I will be unable to witness, but Stuart indicated his day was open so he will make it.

If you have any other questions, please let me know. Thanks
Craig

METHOD PM Test No. 1 Test Date(s) 6/5/95

Run No. 1 AQD File 879

Unit tested: Inc. 10 (ep#6)

										sqrt avg dp		1.530199
Nozzle diameter	Dn	0.186	inches							counter		24
Stack Diameter	Ds	29.1	inches	A(stack)	4.62	l	0	inches		sum sqrt		36.72479
Area of nozzle	Area n	0.000189	square feet	D(stack)	29.10431	w	0	inches			3.3	1.81659
Area of stack	Area s	4.62	square feet			De	#DIV/0!	inches			3.6	1.897367
time of run	theta	60	minutes			As	0	sq ft			3.6	1.897367
meter coefficient	gamma	1.0049	unitless								2.5	1.581139
volume of water in impingers	Vwc	26.59	ml		front mass	5.62E-02	grams				2.9	1.702939
volume of water in silica gel	Vwsg	14.48	grams		back mass	0.00151	grams				2.2	1.48324
	Vwc,std	1.251591	scf		total mass	0.05767	grams				2.5	1.581139
	Vwsg,std	0.682732	scf		front C	0.01612626	gr/dscf				2.5	1.581139
Moisture content of gas	Bws	0.034746	fraction		front C	2.3038E-06	lb/dscf				2.2	1.48324
vol of gas as measured by dry gas meter	Vm	56.771	dcf		front C	3.06665419	lb/hr				2.9	1.702939
pitot tube coefficient	Cp	0.84			back C	0.00043359	gr/dscf				2.5	1.581139
pitot tube constant	Kp	85.49	*const		back C	6.1942E-08	lb/dscf				2	1.414214
stack temperature (F +460)	Ts	544.5	R		back C,lb/hr	0.08245456	lb/hr				2.3	1.516575
Meter temperature (F+460)	Tm	550.7	R		total C	0.01655985	gr/dscf				2.3	1.516575
barometric pressure	Pb	29.15	in Hg		total C	2.3657E-06	lb/dscf				2.4	1.549193
static pressure	Pg	0.39	in H2O		total C	3.14910874	lb/hr				2.1	1.449138
Absolute stack gas pressure	Ps	29.17867647	in Hg		total c	0.03792882	grams/dscm				2.3	1.516575
ave press diff across orifice meter	delta H	3.313	inches		total c	1074.02458	micrograms/dscf				2.2	1.48324
ave of square root delta p's	deltap	1.530199	inch		total c	37.9288195	mg/dscm				1.8	1.341641
stack gas velocity	Vs	87.68057	ft/s								1.9	1.378405
stack gas volumetric flow rate	Qa	24305.06	acfm		Uncorrected	0.0161					1.9	1.378405
stack gas dry volumentric flow rate	Qsd	22185.95	dscfm		at 7%O2	0.02906364					1.6	1.264911
	Vmstd	53.73527			at 12%CO2	0.02617886					1.7	1.30384
Wet molecular weight	Ms	29.30966									1.7	1.30384
	%CO2	7.38										0
	%O2	13.2										0
	%N2	0.0485										0
	%CO	79.4										0
dry molelcular weight	Md	29.71678										0
	%EA	-99.95171										0
CONCENTRATION FROM F FACTOR For Total												0
F-factor		dscf/mmbtu	Front Only									0
	2E-06	lb/dscf	2.3E-06	lb/dscf								0
	1.0434		0	lb/mmbtu								0
	0	lb/mmbtu	Back Only									0
intermediate values	98.895	%	6.19E-08	lb/dscf								0
raw	97.626	%	0	lb/mmbtu								0
												0

METHOD PM

Test No. 1 | Run No. 2 | Test Date(s) 6/5/95 | AQD File 879 | Unit tested: Inc. 10 (ep#6)

Nozzle diameter	Dn	0.186	inches
Stack Diameter	Ds	29.1	inches
Area of nozzle	Area n	0.000189	square feet
Area of stack	Area s	4.62	square feet
ime of run	theta	60	minutes
eter coefficient	gamma	1.0049	unitless
olume of water in impingers	Vwc	30.46	ml
olume of water in silica gel	Vwsg	13.59	grams
	Vwc,std	1.433752	scf
	Vwsg,std	0.640769	scf
Moisture content of gas	Bws	0.035711	fraction
ol of gas as measured by dry gas meter	Vm	59.138	dcf
itot tube coefficient	Cp	0.84	
itot tube constant	Kp	85.49	*const
tack temperature (F +460)	Ts	544.2	R
Meter temperature (F+460)	Tm	550.6	R
arometric pressure	Pb	29.15	in Hg
tatic pressure	Pg	0.39	in H2O
Absolute stack gas pressure	Ps	29.17867647	in Hg
ve press diff across orifice meter	delta H	3.541	inches
ve of square root delta p's	deltap	1.578286	inch
tack gas velocity	Vs	90.66037	ft/s
tack gas volumetric flow rate	Qa	25131.06	acfm
tack gas dry volumentric flow rate	Qsd	22929.65	dscfm
	Vmstd	56.0178	
Wet molecular weight	Ms	29.14865	
	%CO2	6.4	
	%O2	13.1	
	%N2	0.0483	
	%CO	80.5	
Dry molelcular weight	Md	29.56152	
	%EA	-99.95306	

A(stack)	4.62	l	0	inches	
D(stack)	29.10431	w	0	inches	
		De	#DIV/0!	inches	
		As	0	sq ft	

front mass	1.24E-01	grams
back mass	0.00701	grams
total mass	0.1311	grams
front C	0.03418036	gr/dscf
front C	4.8829E-06	lb/dscf
front C	6.71780358	lb/hr
back C	0.00193089	gr/dscf
back C	2.7584E-07	lb/dscf
back C,lb/hr	0.37949716	lb/hr
total C	0.03611125	gr/dscf
total C	5.1588E-06	lb/dscf
total C	7.09730075	lb/hr
total c	0.08270952	grams/dscm
total c	2342.0727	micrograms/dscf
total c	82.7095156	mg/dscm
Uncorrected	0.0341	
at 7%O2	0.06076795	
at 12%CO2	0.0639375	

sqrt avg dp	1.578286
counter	24
sum sqrt	37.87886
2.3	1.516575
1.9	1.378405
2.3	1.516575
2.1	1.449138
2	1.414214
1.85	1.360147
2.3	1.516575
1.9	1.378405
2.1	1.449138
1.9	1.378405
1.8	1.341641
1.7	1.30384
3.15	1.774824
3.7	1.923538
3.25	1.802776
3.6	1.897367
2.4	1.549193
2.5	1.581139
3.1	1.760682
2.15	1.466288
2.9	1.702939
3.5	1.870829
3.8	1.949359
2.55	1.596872
	0
	0
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	0
	0
	0

ONCENTRATION FROM F FACTOR For Total

-factor		dscf/mmbtu	Front Only	
	5E-06	lb/dscf	4.88E-06	lb/dscf
o	1.2188		0	lb/mmbtu
*	0	lb/mmbtu	Back Only	
intermediate values	99.752	%	2.76E-07	lb/dscf
raw	98.595	%	0	lb/mmbtu

METHOD PM | Test No. 1 | Run No. 3 | Test Date(s) 6/5/95 | AQD File 879

Unit tested: Inc. 10 (ep#6)

Nozzle diameter	Dn	0.186	inches							sqrt avg dp	1.681219
Stack Diameter	Ds	29.1	inches	A(stack)	4.62	l	0	inches		counter	24
Area of nozzle	Area n	0.000189	square feet	D(stack)	29.10431	w	0	inches		sum sqrt	40.34925
Area of stack	Area s	4.62	square feet			De	#DIV/0!	inches		1.9	1.378405
Time of run	theta	60	minutes			As	0	sq ft		3	1.732051
meter coefficient	gamma	1.0049	unitless							3.6	1.897367
volume of water in impingers	Vwc	35.08	ml		front mass	1.42E-01	grams			2.9	1.702939
volume of water in silica gel	Vwsg	16.52	grams		back mass	0.00517	grams			2.8	1.67332
	Vwc,std	1.651216	scf		total mass	0.14669	grams			3.6	1.897367
	Vwsg,std	0.778918	scf	front	C	0.03627594	gr/dscf			2.9	1.702939
Moisture content of gas	Bws	0.038804	fraction	front	C	5.1823E-06	lb/dscf			3.5	1.870829
vol of gas as measured by dry gas meter	Vm	63.75	dcf	front	C	7.57060499	lb/hr			4.2	2.04939
pitot tube coefficient	Cp	0.84		back	C	0.00132523	gr/dscf			4.25	2.061553
pitot tube constant	Kp	85.49	*const	back	C	1.8932E-07	lb/dscf			3.4	1.843909
stack temperature (F +460)	Ts	545.8	R	back	C,lb/hr	0.27656888	lb/hr			3.6	1.897367
Meter temperature (F+460)	Tm	553	R	total	C	0.03760117	gr/dscf			2.1	1.449138
barometric pressure	Pb	29.15	in Hg	total	C	5.3716E-06	lb/dscf			2.8	1.67332
static pressure	Pg	0.039	in H2O	total	C	7.84717387	lb/hr			2.65	1.627882
Absolute stack gas pressure	Ps	29.1 ~~29.1206765~~ 384765	in Hg	total	c	0.08612204	grams/dscm			2.4	1.549193
ave press diff across orifice meter	delta H	4.015	inches	total	c	2438.7046	micrograms/dscf			2	1.414214
ave of square root delta p's	deltap	1.681219	inch	total	c	86.122039	mg/dscm			2.8	1.67332
stack gas velocity	Vs	96.9 ~~46.79~~ 8396	ft/s							2.2	1.48324
stack gas volumetric flow rate	Qa	268 ~~73.65~~ 61.36	acfm		Uncorrected	0.0376				1.7	1.30384
stack gas dry volumentric flow rate	Qsd	243 ~~47.74~~ 57	dscfm		at 7%O2	0.07258889				2.15	1.466288
	Vmstd	60.19564			at 12%CO2	0.07647458				2.85	1.688194
Wet molecular weight	Ms	29.03508								2.5	1.581139
	%CO2	5.9								3	1.732051
	%O2	13.7									0
	%N2	0.0592									0
	%CO	80.3									0
Dry molelcular weight	Md	29.48058									0
	%EA	-99.94095									0
CONCENTRATION FROM F FACTOR For Total											0
F-factor		dscf/mmbtu	Front Only								0
	5E-06	lb/dscf	5.18E-06	lb/dscf							0
	1.2203		0	lb/mmbtu							0
	0	lb/mmbtu	Back Only								0
intermediate values	100.95	%	1.89E-07	lb/dscf							0
raw	99.636	%	0	lb/mmbtu							0
											0

electronic copy is correct