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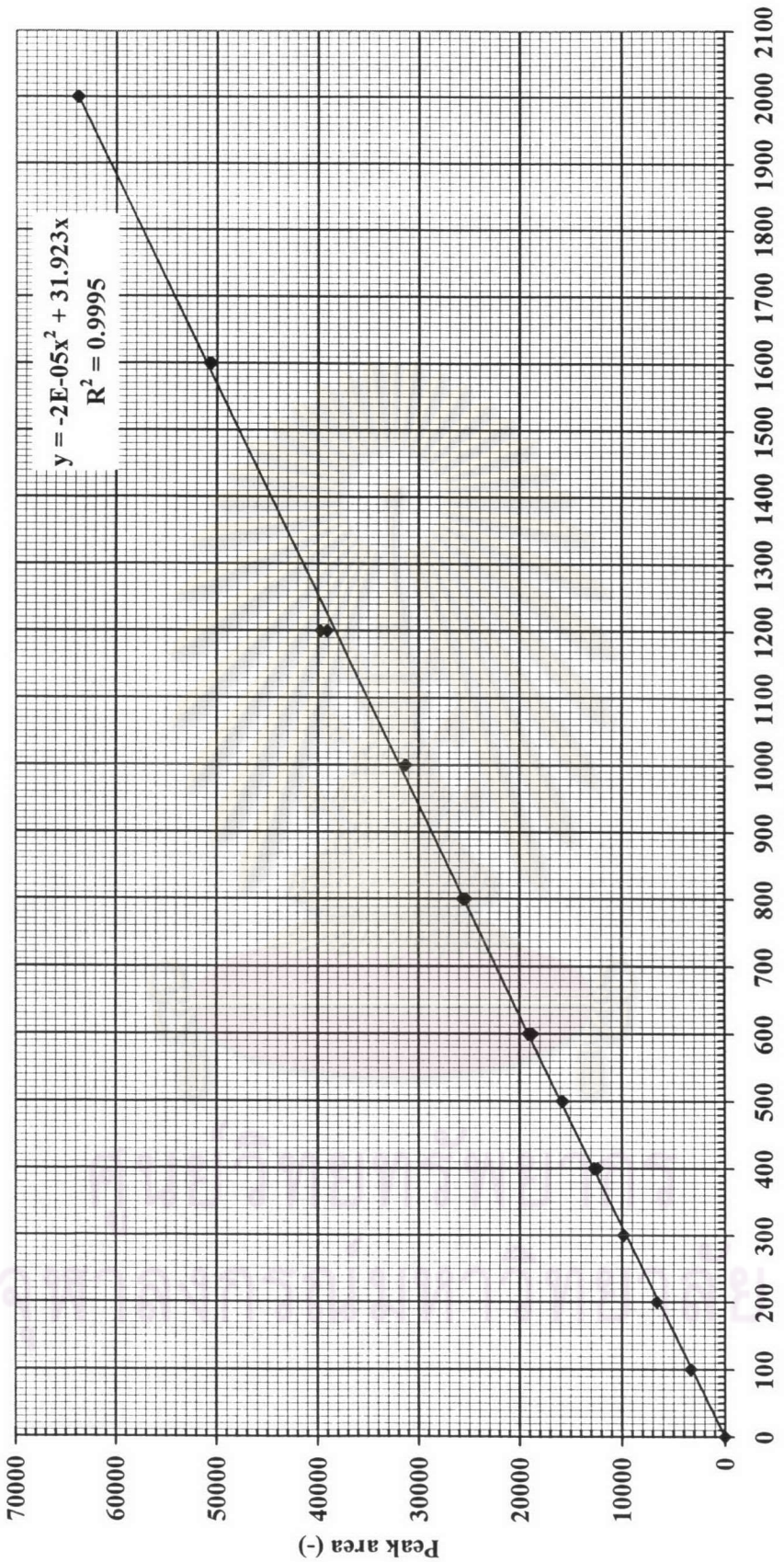
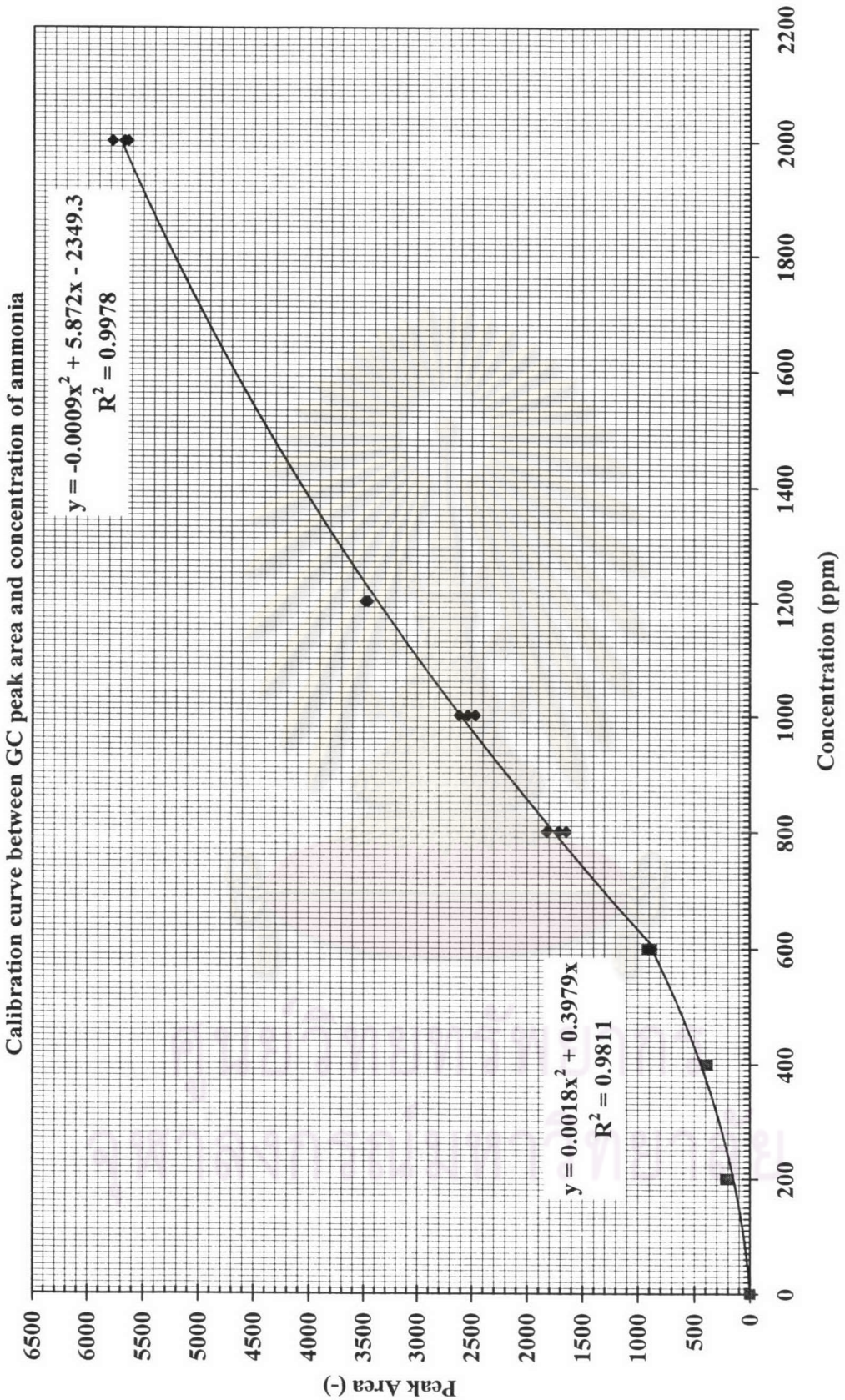
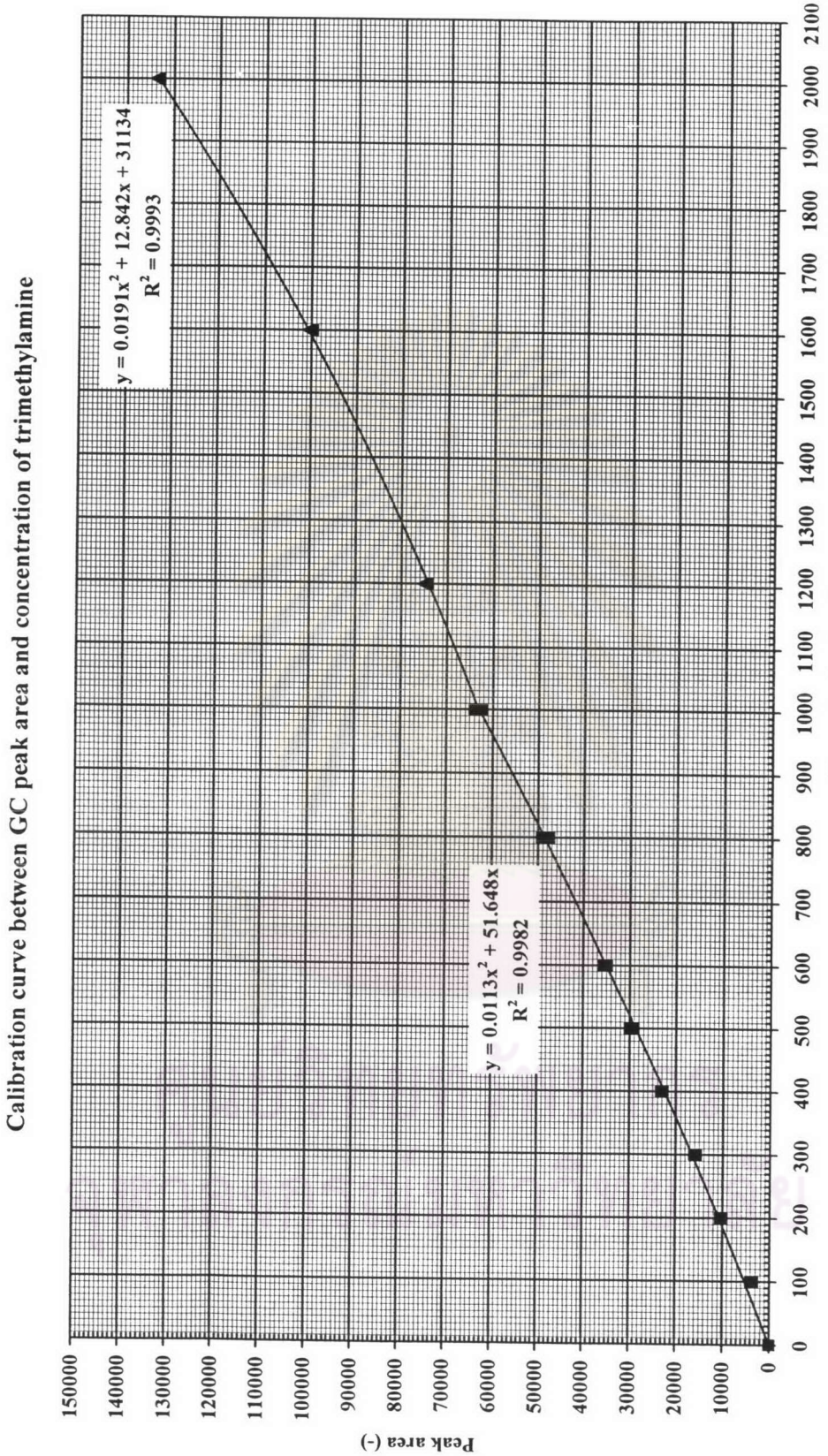
APPENDICES

APPENDIX A

Calibration Curve


Calibration curve between GC peak area and concentration of acetaldehyde
y = -2E-05x² + 31.923x
R² = 0.9995
Peak area (-)
70000
60000
50000
40000
30000
20000
10000
0
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100
Concentration (ppm)


Calibration curve between GC peak area and concentration of ammonia
y = -0.0009x² + 5.872x - 2349.3
R² = 0.9978
y = 0.0018x² + 0.3979x
R² = 0.9811
Peak Area (-)
Concentration (ppm)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200


Calibration curve between GC peak area and concentration of trimethylamine
y = 0.0191x² + 12.842x + 31134
R² = 0.9993
y = 0.0113x² + 51.648x
R² = 0.9982
Peak area (-)
Concentration (ppm)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
110000
120000
130000
140000
150000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100

APPENDIX B

Calculation of Water Vapor Concentration

CALCULATION OF WATER VAPOR CONCENTRATION

Vapor pressure of liquid water from "PERRY'S CHEMICAL ENGINEER'S HANDBOOK" 7th Edition, Page 2-49

			N_2 bubbling water flow rate (cc/min) : total flow rate (cc/min)		
T(°C)	Vapor pressure (mmHg)	conc. (ppm)	10/100	20/100	30/100
0	4.579	6025	603	1205	1808
2	5.294	6966	697	1393	2090
4	6.101	8028	803	1606	2408
6	7.013	9228	923	1846	2768
8	8.045	10586	1059	2117	3176
10	9.209	12117	1212	2423	3635
12	10.518	13839	1384	2768	4152
14	11.987	15772	1577	3154	4732
16	13.634	17939	1794	3588	5382
18	15.477	20364	2036	4073	6109
20	17.535	23072	2307	4614	6922
22	19.827	26088	2609	5218	7826
24	22.377	29443	2944	5889	8833
26	25.209	33170	3317	6634	9951
28	28.349	37301	3730	7460	11190
30	31.824	41874	4187	8375	12562
32	35.663	46925	4693	9385	14078
34	39.898	52497	5250	10499	15749
36	44.563	58636	5864	11727	17591
38	49.692	65384	6538	13077	19615
40	55.324	72795	7279	14559	21838
41	58.338	76761	7676	15352	23028

APPENDIX C

Calculation of Residence Time and Space Velocity

CALCULATION OF RESIDENCE TIME AND SPACE VELOCITY

$$\text{Effective residence time} = \frac{\text{Volume of corona discharge region}}{\text{Volumetric flow rate}}$$

Corona discharge region (i.d. 37 mm x 100 mm)

$$= \pi \times 3.7^2 \times 10 / 4 = 107.535 \text{ cm}^3$$

Volumetric flow rate (at 33 ^{0}C)

$$= 100 \text{ cm}^3 / \text{min}$$

Volumetric flow rate (at 100 ^{0}C)

From $PV = nRT$; P,n,R constant

$$= 100 \times (373/306) = 121.9 \text{ cm}^3 / \text{min}$$

Temperature (^{0}C)	Volumetric flow rate (cc/min)	Residence time (min)	Space velocity (hr^{-1})
25	97.39	1.10	54.34
33	100.00	1.08	55.80
100	121.90	0.88	68.01
200	154.58	0.70	86.25
300	187.25	0.57	104.48

APPENDIX D

Removal of Acetaldehyde

Date : 16/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
CO_2	10 cc/min
N_2	80 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.5	2.5	5962	219	188	6.8	0.97	0.96	0.98	CO=90ppm,NOx=ND	3.9	4.8E-09	7.78
100	9.7	1.94	6781	391	212	12.2	0.94	0.94	1.18	CO=60ppm,NOx=ND	3.5	5.6E-09	7.36
200	6.1	1.22	6500	4103	203	128.0	0.40	0.37	0.58	CO=60ppm,NOx=25ppm	1.0	2.6E-09	5.87
300	4.6	0.92	5141	1482	161	46.0	0.78	0.71	1.38	CO=30ppm,NOx=30ppm	1.3	4.4E-09	5.36

Date : 18/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
CO_2	20 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.1	2.62	6699	0	210	0	1.00	1.00	1.02	CO=210ppm,NOx=ND	4.5	5.3E-09	8.15
100	10.5	2.1	6669	0	209	0	1.00	1.00	1.25	CO=150ppm,NOx=ND	3.7	5.4E-09	7.96
200	7.5	1.5	4854	1796	152	56	0.74	0.63	0.99	CO=140ppm,NOx=55ppm	1.3	2.7E-09	7.21
300	5.8	1.16	3926	544	123	17	0.92	0.86	1.66	CO=220ppm,NOx=45ppm	1.2	3.2E-09	6.76

Date : 23/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.5	2.7	5860	0	184	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=400ppm	3.9	4.5E-09	8.40
100	11.6	2.32	4253	0	133	0	1.00	1.00	1.25	CO=220ppm,O_3=200ppm,NOx=100ppm	2.3	3.1E-09	8.80
200	9.7	1.94	4276	0	134	0	1.00	1.00	1.57	CO=220ppm,O_3=ND,NOx=10ppm	1.8	3.0E-09	9.33
300	7.9	1.58	1736	0	54	0	1.00	1.00	1.93	CO=180ppm,O_3=ND,NOx=20ppm	0.6	1.2E-09	9.21

Date : 20/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.7	2.74	6028	242	189	8	0.96	0.96	0.98	CO=ND,O_3>400ppm,NOx=650ppm	3.9	4.4E-09	8.53
100	11.4	2.28	5461	0	171	0	1.00	1.00	1.25	CO=ND,O_3=230ppm,NOx=180ppm	3.0	4.1E-09	8.65
200	9.7	1.94	6361	0	199	0	1.00	1.00	1.57	CO=150ppm,O_3=ND,NOx=ND	2.7	4.4E-09	9.33
300	7.4	1.48	2335	105	73	3	0.98	0.95	1.84	CO=100ppm,O_3=ND,NOx=55ppm	0.8	1.7E-09	8.62

Date : 25/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.7	2.74	4134	0	189	0	1.00	1.00	1.02	CO=150ppm,O_3>400ppm,NOx=1300ppm	4.0	4.6E-09	8.53
100	11.4	2.28	5147	0	171	0	1.00	1.00	1.25	CO=200ppm,O_3=360ppm,NOx=280ppm	3.0	4.1E-09	8.65
200	9.7	1.94	4776	0	199	0	1.00	1.00	1.57	CO=130ppm,O_3=ND,NOx=ND	2.7	4.4E-09	9.33
300	7.2	1.44	1557	0	73	0	1.00	1.00	1.93	CO=100ppm,O_3=ND,NOx=40ppm	0.8	1.8E-09	8.39

Date : 27/6/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.8	2.76	4968	0	156	0	1.00	1.00	1.02	CO=380ppm,O_3>400ppm,NOx=1050ppm	3.3	3.8E-09	8.59
100	11.7	2.34	4901	0	153	0	1.00	1.00	1.25	CO=250ppm,O_3>400ppm,NOx=220ppm	2.7	3.6E-09	8.87
200	9.9	1.98	4881	0	153	0	1.00	1.00	1.57	CO=25ppm,O_3=ND,NOx=ND	2.1	3.3E-09	9.52
300	7.4	1.48	1637	0	51	0	1.00	1.00	1.93	CO=200ppm,O_3=ND,NOx=35ppm	0.6	1.2E-09	8.62

Date : 2/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.3	2.66	4760	0	149	0	1.00	1.00	1.02	CO=120ppm,NOx=ND	3.2	3.7E-09	8.28
100	10.8	2.16	4214	0	132	0	1.00	1.00	1.25	CO=80ppm,NOx=ND	2.3	3.3E-09	8.19
200	6.7	1.34	3622	2186	113	68	0.59	0.40	0.63	CO=125ppm,NOx=20ppm	0.6	1.4E-09	6.44
300	5	1	3848	952	120	30	0.82	0.75	1.45	CO=140ppm,NOx=22ppm	1.0	3.2E-09	5.83

Date : 4/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.3	2.66	5690	0	178	0	1.00	1.00	1.02	CO=130ppm,NOx=ND	3.8	4.4E-09	8.28
100	10.7	2.14	5077	0	159	0	1.00	1.00	1.25	CO=120ppm,NOx=ND	2.8	4.0E-09	8.12
200	7.3	1.46	5265	2208	165	69	0.61	0.58	0.91	CO=220ppm,NOx=22ppm	1.3	2.8E-09	7.02
300	6.2	1.24	4400	887	138	28	0.84	0.80	1.54	CO=220ppm,NOx=18ppm	1.3	3.1E-09	7.22

Date : 8/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.3	2.66	5261	0	165	0	1.00	1.00	1.02	CO=130ppm,NOx=ND	3.5	4.1E-09	8.28
100	11	2.2	5452	0	171	0	1.00	1.00	1.25	CO=75ppm,NOx=ND	3.0	4.2E-09	8.34
200	7.6	1.52	5584	2255	175	71	0.62	0.59	0.93	CO=230ppm,NOx=38ppm	1.4	2.9E-09	7.31
300	5.4	1.08	4572	946	143	30	0.84	0.79	1.52	CO=220ppm,NOx=25ppm	1.3	3.7E-09	6.29

Date : 7/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.4	2.68	5530	0	173	0	1.00	1.00	1.02	CO=230ppm,NOx=ND	3.7	4.3E-09	8.34
100	11	2.2	5489	0	172	0	1.00	1.00	1.25	CO=140ppm,NOx=ND	3.0	4.3E-09	8.34
200	7.7	1.54	5549	2157	174	68	0.63	0.61	0.96	CO=280ppm,NOx=27ppm	1.5	3.0E-09	7.41
300	5.8	1.16	5011	731	157	23	0.88	0.85	1.65	CO=330ppm,NOx=36ppm	1.5	4.1E-09	6.76

Date : 9/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.2	2.64	6096	0	191	0	1.00	1.00	1.02	CO=75ppm,NOx=ND	4.1	4.8E-09	8.21
100	11.2	2.24	5557	0	174	0	1.00	1.00	1.25	CO=70ppm,NOx=ND	3.0	4.2E-09	8.50
200	7.3	1.46	5486	2161	172	68	0.67	0.60	0.95	CO=130ppm,NOx=32ppm	1.4	3.1E-09	7.02
300	5.6	1.12	4553	1034	142	32	0.84	0.77	1.49	CO=130ppm,NOx=28ppm	1.3	3.5E-09	6.53

Date : 11/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
H_2O	30 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.5	2.7	6052	0	190	0	1.00	1.00	1.02	CO=130ppm,NOx=ND	4.1	4.7E-09	8.40
100	11	2.2	5706	0	179	0	1.00	1.00	1.25	CO=120ppm,NOx=ND	3.1	4.4E-09	8.34
200	9.3	1.86	5779	0	181	0	1.00	1.00	1.57	CO=110ppm,NOx=10ppm	2.5	4.2E-09	8.95
300	7	1.4	5066	853	159	27	0.86	0.83	1.60	CO=150ppm,NOx=18ppm	1.5	3.3E-09	8.16

Date : 25/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :		
	CH_3CHO (2000ppm)	10 cc/min
	O_2	10 cc/min
	H_2O	10 cc/min
	CO_2	10 cc/min
	N_2	60 cc/min
	Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.9	2.78	6015	0	188	0	1.00	1.00	1.02	CO=140ppm,O_3>400ppm,NOx=550ppm	4.0	4.5E-09	8.65
100	11.6	2.32	5969	0	187	0	1.00	1.00	1.25	CO=130ppm,O_3=120ppm,NOx=50ppm	3.3	4.4E-09	8.80
200	9.8	1.96	5710	0	179	0	1.00	1.00	1.57	CO=110ppm,O_3=ND,NOx=ND	2.5	3.9E-09	9.43
300	7.5	1.5	2545	0	80	0	1.00	1.00	1.93	CO=80ppm,O_3=ND,NOx=25ppm	0.9	1.9E-09	8.74

Date : 24/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14.1	2.82	5947	0	186	0	1.00	1.00	1.02	CO=270ppm,O_3>400ppm,NOx=470ppm	4.0	4.4E-09	8.77
100	11.8	2.36	5854	0	183	0	1.00	1.00	1.25	CO=220ppm,O_3=160ppm,NOx=60ppm	3.2	4.2E-09	8.95
200	9.9	1.98	5427	0	170	0	1.00	1.00	1.57	CO=170ppm,O_3=ND,NOx=ND	2.3	3.7E-09	9.52
300	7.7	1.54	2675	0	84	0	1.00	1.00	1.93	CO=130ppm,O_3=ND,NOx=30ppm	1.0	1.9E-09	8.97

Date : 25/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	10 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.8	2.76	5992	0	188	0	1.00	1.00	1.02	CO=230ppm,O_3>400ppm,NOx=1000ppm	4.0	4.5E-09	8.59
100	11.5	2.3	5456	0	171	0	1.00	1.00	1.25	CO=140ppm,O_3=280ppm,NOx=270ppm	3.0	4.0E-09	8.72
200	9.8	1.96	5478	0	172	0	1.00	1.00	1.57	CO=80ppm,O_3=ND,NOx=ND	2.4	3.8E-09	9.43
300	7.7	1.54	2576	0	81	0	1.00	1.00	1.93	CO=65ppm,O_3=ND,NOx=30ppm	0.9	1.9E-09	8.97

Date : 23/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14	2.8	6464	0	203	0	1.00	1.00	1.02	CO=340ppm,O_3>400ppm,NOx=1200ppm	4.3	4.8E-09	8.71
100	11.7	2.34	6267	0	196	0	1.00	1.00	1.25	CO=220ppm,O_3=350ppm,NOx=360ppm	3.4	4.6E-09	8.87
200	10	2	6083	0	191	0	1.00	1.00	1.57	CO=150ppm,O_3=ND,NOx=ND	2.6	4.1E-09	9.62
300	7.8	1.56	2278	0	71	0	1.00	1.00	1.93	CO=130ppm,O_3=ND,NOx=25ppm	0.8	1.6E-09	9.09

Date : 21/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14	2.8	6060	0	190	0	1.00	1.00	1.02	CO=200ppm,O_3>400ppm,NOx=400ppm	4.1	4.5E-09	8.71
100	11.6	2.32	5991	0	188	0	1.00	1.00	1.25	CO=125ppm,O_3=140ppm,NOx=60ppm	3.3	4.4E-09	8.80
200	9.8	1.96	6067	0	190	0	1.00	1.00	1.57	CO=100ppm,O_3=ND,NOx=ND	2.6	4.2E-09	9.43
300	7.4	1.48	2615	0	82	0	1.00	1.00	1.93	CO=80ppm,O_3=ND,NOx=22ppm	0.9	2.0E-09	8.62

Date : 22/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	20 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14.1	2.82	5711	0	180	0	1.00	1.00	1.02	CO=230ppm,O_3>400ppm,NOx=180ppm	3.8	4.2E-09	8.77
100	11.8	2.36	5139	0	161	0	1.00	1.00	1.25	CO=220ppm,O_3=120ppm,NOx=60ppm	2.8	3.7E-09	8.95
200	10	2	6177	0	194	0	1.00	1.00	1.57	CO=200ppm,O_3=ND,NOx=ND	2.7	4.2E-09	9.62
300	7.8	1.56	2472	0	77	0	1.00	1.00	1.93	CO=160ppm,O_3=ND,NOx=20ppm	0.9	1.8E-09	9.09

Date : 21/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.9	2.78	6277	0	197	0	1.00	1.00	1.02	CO=270ppm,O_3>400ppm,NOx=1000ppm	4.2	4.7E-09	8.65
100	11.4	2.28	5944	0	186	0	1.00	1.00	1.25	CO=120ppm,O_3=240ppm,NOx=190ppm	3.3	4.4E-09	8.65
200	9.7	1.94	5485	0	172	0	1.00	1.00	1.57	CO=80ppm,O_3=ND,NOx=ND	2.4	3.8E-09	9.33
300	7.5	1.5	2093	0	66	0	1.00	1.00	1.93	CO=70ppm,O_3=ND,NOx=35ppm	0.7	1.6E-09	8.74

Date : 21/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	20 cc/min
CO_2	20 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14	2.8	6125	0	192	0	1.00	1.00	1.02	CO=360ppm,O_3>400ppm,NOx=1250ppm	4.1	4.6E-09	8.71
100	11.7	2.34	6542	0	205	0	1.00	1.00	1.25	CO=220ppm,O_3=320ppm,NOx=370ppm	3.6	4.8E-09	8.87
200	9.9	1.98	5404	0	169	0	1.00	1.00	1.57	CO=190ppm,O_3=ND,NOx=ND	2.3	3.7E-09	9.52
300	7.7	1.54	2621	0	82	0	1.00	1.00	1.93	CO=170ppm,O_3=ND,NOx=32ppm	0.9	1.9E-09	8.97

Date : 17/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14	2.8	6033	0	189	0	1.00	1.00	1.02	CO=200ppm,O_3>400ppm,NOx=300ppm	4.0	4.5E-09	8.71
100	11.7	2.34	5594	0	175	0	1.00	1.00	1.25	CO=120ppm,O_3=130ppm,NOx=45ppm	3.1	4.1E-09	8.87
200	9.9	1.98	5445	0	171	0	1.00	1.00	1.57	CO=100ppm,O_3=ND,NOx=ND	2.4	3.7E-09	9.52
300	7.9	1.58	2293	0	72	0	1.00	1.00	1.93	CO=90ppm,O_3=ND,NOx=42ppm	0.8	1.6E-09	9.21

Date : 16/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(10%)-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	30 cc/min
CO_2	20 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14.2	2.84	6345	0	199	0	1.00	1.00	1.02	CO=200ppm,O_3>400ppm,NOx=650ppm	4.2	4.6E-09	8.84
100	11.8	2.36	5267	0	165	0	1.00	1.00	1.25	CO=180ppm,O_3=160ppm,NOx=90ppm	2.9	3.8E-09	8.95
200	10	2	5309	0	166	0	1.00	1.00	1.57	CO=150ppm,O_3=ND,NOx=ND	2.3	3.6E-09	9.62
300	7.9	1.58	2734	0	86	0	1.00	1.00	1.93	CO=130ppm,O_3=ND,NOx=40ppm	1.0	1.9E-09	9.21

Date : 18/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.8	2.76	6740	0	211	0	1.00	1.00	1.02	CO=230ppm,O_3>400ppm,NOx=1000ppm	4.5	5.1E-09	8.59
100	11.5	2.3	6664	0	208	0	1.00	1.00	1.25	CO=120ppm,O_3=260ppm,NOx=155ppm	3.6	4.9E-09	8.72
200	9.8	1.96	6162	0	193	0	1.00	1.00	1.57	CO=75ppm,O_3=ND,NOx=ND	2.7	4.2E-09	9.43
300	7.8	1.56	2538	0	80	0	1.00	1.00	1.93	CO=70ppm,O_3=ND,NOx=55ppm	0.9	1.8E-09	9.09

Date : 15/7/2003

Subject : Removal of CH_3CHO 200 ppm from N_2-O_2(20%)-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	30 cc/min
CO_2	20 cc/min
N_2	20 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	14	2.8	5171	0	162	0	1.00	1.00	1.02	CO=300ppm,O_3>400ppm,NOx=1150ppm	3.5	3.8E-09	8.71
100	11.7	2.34	5790	0	181	0	1.00	1.00	1.25	CO=220ppm,O_3>400ppm,NOx=230ppm	3.2	4.2E-09	8.87
200	10	2	5416	0	170	0	1.00	1.00	1.57	CO=150ppm,O_3=ND,NOx=15ppm	2.3	3.6E-09	9.62
300	8.1	1.62	2426	0	76	0	1.00	1.00	1.93	CO=120ppm,O_3=ND,NOx=60ppm	0.9	1.7E-09	9.44

APPENDIX E

Removal of Ammonia

Date : 26/5/2003

Subject : Removal of NH_3 200 ppm from N_2-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
CO_2	10 cc/min
N_2	80 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	8.6	1.72	366	348	168	159	0.34	0.05	0.05	CO=200ppm,NOx=ND	0.2	3.2E-10	5.35
100	7.6	1.52	373	311	171	142	0.41	0.17	0.21	CO=330ppm,NOx=ND	0.5	1.0E-09	5.76
200	4.8	0.96	412	307	189	141	0.42	0.25	0.40	CO=250ppm,NOx=15ppm	0.7	2.1E-09	4.62
300	4.2	0.84	358	243	164	111	0.54	0.32	0.62	CO=320ppm,NOx=20ppm	0.6	2.2E-09	4.89

Date : 26/5/2003

Subject : Removal of NH_3 200 ppm from N_2-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
CO_2	20 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	9	1.8	479	370	219	169	0.36	0.23	0.23	CO=330ppm,NOx=ND	1.1	1.8E-09	5.60
100	7.6	1.52	462	366	211	168	0.36	0.21	0.26	CO=300ppm,NOx=ND	0.8	1.6E-09	5.76
200	5.3	1.06	439	341	201	156	0.41	0.22	0.35	CO=320ppm,NOx=15ppm	0.6	1.8E-09	5.10
300	4.5	0.9	372	231	170	106	0.60	0.38	0.73	CO=530ppm,NOx=20ppm	0.7	2.5E-09	5.24

Date : 4/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2 (10%)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.1	2.62	394	0	180	0	1	1	1.02	CO=320ppm,O_3>400ppm,NOx=560ppm	3.8	4.6E-09	8.15
100	11.3	2.26	356	0	163	0	1	1	1.25	CO=180ppm,O_3=240ppmNOx=180ppm	2.9	3.9E-09	8.57
200	9.6	1.92	372	0	170	0	1	1	1.57	CO=130ppm,O_3=ND,NOx=25ppm	2.4	3.8E-09	9.23
300	7	1.4	317	0	145	0	1	1	1.93	CO=130ppm,O_3=ND,NOx=50ppm	1.7	3.7E-09	8.16

Date : 5/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2 (10%)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.5	2.7	403	0	184	0	1	1	1.02	CO=450ppm,O_3>400ppm,NOx=620ppm	3.9	4.5E-09	8.40
100	11.4	2.28	374	0	171	0	1	1	1.25	CO=260ppm,O_3=320ppm,NOx=220ppm	3.0	4.1E-09	8.65
200	10.4	2.08	367	0	168	0	1	1	1.57	CO=230ppm,O_3=ND,NOx=50ppm	2.3	3.5E-09	10.00
300	7.2	1.44	305	0	140	0	1	1	1.93	CO=140ppm,O_3=ND,NOx=75ppm	1.6	3.4E-09	8.39

Date : 6/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2 (20%)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	ψ_{elec}	ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.5	2.7	324	0	148	0	1	1	1.02	CO=340ppm,O_3>400ppm,NOx=900ppm	3.2	3.6E-09	8.40
100	11.4	2.28	338	0	155	0	1	1	1.25	CO=350ppm,O_3>400ppm,NOx=190ppm	2.7	3.7E-09	8.65
200	10.4	2.08	325	0	149	0	1	1	1.57	CO=150ppm,O_3=10ppm,NOx=ND	2.1	3.1E-09	10.00
300	7.2	1.44	253	0	116	0	1	1	1.93	CO=80ppm,O_3=ND,NOx=50ppm	1.3	2.9E-09	8.39

Date : 7/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2 (20%)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.3	2.66	386	0	177	0	1	1	1.02	CO=440ppm,O_3>400ppm,NOx=1100ppm	3.8	4.4E-09	8.28
100	11.4	2.28	344	0	157	0	1	1	1.25	CO=200ppm,O_3>400ppm,NOx=390ppm	2.8	3.8E-09	8.65
200	9.9	1.98	342	0	157	0	1	1	1.57	CO=210ppm,O_3=20ppm,NOx=ND	2.2	3.4E-09	9.52
300	7.4	1.48	225	0	103	0	1	1	1.93	CO=50ppm,O_3=ND,NOx=30ppm	1.2	2.5E-09	8.62

Date : 16/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (5250 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	9.7	1.94	467	380	214	174	0.30	0.19	0.19	CO=175ppm,NOx=ND	0.8	1.4E-09	6.04
100	7.4	1.48	484	377	222	173	0.31	0.22	0.28	CO=220ppm,NOx=40ppm	0.9	1.8E-09	5.61
200	5.2	1.04	468	306	214	140	0.44	0.35	0.54	CO=140ppm,NOx=50ppm	1.0	3.1E-09	5.00
300	4.5	0.9	453	267	207	122	0.51	0.41	0.79	CO=230ppm,NOx=35ppm	1.0	3.4E-09	5.24

Date : 20/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (5250 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	ψ_{elec}	ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	10.1	2.02	486	382	222	175	0.28	0.22	0.22	CO=320ppm,NOx=40ppm	1.0	1.6E-09	6.29
100	8.1	1.62	495	369	227	169	0.31	0.25	0.32	CO=330ppm,NOx=45ppm	1.0	1.9E-09	6.14
200	5.7	1.14	445	325	204	149	0.39	0.27	0.42	CO=290ppm,NOx=40ppm	0.8	2.1E-09	5.48
300	5.4	1.08	479	304	219	139	0.43	0.37	0.71	CO=280ppm,NOx=35ppm	0.9	2.6E-09	6.29

Date : 22/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (10500 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	9.6	1.92	416	315	190	144	0.39	0.24	0.25	CO=120ppm,NOx=ND	1.0	1.6E-09	5.97
100	8.2	1.64	418	329	191	151	0.37	0.21	0.27	CO=150ppm,NOx=ND	0.7	1.4E-09	6.22
200	6.5	1.3	448	331	205	151	0.36	0.26	0.41	CO=140ppm,NOx=25ppm	0.7	1.8E-09	6.25
300	5.3	1.06	471	354	215	162	0.32	0.25	0.48	CO=75ppm,NOx=40ppm	0.6	1.8E-09	6.18

Date : 20/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (10500 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	10.4	2.08	363	290	166	132	0.28	0.20	0.21	CO=270ppm,NOx=ND	0.7	1.1E-09	6.47
100	8.3	1.66	362	263	166	120	0.35	0.27	0.34	CO=380ppm,NOx=ND	0.8	1.5E-09	6.30
200	6.7	1.34	350	188	160	86	0.53	0.46	0.73	CO=350ppm,NOx=30ppm	1.0	2.4E-09	6.44
300	5.4	1.08	362	255	166	117	0.37	0.30	0.57	CO=220ppm,NOx=40ppm	0.6	1.6E-09	6.29

Date : 22/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (21800 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	30 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	10	2	346	312	158	143	0.26	0.10	0.10	CO=180ppm,NOx=20ppm	0.3	5.2E-10	6.22
100	8.6	1.72	374	304	171	139	0.28	0.19	0.23	CO=200ppm,NOx=30ppm	0.6	1.0E-09	6.52
200	6.4	1.28	354	292	162	134	0.31	0.18	0.28	CO=190ppm,NOx=40ppm	0.4	9.5E-10	6.16
300	4.7	0.94	300	275	137	126	0.35	0.08	0.16	CO=200ppm,NOx=40ppm	0.1	4.3E-10	5.48

Date : 23/5/2003

Subject : Removal of NH_3 200 ppm from N_2-H_2O (21800 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
N_2 bubbling	30 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	10.6	2.12	315	307	144	141	0.23	0.03	0.03	CO=180ppm,NOx=20ppm	0.1	1.1E-10	6.60
100	9	1.8	378	347	173	159	0.13	0.08	0.10	CO=200ppm,NOx=35ppm	0.2	4.3E-10	6.83
200	6.8	1.36	329	318	151	146	0.20	0.03	0.05	CO=190ppm,NOx=45ppm	0.1	1.6E-10	6.54
300	6.4	1.28	333	318	152	146	0.20	0.05	0.09	CO=200ppm,NOx=45ppm	0.1	1.9E-10	7.46

Date : 28/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (5250 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	10 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.9	2.58	458	0	210	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=160ppm	4.5	5.4E-09	8.03
100	10.7	2.14	357	0	163	0	1.00	1.00	1.25	CO=35ppm,O_3=160ppm,NOx=70ppm	2.9	4.2E-09	8.12
200	9.1	1.82	387	0	177	0	1.00	1.00	1.57	CO=50ppm,O_3=ND,NOx=ND	2.4	4.2E-09	8.75
300	7.1	1.42	402	0	184	0	1.00	1.00	1.93	CO=30ppm,O_3=ND,NOx=25ppm	2.1	4.6E-09	8.27

Date : 29/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (5250 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	10 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.6	2.52	335	0	153	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=240ppm	3.3	4.0E-09	7.84
100	10.8	2.16	333	0	152	0	1.00	1.00	1.25	CO=50ppm,O_3=160ppm,NOx=80ppm	2.7	3.8E-09	8.19
200	9.3	1.86	327	0	150	0	1.00	1.00	1.57	CO=110ppm,O_3=ND,NOx=ND	2.1	3.5E-09	8.95
300	7.3	1.46	365	50	167	23	0.88	0.86	1.67	CO=60ppm,O_3=ND,NOx=30ppm	1.6	3.5E-09	8.51

Date : 31/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (5250 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	10 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.5	2.5	390	0	178	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=750ppm	3.8	4.7E-09	7.78
100	10.8	2.16	360	0	165	0	1.00	1.00	1.25	CO=ND,O_3=240ppm,NOx=250ppm	2.9	4.2E-09	8.19
200	9.3	1.86	341	0	156	0	1.00	1.00	1.57	CO=ND,O_3=ND,NOx=ND	2.2	3.6E-09	8.95
300	7.4	1.48	364	0	167	0	1.00	1.00	1.93	CO=25ppm,O_3=ND,NOx=40ppm	1.9	4.0E-09	8.62

Date : 30/5/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (5250 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	10 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.7	2.54	360	0	165	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=590ppm	3.5	4.3E-09	7.90
100	10.9	2.18	333	0	152	0	1.00	1.00	1.25	CO=ND,O_3=350ppm,NOx=350ppm	2.7	3.8E-09	8.27
200	9.5	1.9	348	0	159	0	1.00	1.00	1.57	CO=25ppm,O_3=ND,NOx=ND	2.2	3.6E-09	9.14
300	7.6	1.52	327	0	150	0	1.00	1.00	1.93	CO=60ppm,O_3=ND,NOx=100ppm	1.7	3.5E-09	8.86

Date : 2/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (10500 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	20 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.6	2.52	393	0	180	0	1.00	1.00	1.02	CO=ND,O_3=320ppm,NOx=390ppm	3.8	4.7E-09	7.84
100	10.8	2.16	359	0	164	0	1.00	1.00	1.25	CO=ND,O_3=60ppm,NOx=110ppm	2.9	4.1E-09	8.19
200	9.1	1.82	365	0	167	0	1.00	1.00	1.57	CO=35ppm,O_3=ND,NOx=ND	2.3	3.9E-09	8.75
300	7	1.4	333	0	152	0	1.00	1.00	1.93	CO=25ppm,O_3=ND,NOx=20ppm	1.7	3.9E-09	8.16

Date : 2/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (10500 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	20 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.9	2.58	318	0	146	0	1.00	1.00	1.02	CO=ND,O_3=260ppm,NOx=300ppm	3.1	3.7E-09	8.03
100	10.9	2.18	314	0	144	0	1.00	1.00	1.25	CO=ND,O_3=100ppm,NOx=100ppm	2.5	3.6E-09	8.27
200	9.2	1.84	296	0	135	0	1.00	1.00	1.57	CO=60ppm,O_3=ND,NOx=ND	1.9	3.2E-09	8.85
300	7.5	1.5	280	0	128	0	1.00	1.00	1.93	CO=50ppm,O_3=ND,NOx=25ppm	1.5	3.0E-09	8.74

Date : 4/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (10500 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	20 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.7	2.54	395	0	181	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=650ppm	3.9	4.7E-09	7.90
100	10.9	2.18	310	0	142	0	1.00	1.00	1.25	CO=ND,O_3=300ppm,NOx=110ppm	2.5	3.5E-09	8.27
200	9.4	1.88	357	0	163	0	1.00	1.00	1.57	CO=25ppm,O_3=ND,NOx=10ppm	2.3	3.7E-09	9.04
300	7.5	1.5	295	0	135	0	1.00	1.00	1.93	CO=30ppm,O_3=ND,NOx=20ppm	1.5	3.2E-09	8.74

Date : 3/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (10500 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	20 cc/min
CO_2	20 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.9	2.58	333	0	152	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=430ppm	3.3	3.9E-09	8.03
100	11	2.2	305	0	140	0	1.00	1.00	1.25	CO=ND,O_3=360ppm,NOx=200ppm	2.4	3.5E-09	8.34
200	9.5	1.9	316	0	145	0	1.00	1.00	1.57	CO=50ppm,O_3=ND,NOx=20ppm	2.0	3.3E-09	9.14
300	7.5	1.5	312	0	143	0	1.00	1.00	1.93	CO=65ppm,O_3=ND,NOx=25ppm	1.6	3.4E-09	8.74

Date : 4/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (21800 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	30 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.7	2.54	331	0	151	0	1.00	1.00	1.02	CO=ND,O_3=380ppm,NOx=240ppm	3.2	4.0E-09	7.90
100	10.8	2.16	329	0	151	0	1.00	1.00	1.25	CO=ND,O_3=120ppm,NOx=60ppm	2.6	3.8E-09	8.19
200	9.2	1.84	329	0	151	0	1.00	1.00	1.57	CO=30ppm,O_3=ND,NOx=ND	2.1	3.5E-09	8.85
300	7.7	1.54	297	0	136	0	1.00	1.00	1.93	CO=40ppm,O_3=ND,NOx=20ppm	1.5	3.1E-09	8.97

Date : 7/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(10%)-H_2O (21800 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	10 cc/min
N_2 bubbling	30 cc/min
CO_2	20 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.1	2.62	383	0	175	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=340ppm	3.7	4.4E-09	8.15
100	11.2	2.24	362	0	166	0	1.00	1.00	1.25	CO=ND,O_3=160ppm,NOx=90ppm	2.9	4.0E-09	8.50
200	9.5	1.9	369	0	169	0	1.00	1.00	1.57	CO=70ppm,O_3=ND,NOx=ND	2.3	3.8E-09	9.14
300	7.5	1.5	341	0	156	0	1.00	1.00	1.93	CO=60ppm,O_3=ND,NOx=35ppm	1.8	3.7E-09	8.74

Date : 9/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (21800 ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	30 cc/min
CO_2	10 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	12.7	2.54	413	0	189	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=400ppm	4.0	4.9E-09	7.90
100	10.9	2.18	349	0	160	0	1.00	1.00	1.25	CO=ND,O_3=270ppm,NOx=190ppm	2.8	4.0E-09	8.27
200	9.4	1.88	337	0	154	0	1.00	1.00	1.57	CO=30ppm,O_3=ND,NOx=10ppm	2.1	3.5E-09	9.04
300	7.3	1.46	327	0	150	0	1.00	1.00	1.93	CO=40ppm,O_3=ND,NOx=35ppm	1.7	3.6E-09	8.51

Date : 8/6/2003

Subject : Removal of NH_3 200 ppm from N_2-O_2(20%)-H_2O (21800 ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	10 cc/min
O_2	20 cc/min
N_2 bubbling	30 cc/min
CO_2	20 cc/min
N_2	20 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13	2.6	385	0	176	0	1.00	1.00	1.02	CO=ND,O_3>400ppm,NOx=900ppm	3.8	4.5E-09	8.09
100	11.1	2.22	365	0	167	0	1.00	1.00	1.25	CO=ND,O_3=280ppm,NOx=200ppm	2.9	4.1E-09	8.42
200	9.6	1.92	357	0	163	0	1.00	1.00	1.57	CO=30ppm,O_3=ND,NOx=10ppm	2.3	3.7E-09	9.23
300	7.5	1.5	328	0	150	0	1.00	1.00	1.93	CO=25ppm,O_3=ND,NOx=40ppm	1.7	3.5E-09	8.74

APPENDIX F

Removal of Trimethylamine

Date : 5/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
CO_2	10 cc/min
N_2	80 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.5	2.3	11803	418	218	8	0.97	0.96	0.98	CO=60ppm,NOx=ND	4.5	6.1E-09	7.16
100	10.3	2.06	12491	353	230	7	0.97	0.97	0.99	CO=135ppm,NOx=ND	3.9	5.9E-09	7.81
200	7.8	1.56	11650	0	215	0	1.00	1.00	1.02	CO=180ppm,NOx=20ppm	3.0	5.9E-09	7.50
300	6	1.2	0	0	0	0	1.00	0.00	0.00	CO=255ppm,NOx=22ppm	0.0	0.0E+00	6.99

Date : 3/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
CO_2	20 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.7	2.34	9306	575	174	11	0.94	0.94	0.95	CO=170ppm,NOx=ND	3.5	4.6E-09	7.28
100	10.4	2.08	10576	320	196	6	0.97	0.97	0.99	CO=230ppm,NOx=ND	3.3	5.0E-09	7.89
200	7.9	1.58	7147	0	134	0	1.00	1.00	1.02	CO=225ppm,NOx=25ppm	1.8	3.6E-09	7.60
300	6.2	1.24	0	0	0	0	1.00	0.00	0.00	CO=310ppm,NOx=25ppm	0.0	0.0E+00	7.22

Date : 8/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.4	2.68	11805	2201	218	42	0.82	0.81	0.82	CO=60ppm,O_3=180ppm,NOx=170ppm	3.8	4.4E-09	8.34
100	11.4	2.28	0	1921	0	37	0.84	#	#	CO=110ppm,O_3=40ppm,NOx=15ppm	-0.6	-8.8E-10	8.65
200	9.4	1.88	0	199	0	4	0.98	#	#	CO=105ppm,O3=ND,NOx=ND	-0.1	-8.7E-11	9.04
300	6.9	1.38	0	0	0	0	1.00	#	#	CO=100ppm,O3=ND,NOx=20ppm	0.0	0.0E+00	8.04

Date : 10/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.6	2.72	13177	2626	242	50	0.80	0.79	0.81	CO=230ppm,O_3=200ppm,NOx=220ppm	4.1	4.7E-09	8.46
100	11.6	2.32	0	2077	0	40	0.84	#	#	CO=220ppm,O_3=85ppm,NOx=38ppm	-0.7	-9.4E-10	8.80
200	9.7	1.94	0	182	0	4	0.99	#	#	CO=235ppm,O_3=ND,NOx=ND	0.0	-7.7E-11	9.33
300	7.2	1.44	0	0	0	0	1.00	#	#	CO=180ppm,O_3=ND,NOx=25ppm	0.0	0.0E+00	8.39

Date : 8/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.5	2.7	11144	2596	206	50	0.79	0.76	0.77	CO=220ppm,O_3>400ppm,NOx=580ppm	3.3	3.8E-09	8.40
100	11.6	2.32	0	2369	0	45	0.81	#	#	CO=140ppm,O_3=180ppm,NOx=60ppm	-0.8	-1.1E-09	8.80
200	9.7	1.94	0	426	0	8	0.96	#	#	CO=90ppm,O_3=ND,NOx=ND	-0.1	-1.8E-10	9.33
300	7.2	1.44	0	0	0	0	1.00	#	#	CO=180ppm,O_3=ND,NOx=30ppm	0.0	0.0E+00	8.39

Date : 9/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.6	2.72	11038	2856	204	55	0.78	0.73	0.75	CO=200ppm,O_3>400ppm,NOx=600ppm	3.2	3.6E-09	8.46
100	11.6	2.32	0	2410	0	46	0.81	#	#	CO=210ppm,O_3=200ppm,NOx=200ppm	-0.8	-1.1E-09	8.80
200	10	2	0	471	0	9	0.96	#	#	CO=140ppm,O_3=ND,NOx=ND	-0.1	-2.0E-10	9.62
300	7.6	1.52	0	0	0	0	1.00	#	#	CO=200ppm,O_3=ND,NOx=25ppm	0.0	0.0E+00	8.86

Date : 12/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	10 cc/min
CO_2	10 cc/min
N_2	70 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.5	2.3	12196	373	225	7	0.97	0.97	0.99	CO=100ppm,NOx=ND	4.6	6.3E-09	7.16
100	10.3	2.06	0	300	0	6	9.78	#	#	CO=100ppm,NOx=ND	-0.1	-1.5E-10	7.81
200	7	1.4	0	0	0	0	1.00	#	#	CO=115ppm,NOx=20ppm	0.0	0.0E+00	6.73
300	5.1	1.02	0	0	0	0	1.00	#	#	CO=200ppm,NOx=40ppm	0.0	0.0E+00	5.94

Date : 11/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.6	2.32	11962	485	220	9	0.96	0.96	0.98	CO=140ppm,NOx=ND	4.5	6.0E-09	7.22
100	10.5	2.1	0	290	0	6	0.98	#	#	CO=160ppm,NOx=ND	-0.1	-1.5E-10	7.96
200	7.7	1.54	0	0	0	0	1.00	#	#	CO=150ppm,NOx=20ppm	0.0	0.0E+00	7.41
300	5.6	1.12	0	0	0	0	1.00	#	#	CO=230ppm,NOx=45ppm	0.0	0.0E+00	6.53

Date : 12/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.4	2.28	10166	369	189	7	0.98	0.96	0.98	CO=100ppm,NOx=ND	3.9	5.3E-09	7.09
100	10.3	2.06	0	250	0	5	0.98	#	#	CO=100ppm,NOx=ND	-0.1	-1.3E-10	7.81
200	7.4	1.48	0	0	0	0	1.00	#	#	CO=115ppm,NOx=15ppm	0.0	0.0E+00	7.12
300	5.55	1.11	0	0	0	0	1.00	#	#	CO=180ppm,NOx=18ppm	0.0	0.0E+00	6.47

Date : 13/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	20 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.7	2.34	16080	390	293	8	0.98	0.97	0.99	CO=150ppm,NOx=ND	6.1	8.1E-09	7.28
100	10.7	2.14	0	304	0	6	0.98	#	#	CO=160ppm,NOx=ND	-0.1	-1.5E-10	8.12
200	8.7	1.74	0	246	0	5	0.98	#	#	CO=170ppm,NOx=10ppm	-0.1	-1.1E-10	8.37
300	5.45	1.09	0	0	0	0	1.00	#	#	CO=190ppm,NOx=20ppm	0.0	0.0E+00	6.35

Date : 15/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	11.5	2.3	10639	285	197	6	0.98	0.97	0.99	CO=70ppm,NOx=ND	4.1	5.5E-09	7.16
100	10.5	2.1	0	205	0	4	0.98	#	#	CO=100ppm,NOx=ND	-0.1	-9.6E-11	7.96
200	9	1.8	0	0	0	0	1.00	#	#	CO=120ppm,NOx=15ppm	0.0	0.0E+00	8.66
300	6.2	1.24	0	0	0	0	1.00	#	#	CO=150ppm,NOx=20ppm	0.0	0.0E+00	7.22

Date : 15/9/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
H_2O	30 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	11.6	2.32	11915	429	220	8	0.96	0.96	0.98	CO=160ppm,NOx=ND	4.5	6.1E-09	7.22
100	10.6	2.12	0	258	0	5	0.98	#	#	CO=200ppm,NOx=ND	-0.1	-1.3E-10	8.04
200	8.8	1.76	0	233	0	5	1.00	#	#	CO=180ppm,NOx=10ppm	-0.1	-1.1E-10	8.46
300	5.4	1.08	0	0	0	0	1.00	#	#	CO=230ppm,NOx=25ppm	0.0	0.0E+00	6.29

Date : 7/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$(2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	10 cc/min
CO_2	10 cc/min
N_2	60 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.4	2.68	10559	2366	196	45	0.78	0.77	0.78	CO=160ppm,NOx=ND	3.2	3.7E-09	8.34
100	11.2	2.24	0	1450	0	28	0.86	#	#	CO=200ppm,NOx=ND	-0.5	-6.8E-10	8.50
200	9	1.8	0	0	0	0	1.00	#	#	CO=180ppm,NOx=10ppm	0.0	0.0E+00	8.66
300	6.8	1.36	0	0	0	0	1.00	#	#	CO=230ppm,NOx=25ppm	0.0	0.0E+00	7.92

Date : 10/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.4	2.68	7948	2402	149	46	0.74	0.69	0.70	CO=150ppm,O_3=70ppm,NOx=40ppm	2.2	2.6E-09	8.34
100	11.5	2.3	0	1364	0	26	0.85	#	#	CO=130ppm,O_3=40ppm,NOx=15ppm	-0.5	-6.2E-10	8.72
200	9.7	1.94	0	0	0	0	1.00	#	#	CO=120ppm,O_3=ND,NOx=ND	0.0	0.0E+00	9.33
300	7.3	1.46	0	0	0	0	1.00	#	#	CO=115ppm,O_3=ND,NOx=20ppm	0.0	0.0E+00	8.51

Date : 8/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(5250 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	10 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.2	2.64	7707	2635.5	145	50	0.70	0.65	0.66	CO=105ppm,O_3=185ppm,NOx=125ppm	2.0	2.4E-09	8.21
100	11.2	2.24	0	1701	0	33	0.80	#	#	CO=100ppm,O_3=80ppm,NOx=55ppm	-0.6	-7.9E-10	8.50
200	9.4	1.88	0	228	0	4	0.97	#	#	CO=70ppm,O_3=ND,NOx=ND	-0.1	-1.0E-10	9.04
300	7.1	1.42	0	0	0	0	1.00	#	#	CO=125ppm,O_3=ND,NOx=20ppm	0.0	0.0E+00	8.27

Date : 9/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(5250 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	10 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.4	2.68	7555	2142	142	41	0.75	0.71	0.72	CO=200ppm,O_3=310ppm,NOx=140ppm	2.2	2.5E-09	8.34
100	11.5	2.3	0	1734	0	33	0.80	#	#	CO=150ppm,O_3=100ppm,NOx=30ppm	-0.6	-7.9E-10	8.72
200	9.7	1.94	0	288	0	6	0.97	#	#	CO=120ppm,O_3=ND,NOx=ND	-0.1	-1.2E-10	9.33
300	7.4	1.48	0	0	0	0	1.00	#	#	CO=115ppm,O_3=ND,NOx=18ppm	0.0	0.0E+00	8.62

Date : 15/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	50 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.6	2.72	9674	2276	180	44	0.78	0.76	0.77	CO=85ppm,O_3=ND,NOx=ND	2.9	3.3E-09	8.46
100	11.3	2.26	0	1501	0	29	0.86	#	#	CO=100ppm,O3=ND,NOx=ND	-0.5	-7.0E-10	8.57
200	9.4	1.88	0	151	0	3	0.98	#	#	CO=120ppm,O_3=ND,NOx=ND	0.0	-6.6E-11	9.04
300	6.9	1.38	0	0	0	0	1.00	#	#	CO=105ppm,O_3=ND,NOx=20ppm	0.0	0.0E+00	8.04

Date : 13/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	20 cc/min
CO_2	20 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.6	2.72	6599	2319	124	45	0.75	0.64	0.65	CO=150ppm,O_3=ND,NOx=ND	1.7	1.9E-09	8.46
100	11.6	2.32	0	1599	0	31	0.83	#	#	CO=210ppm,O3=ND,NOx=ND	-0.5	-7.2E-10	8.80
200	9.5	1.9	0	147	0	3	0.98	#	#	CO=180ppm,O_3=ND,NOx=ND	0.0	-6.3E-11	9.14
300	7.3	1.46	0	0	0	0	1.00	#	#	CO=190ppm,O_3=ND,NOx=25ppm	0.0	0.0E+00	8.51

Date : 17/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(10500 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	20 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.4	2.68	8573	2923	160	56	0.68	0.65	0.66	CO=110ppm,O_3=180ppm,NOx=190ppm	2.2	2.6E-09	8.34
100	11.3	2.26	0	2072	0	40	0.77	#	#	CO=105ppm,O_3=120ppm,NOx=40ppm	-0.7	-9.6E-10	8.57
200	9.5	1.9	0	314	0	6	0.97	#	#	CO=90ppm,O_3=ND,NOx=ND	-0.1	-1.4E-10	9.14
300	7.3	1.46	0	0	0	0	1.00	#	#	CO=180ppm,O_3=ND,NOx=25ppm	0.0	0.0E+00	8.51

Date : 24/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(10500 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10	cc/min
O_2	20	cc/min
H_2O	20	cc/min
CO_2	20	cc/min
N_2	30	cc/min
Total flow rate	100	cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(-)	ψ' ,(-)	ψ'' ,(-)				
33	13.7	2.74	11166	3010	207	58	0.74	0.72	0.73	CO=190ppm,O_3=200ppm,NOx=250ppm	3.2	3.6E-09	8.53
100	10.9	2.18	0	2052	0	39	0.82	#	#	CO=130ppm,O_3=120ppm,NOx=35ppm	-0.7	-9.8E-10	8.27
200	9.6	1.92	0	406	0	8	0.96	#	#	CO=150ppm,O_3=ND,NOx=ND	-0.1	-1.7E-10	9.23
300	7.7	1.54	0	0	0	0	1.00	#	#	CO=250ppm,O_3=ND,NOx=50ppm	0.0	0.0E+00	8.97

Date : 29/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	40 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.8	2.76	13976	2564	256	49	0.76	0.80	0.81	CO=100ppm,O_3=ND,NOx=ND	4.4	5.0E-09	8.59
100	10.9	2.18	0	1649	0	32	0.87	#	#	CO=120ppm,O_3=ND,NOx=ND	-0.6	-7.9E-10	8.27
200	9.4	1.88	0	158	0	3	0.99	#	#	CO=100ppm,O_3=ND,NOx=ND	0.0	-6.9E-11	9.04
300	7.1	1.42	0	0	0	0	1.00	#	#	CO=120ppm,O_3=ND,NOx=10ppm	0.0	0.0E+00	8.27

Date : 30/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(10%)-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	10 cc/min
H_2O	30 cc/min
CO_2	20 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	ψ ,(–)	ψ' ,(-)	ψ'' ,(-)				
33	13.7	2.74	12162	2620	224	50	0.77	0.77	0.78	CO=100ppm,O_3=25ppm,NOx=25ppm	3.7	4.2E-09	8.53
100	11.5	2.3	0	1795	0	35	0.84	#	#	CO=100ppm,O_3=10ppm,NOx=10ppm	-0.6	-8.2E-10	8.72
200	9.5	1.9	0	150	0	3	0.98	#	#	CO=90ppm,O_3=ND,NOx=ND	0.0	-6.6E-11	9.14
300	7.2	1.44	0	0	0	0	1.00	#	#	CO=120ppm,O_3=ND,NOx=20ppm	0.0	0.0E+00	8.39

Date : 28/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(21800 ppm)-CO_2 (10%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10 cc/min
O_2	20 cc/min
H_2O	30 cc/min
CO_2	10 cc/min
N_2	30 cc/min
Total flow rate	100 cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.4	2.68	12698	3296	234	63	0.70	0.73	0.74	CO=60ppm,O_3=120ppm,NOx=45ppm	3.6	4.2E-09	8.34
100	10.8	2.16	0	2068	0	40	0.80	#	#	CO=100ppm,O_3=60ppm,NOx=20ppm	-0.7	-1.0E-09	8.19
200	9.6	1.92	0	378	0	7	0.96	#	#	CO=80ppm,O_3=ND,NOx=ND	-0.1	-1.6E-10	9.23
300	7.3	1.46	0	0	0	0	1.00	#	#	CO=110ppm,O_3=ND,NOx=25ppm	0.0	0.0E+00	8.51

Date : 26/10/2003

Subject : Removal of $(CH_3)_3N$ 200 ppm from N_2-O_2(20%)-H_2O(21800 ppm)-CO_2 (20%)

Gas flow rate :

$(CH_3)_3N$ (2000ppm)	10	cc/min
O_2	20	cc/min
H_2O	30	cc/min
CO_2	20	cc/min
N_2	20	cc/min
Total flow rate	100	cc/min

Inlet concentration : 200 ppm Current : 0.2 mA

			Peak Area		Concentration (ppm)		Removal Efficiency			Byproduct	Ψ_{elec}	Ψ_{ener}	E/N
T (C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Outlet (mA) (avg.)	Outlet (0.2 mA)	Ψ ,(–)	Ψ' ,(-)	Ψ'' ,(-)				
33	13.5	2.7	5988	3408	113	65	0.57	0.42	0.43	CO=110ppm,O_3=140ppm,NOx=120ppm	1.0	1.2E-09	8.40
100	10.9	2.18	0	2325	0	45	0.70	#	#	CO=170ppm,O_3=40ppm,NOx=20ppm	-0.8	-1.1E-09	8.27
200	9.6	1.92	0	426	0	8	0.95	#	#	CO=160ppm,O_3=ND,NOx=ND	-0.1	-1.8E-10	9.23
300	7.5	1.5	0	0	0	0	1.00	#	#	CO=100ppm,O_3=ND,NOx=15ppm	0.0	0.0E+00	8.74

APPENDIX G

Simultaneous Removal of Acetaldehyde and Ammonia

Date : 24/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-CO_2 (10%)

Gas flow rate : CH_3CHO (2000ppm) 7.5 cc/min

NH_3 (2000ppm) 50 cc/min

CO_2 10 cc/min

N_2 32.5 cc/min

Total flow rate 100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.9	2.38	4487	193	140.0	6.0	0.96	0.96	0.97	2.9	7.5E-10	7.41
100	9.3	1.86	3597	430	113.0	13.0	0.91	0.88	1.11	1.8	5.9E-10	7.05
200	5.6	1.12	3308	2215	104.0	69.0	0.52	0.34	0.53	0.5	2.7E-10	5.39
300	4.1	0.82	2377	1596	74.0	50.0	0.65	0.32	0.63	0.3	2.1E-10	4.78

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	1723	151	874.0	199.0	0.76	0.77	0.79	16.1	3.8E-09	7.41	CO=125ppm,O_3=ND,NOx=ND
100	898	349	604.0	343.0	0.59	0.43	0.54	6.2	1.5E-09	7.05	CO=80ppm,O_3=ND,NOx=ND
200	1222	1167	720.0	702.0	0.16	0.03	0.04	0.4	1.4E-10	5.39	CO=100ppm,O_3=ND,NOx=10ppm
300	1503	1023	810.0	651.0	0.22	0.20	0.38	3.8	1.4E-09	4.78	CO=110ppm,O_3=ND,NOx=10ppm

Date : 24/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
CO_2	20 cc/min
N_2	22.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.8	2.36	3559	339	111.0	11.0	0.92	0.90	0.92	2.1	5.6E-10	7.34
100	9.6	1.92	3749	344	117.0	11.0	0.92	0.91	1.13	1.9	6.0E-10	7.28
200	6.1	1.22	3393	2046	106.0	64.0	0.51	0.40	0.62	0.6	3.0E-10	5.87
300	4.8	0.96	2661	1455	83.0	46.0	0.65	0.45	0.86	0.4	2.7E-10	5.59

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	1493	356	807.0	348.0	0.59	0.57	0.58	11.0	2.6E-09	7.34	CO=180ppm,O_3=ND,NOx=ND
100	1286	238	742.0	270.0	0.68	0.64	0.80	11.3	2.7E-09	7.28	CO=140ppm,O_3=ND,NOx=ND
200	1335	997	758.0	642.0	0.24	0.15	0.24	2.8	8.2E-10	5.87	CO=125ppm,O_3=ND,NOx=10ppm
300	1078	1045	671.0	659.0	0.22	0.02	0.03	0.3	8.9E-11	5.59	CO=160ppm,O_3=ND,NOx=15ppm

Date : 26/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	22.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.2	2.44	4676	0	146.0	0.0	1.00	1.00	1.02	3.1	7.9E-10	7.59
100	10.2	2.04	4697	0	147.0	0.0	1.00	1.00	1.25	2.6	7.8E-10	7.74
200	8.2	1.64	4049	332	127.0	10.0	0.94	0.92	1.45	1.6	6.1E-10	7.89
300	6.5	1.3	476	182	15.0	6.0	0.96	0.60	1.16	0.1	4.9E-11	7.57

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	1044	0	659.0	0.0	1.00	1.00	1.02	15.8	3.6E-09	7.59	CO=175ppm,O_3=200ppm,NOx=110ppm
100	1037	0	656.0	0.0	1.00	1.00	1.25	15.7	3.5E-09	7.74	CO=100ppm,O_3=50ppm,NOx=20ppm
200	766	238	551.0	269.0	0.63	0.51	0.80	6.7	1.5E-09	7.89	CO=120ppm,O_3=ND,NOx=ND
300	1100	236	679.0	268.0	0.63	0.61	1.17	9.8	2.2E-09	7.57	CO=100ppm,O_3=ND,NOx=20ppm

Date : 25/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate : CH_3CHO (2000ppm) 7.5 cc/min

NH_3 (2000ppm) 50 cc/min

O_2 10 cc/min

CO_2 20 cc/min

N_2 12.5 cc/min

Total flow rate 100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.3	2.46	4357	0	136.0	0.0	1.00	1.00	1.02	2.9	7.3E-10	7.65
100	10.2	2.04	4144	0	130.0	0.0	1.00	1.00	1.25	2.3	6.9E-10	7.74
200	8.4	1.68	3614	389	113.0	12.0	0.91	0.89	1.40	1.4	5.2E-10	8.08
300	7	1.4	561	187	18.0	6.0	0.96	0.67	1.29	0.1	6.1E-11	8.16

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	975	0	634.0	0.0	1.00	1.00	1.02	15.2	3.4E-09	7.65	CO=240ppm,O_3=240ppm,NOx=100ppm
100	719	0	531.0	0.0	1.00	1.00	1.25	12.7	2.8E-09	7.74	CO=190ppm,O_3=50ppm,NOx=20ppm
200	1378	170	771.0	216.0	0.67	0.72	1.13	13.3	2.8E-09	8.08	CO=200ppm,O_3=ND,NOx=ND
300	1012	166	647.0	213.0	0.68	0.67	1.29	10.4	2.2E-09	8.16	CO=180ppm,O_3=ND,NOx=80ppm

Date : 27/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-O_2(20%)-CO_2 (10%)

Gas flow rate : CH_3CHO (2000ppm) 7.5 cc/min

NH_3 (2000ppm) 50 cc/min

O_2 20 cc/min

CO_2 10 cc/min

N_2 12.5 cc/min

Total flow rate 100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.1	2.42	4302	0	135.0	0.0	1.00	1.00	1.02	2.9	7.4E-10	7.53
100	10.4	2.08	4344	0	136.0	0.0	1.00	1.00	1.25	2.4	7.1E-10	7.89
200	9	1.8	4045	160	137.0	5.0	0.97	0.96	1.51	1.8	6.3E-10	8.66
300	7.2	1.44	481	121	15.0	4.0	0.97	0.73	1.42	0.1	5.4E-11	8.39

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	928	0	616.0	0.0	1.00	1.00	1.02	14.7	3.4E-09	7.53	CO=190ppm,O_3=400ppm,NOx=480ppm
100	874	0	595.0	0.0	1.00	1.00	1.25	14.2	3.1E-09	7.89	CO=95ppm,O_3=100ppm,Nox=60ppm
200	1024	185	651.0	229.0	0.68	0.65	1.02	10.1	2.0E-09	8.66	CO=100ppm,O_3=ND,NOx=ND
300	1056	191	663.0	233.0	0.67	0.65	1.25	10.3	2.1E-09	8.39	CO=100ppm,O_3=ND,NOx=15ppm

Date : 28/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	22.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.5	2.3	4922	382	154.0	12.0	0.93	0.92	0.94	3.0	8.2E-10	7.16
100	9.5	1.9	4910	353	154.0	11.0	0.93	0.93	1.16	2.5	8.2E-10	7.21
200	5.5	1.1	4616	2828	145.0	89.0	0.45	0.39	0.61	0.8	4.4E-10	5.29
300	4.3	0.86	2710	1483	85.0	46.0	0.72	0.46	0.89	0.4	3.2E-10	5.01

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	875	375	595.0	359.0	0.50	0.40	0.40	5.6	1.4E-09	7.16	CO=130ppm,O_3=ND,NOx=ND
100	1271	337	737.0	336.0	0.53	0.54	0.68	9.6	2.3E-09	7.21	CO=115ppm,O_3=ND,Nox=ND
200	624	1191	489.0	710.0	0.01	-0.45	-0.87	-5.3	-1.7E-09	5.29	CO=125ppm,O_3=ND,NOx=10ppm
300	1500	512	809.0	434.0	0.39	0.46	0.73	9.0	3.1E-09	5.01	CO=130ppm,O_3=ND,NOx=15ppm

Date : 30/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-H_2O(5250ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
N_2(bubbling)	10 cc/min
CO_2	20 cc/min
N_2	12.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.9	2.38	4296	236	135.0	7.4	0.95	0.95	0.96	2.7	7.1E-10	7.41
100	9.8	1.96	4625	281	145.0	9.0	0.94	0.94	1.17	2.4	7.6E-10	7.43
200	5.7	1.14	4370	2407	137.0	75.0	0.50	0.45	0.71	0.9	4.7E-10	5.48
300	4.5	0.9	3349	1522	105.0	47.0	0.69	0.55	1.07	0.7	4.6E-10	5.24

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	2208	227	1002.0	261.0	0.64	0.74	0.75	17.7	4.1E-09	7.41	CO=210ppm,O_3=ND,NOx=ND
100	1116	332	684.0	333.0	0.54	0.51	0.64	8.4	2.0E-09	7.43	CO=160ppm,O_3=ND,NOx=ND
200	1467	834	799.0	579.0	0.21	0.28	0.43	5.3	1.7E-09	5.48	CO=150ppm,O_3=ND,NOx=10ppm
300	527	706	441.0	525.0	0.28	-0.19	-0.37	-2.0	-6.6E-10	5.24	CO=165ppm,O_3=ND,NOx=20ppm

Date : 29/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-H_2O(10500ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
N_2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	12.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.8	2.36	4472	302	140.0	9.0	0.94	0.94	0.95	2.8	7.4E-10	7.34
100	9.6	1.92	4598	277	144.0	8.0	0.95	0.94	1.18	2.4	7.7E-10	7.28
200	5.5	1.1	4361	2795	137.0	88.0	0.40	0.36	0.56	0.7	3.8E-10	5.29
300	4.8	0.96	2954	1670	93.0	52.0	0.65	0.44	0.85	0.5	3.0E-10	5.59

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	1159	536	699.0	446.0	0.41	0.36	0.37	6.1	1.4E-09	7.34	CO=125ppm,O_3=ND,NOx=ND
100	1399	239	778.0	270.0	0.64	0.65	0.82	12.1	2.9E-09	7.28	CO=100ppm,O_3=ND,NOx=ND
200	1841	951	907.0	625.0	0.17	0.31	0.49	6.7	2.2E-09	5.29	CO=115ppm,O_3=ND,NOx=20ppm
300	3560	574	1300.0	465.0	0.38	0.64	1.24	20.0	6.2E-09	5.59	CO=200ppm,O_3=ND,NOx=40ppm

Date : 31/12/2003

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm from N_2-O_2(10%)-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
O_2	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	12.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.2	2.44	4880	0	153.0	0.0	1.00	1.00	1.02	3.3	8.3E-10	7.59
100	10.2	2.04	4792	0	150.0	0.0	1.00	1.00	1.25	2.6	8.0E-10	7.74
200	8.6	1.72	4385	240	137.0	7.5	0.95	0.95	1.49	1.8	6.5E-10	8.27
300	6.7	1.34	688	204	22.0	6.0	0.96	0.73	1.40	0.2	8.5E-11	7.81

	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	894	0	603.0	0.0	1.00	1.00	1.02	14.4	3.3E-09	7.59	CO=150ppm,O_3=160ppm,NOx=110ppm
100	1214	0	718.0	0.0	1.00	1.00	1.25	17.2	3.8E-09	7.74	CO=100ppm,O_3=50ppm,NOx=15ppm
200	1207	181	716.0	225.0	0.68	0.69	1.08	11.7	2.5E-09	8.27	CO=125ppm,O_3=ND,NOx=ND
300	1045	282	659.0	300.0	0.57	0.54	1.05	8.6	1.9E-09	7.81	CO=95ppm,O_3=ND,NOx=15ppm

APPENDIX H

Simultaneous Removal of Acetaldehyde and Trimethylamine

Date : 4/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
CO_2	10 cc/min
N_2	77.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.9	2.38	5670	900	177	28	0.84	0.84	0.86	3.2	8.3E-10	7.41
100	10.1	2.02	5550	365	174	11	0.94	0.94	1.17	2.9	8.8E-10	7.66
200	5.9	1.18	5170	3544	162	111	0.38	0.31	0.49	0.7	3.7E-10	5.68
300	5.2	1.04	2651	1604	83	50	0.72	0.40	0.77	0.4	2.2E-10	6.06

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5872	275	111	5	0.95	0.95	0.97	2.5	5.9E-10	7.41	CO=100ppm,NOx=ND
100	7045	294	133	5	0.95	0.96	1.20	3.1	6.9E-10	7.66	CO=120ppm,NOx=ND
200	7128	3206	134	61	0.36	0.54	0.86	1.7	5.3E-10	5.68	CO=70ppm,NOx=10ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=95ppm,NOx=15ppm

Date : 5/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
CO_2	20 cc/min
N_2	67.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12	2.4	5471	851	171	27	0.85	0.84	0.86	3.1	8.0E-10	7.47
100	10.2	2.04	5272	351	165	11	0.94	0.93	1.17	2.7	8.2E-10	7.74
200	8	1.6	5141	830	161	26	0.85	0.84	1.32	1.9	7.2E-10	7.70
300	5	1	3161	1595	99	50	0.71	0.49	0.96	0.6	3.5E-10	5.83

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5284	276	100	5	0.96	0.95	0.97	2.3	5.3E-10	7.47	CO=115ppm,NOx=ND
100	6798	328	128	6	0.95	0.95	1.19	2.9	6.5E-10	7.74	CO=140ppm,NOx=ND
200	6656	355	125	7	0.95	0.94	1.48	2.8	6.3E-10	7.70	CO=165ppm,NOx=5ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	5.83	CO=180ppm,NOx=10ppm

Date : 7/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	67.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.9	2.78	5424	0	170	0	1.00	1.00	1.02	3.6	8.1E-10	8.65
100	11.3	2.26	5535	0	173	0	1.00	1.00	1.25	3.0	8.3E-10	8.57
200	8.7	1.74	4018	153	126	5	0.97	0.96	1.51	1.7	6.0E-10	8.37
300	6.7	1.34	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	7.81

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4513	1591	86	31	0.71	0.64	0.65	1.3	2.6E-10	8.65	CO=160ppm,O_3=240ppm,NOx=115ppm
100	3999	648	76	13	0.88	0.83	1.04	1.5	3.0E-10	8.57	CO=120ppm,O_3=40ppm,NOx=15ppm
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.37	CO=115ppm,O_3=ND,NOx=10ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	7.81	CO=100pm,O_3=ND,NOx=20ppm

Date : 12/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
CO_2	20 cc/min
N_2	57.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.7	2.74	5646	268	177	8	0.96	0.95	0.97	3.6	8.2E-10	8.53
100	11.2	2.24	5642	603	177	19	0.90	0.89	1.12	2.8	7.7E-10	8.50
200	9.2	1.84	3859	279	121	9	0.95	0.93	1.45	1.5	5.2E-10	8.85
300	6.7	1.34	151	0	5	0	1.00	1.00	1.93	0.1	2.6E-11	7.81

	Peak Area($CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4772	1753	91	34	0.66	0.63	0.64	1.4	2.8E-10	8.53	CO=150ppm,O_3=140ppm,NOx=50ppm
100	5823	647	110	12	0.88	0.89	1.11	2.3	4.8E-10	8.50	CO=150ppm,O_3=ND,NOx=10ppm
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.85	CO=200ppm,O_3=ND,NOx=15ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	7.81	CO=125pm,O_3=ND,NOx=20ppm

Date : 13/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
CO_2	10 cc/min
N_2	57.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.6	2.72	5590	239	175	7	0.96	0.96	0.98	3.6	8.2E-10	8.46
100	11.3	2.26	5360	0	168	0	1.00	1.00	1.25	2.9	8.1E-10	8.57
200	9.1	1.82	4231	0	133	0	1.00	1.00	1.57	1.8	6.3E-10	8.75
300	6.9	1.38	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.04

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4418	2049	84	39	0.56	0.54	0.55	1.1	2.2E-10	8.46	CO=100ppm,O_3=320ppm,NOx=350ppm
100	3243	1064	62	21	0.76	0.66	0.83	1.0	2.0E-10	8.57	CO=70ppm,O_3=50ppm,NOx=25ppm
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.75	CO=75ppm,O_3=ND,NOx=10ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.04	CO=90pm,O_3=ND,NOx=20ppm

Date : 15/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
CO_2	20 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.5	2.7	5297	279	166	9	0.95	0.95	0.96	3.4	7.7E-10	8.40
100	11	2.2	5227	0	164	0	1.00	1.00	1.25	2.9	8.1E-10	8.34
200	9	1.8	4427	0	138	0	1.00	1.00	1.57	1.9	6.6E-10	8.66
300	7.2	1.44	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.39

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5472	2045	103	39	0.62	0.62	0.63	1.5	3.1E-10	8.40	CO=190ppm,O_3=340ppm,NOx=360ppm
100	4298	1063	82	20	0.81	0.76	0.95	1.5	3.1E-10	8.34	CO=100ppm,O_3=70ppm,NOx=20ppm
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.66	CO=110ppm,O_3=ND,NOx=10ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.39	CO=100ppm,O_3=ND,NOx=20ppm

Date : 17/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	67.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.8	2.36	5440	336	170	11	0.69	0.94	0.95	3.4	8.9E-10	7.34
100	9.9	1.98	5154	179	161	6	0.72	0.97	1.21	2.7	8.5E-10	7.51
200	6	1.2	4963	3019	155	95	0.34	0.39	0.48	0.8	4.3E-10	5.77
300	5.2	1.04	2441	1051	76	33	0.60	0.57	1.09	0.5	2.9E-10	6.06

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	7590	3762	143	72	0.39	0.50	0.51	1.7	4.0E-10	7.34	CO=120ppm,O_3=ND,NOx=ND
100	8244	0	154	0	1.00	1.00	1.25	3.7	8.5E-10	7.51	CO=110ppm,O_3=ND,NOx=ND
200	6705	2829	126	54	0.54	0.57	0.90	1.7	5.2E-10	5.77	CO=100ppm,O_3=ND,NOx=10ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=125ppm,O_3=ND,NOx=20ppm

Date : 16/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(5250ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	10 cc/min
CO_2	20 cc/min
N_2	57.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12	2.4	5349	341	168.0	11.0	0.94	0.93	0.95	3.4	8.7E-10	7.47
100	10.2	2.04	5099	166	159.0	5.2	0.97	0.97	1.21	2.7	8.2E-10	7.74
200	7.8	1.56	4951	379	155.0	12.0	0.93	0.92	1.45	2.0	7.9E-10	7.50
300	5.2	1.04	2266	863	71.0	27.0	0.84	0.62	1.20	0.5	3.0E-10	6.06

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6249	0	118.0	0.0	1.00	1.00	1.02	2.8	6.5E-10	7.47	CO=200ppm,O_3=ND,NOx=ND
100	8646	0	162.0	0.0	1.00	1.00	1.25	3.9	8.6E-10	7.74	CO=200ppm,O_3=ND,NOx=ND
200	6644	2814	125.0	54.0	0.59	0.57	0.89	1.7	3.9E-10	7.50	CO=145ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=215ppm,O_3=ND,NOx=25ppm

Date : 20/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(10500ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	57.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.9	2.38	5254	294	165.0	9.2	0.94	0.94	0.96	3.3	8.7E-10	7.41
100	9.9	1.98	5150	139	161.0	4.4	0.97	0.97	1.22	2.7	8.6E-10	7.51
200	5.8	1.16	4934	3007	155.0	94.2	0.43	0.39	0.62	0.8	4.5E-10	5.58
300	4.8	0.96	2396	950	75.0	30.0	0.82	0.60	1.16	0.5	3.3E-10	5.59

	Peak Area($CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6602	0	124.0	0.0	1.00	1.00	1.02	3.0	6.9E-10	7.41	CO=110ppm,O_3=ND,NOx=ND
100	8327	0	156.0	0.0	1.00	1.00	1.25	3.7	8.6E-10	7.51	CO=100ppm,O_3=ND,NOx=ND
200	4937	2904	94.0	56.0	0.45	0.40	0.64	0.9	2.8E-10	5.58	CO=100ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	5.59	CO=120ppm,O_3=ND,NOx=15ppm

Date : 21/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(10500ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N2(bubbling)	20 cc/min
CO_2	20 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.9	2.38	5304	293	166.0	9.0	0.95	0.95	0.96	3.4	8.8E-10	7.41
100	10.1	2.02	5279	135	165.0	4.0	0.98	0.98	1.22	2.8	8.7E-10	7.66
200	7.8	1.56	5064	339	158.0	10.6	0.94	0.93	1.47	2.0	8.1E-10	7.50
300	5.2	1.04	2733	1082	86.0	34.0	0.80	0.60	1.17	0.6	3.5E-10	6.06

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6804	3977	128.0	76.0	0.29	0.41	0.41	1.2	2.9E-10	7.41	CO=175ppm,O_3=ND,NOx=ND
100	8217	0	154.0	0.0	1.00	1.00	1.25	3.7	8.3E-10	7.66	CO=150ppm,O_3=ND,NOx=ND
200	4461	0	85.0	0.0	1.00	1.00	1.57	2.0	4.7E-10	7.50	CO=165ppm,O_3=ND,NOx=5ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=150ppm,O_3=ND,NOx=15ppm

Date : 23/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(21800ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N2(bubbling)	30 cc/min
CO_2	10 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.8	2.36	5101	140	159.0	4.4	0.97	0.97	0.99	3.3	8.7E-10	7.34
100	9.9	1.98	5190	129	163.0	4.0	0.98	0.98	1.22	2.8	8.7E-10	7.51
200	5.8	1.16	5055	3074	158.0	96.3	0.43	0.39	0.61	0.9	4.6E-10	5.58
300	4.8	0.96	2706	1289	85.0	40.4	0.76	0.52	1.01	0.5	3.3E-10	5.59

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5848	0	111.0	0.0	1.00	1.00	1.02	2.7	6.2E-10	7.34	CO=65ppm,O_3=ND,NOx=ND
100	5492	0	104.0	0.0	1.00	1.00	1.25	2.5	5.7E-10	7.51	CO=100ppm,O_3=ND,NOx=ND
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	5.58	CO=110ppm,O_3=ND,NOx=15ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	5.59	CO=110ppm,O_3=ND,NOx=20ppm

Date : 22/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(21800ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N2(bubbling)	30 cc/min
CO_2	20 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.8	2.36	5367	227	168.0	7.1	0.96	0.96	0.98	3.4	9.1E-10	7.34
100	10	2	5072	105	159.0	3.3	0.98	0.98	1.22	2.7	8.5E-10	7.59
200	7.8	1.56	5153	456	161.0	14.3	0.91	0.91	1.43	2.0	8.1E-10	7.50
300	5.2	1.04	2579	1014	81.0	31.8	0.80	0.61	1.17	0.6	3.4E-10	6.06

	Peak Area(CH_3)$_3$N		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6993	0	132.0	0.0	1.00	1.00	1.02	3.2	7.4E-10	7.34	CO=115ppm,O_3=ND,NOx=ND
100	6551	0	124.0	0.0	1.00	1.00	1.25	3.0	6.8E-10	7.59	CO=150ppm,O_3=ND,NOx=ND
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	7.50	CO=115ppm,O_3=ND,NOx=5ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=140ppm,O_3=ND,NOx=15ppm

Date : 8/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	57.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	14	2.8	5275	0	165	0	1.00	1.00	1.02	3.5	7.8E-10	8.71
100	11.6	2.32	5037	0	158	0	1.00	1.00	1.25	2.8	7.4E-10	8.80
200	10	2	4454	0	140	0	1.00	1.00	1.57	1.9	6.0E-10	9.62
300	7.3	1.46	1801	0	56	0	1.00	1.00	1.93	0.6	2.7E-10	8.51

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5856	0	111	0	1.00	1.00	1.02	2.7	5.3E-10	0.00	CO=110ppm,O_3=200ppm,NOx=80ppm
100	2852	0	55	0	1.00	1.00	1.25	1.3	2.6E-10	0.00	CO=70ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	0.00	CO=100ppm,O_3=ND,NOx=5ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	0.00	CO=100ppm,O_3=ND,NOx=10ppm

Date : 14/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(10500ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.2	2.64	5169	0	162	0	1.00	1.00	1.02	3.5	8.1E-10	8.21
100	11.1	2.22	5074	0	159	0	1.00	1.00	1.25	2.8	7.8E-10	8.42
200	9.5	1.9	4471	0	140	0	1.00	1.00	1.57	1.9	6.3E-10	9.14
300	7.2	1.44	1429	0	45	0	1.00	1.00	1.93	0.5	2.2E-10	8.39

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3305	0	63	0	1.00	1.00	1.02	1.5	3.2E-10	8.21	CO=110ppm,O_3=155ppm,NOx=70ppm
100	3550	0	68	0	1.00	1.00	1.25	1.6	3.3E-10	8.42	CO=115ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.14	CO=110ppm,O_3=ND,NOx=ND
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.39	CO=110ppm,O_3=ND,NOx=15ppm

Date : 27/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(21800ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	30 cc/min
CO_2	10 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.7	2.54	5194	0	163	0	1.00	1.00	1.02	3.5	8.5E-10	7.90
100	11.8	2.36	5280	0	165	0	1.00	1.00	1.25	2.9	7.6E-10	8.95
200	10.2	2.04	4957	0	155	0	1.00	1.00	1.57	2.1	6.5E-10	9.81
300	7.4	1.48	2633	0	82	0	1.00	1.00	1.93	0.9	3.9E-10	8.62

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6522	0	123	0	1.00	1.00	1.02	2.9	6.4E-10	7.90	CO=75ppm,O_3=90ppm,NOx=40ppm
100	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.95	CO=100ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.81	CO=80ppm,O_3=ND,NOx=ND
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.62	CO=100ppm,O_3=ND,NOx=10ppm

Date : 9/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(5250ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	20 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	14.1	2.82	5042	0	158	0	1.00	1.00	1.02	3.4	7.4E-10	8.77
100	11.7	2.34	4896	0	153	0	1.00	1.00	1.25	2.7	7.1E-10	8.87
200	10.1	2.02	4312	0	135	0	1.00	1.00	1.57	1.9	5.7E-10	9.72
300	7.6	1.52	1635	0	51	0	1.00	1.00	1.93	0.6	2.4E-10	8.86

	Peak Area($CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3533	0	67	0	1.00	1.00	1.02	1.6	3.2E-10	8.77	CO=160ppm,O_3=190ppm,NOx=90ppm
100	3211	0	61	0	1.00	1.00	1.25	1.5	2.8E-10	8.87	CO=130ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.72	CO=160ppm,O_3=ND,NOx=5ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.86	CO=150ppm,O_3=ND,NOx=10ppm

Date : 12/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(10500ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	20 cc/min
CO_2	20 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.5	2.7	5384	0	169	0	1.00	1.00	1.02	3.6	8.3E-10	8.40
100	11.3	2.26	5274	0	165	0	1.00	1.00	1.25	2.9	8.0E-10	8.57
200	9.7	1.94	4582	0	144	0	1.00	1.00	1.57	2.0	6.4E-10	9.33
300	7.6	1.52	1355	0	42	0	1.00	1.00	1.93	0.5	2.0E-10	8.86

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5352	0	101	0	1.00	1.00	1.02	2.4	5.0E-10	8.40	CO=125ppm,O_3=180ppm,NOx=80ppm
100	4920	0	93	0	1.00	1.00	1.25	2.2	4.5E-10	8.57	CO=170ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.33	CO=180ppm,O_3=ND,NOx=ND
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.86	CO=150ppm,O_3=ND.NOx=15ppm

Date : 26/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(21800ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	30 cc/min
CO_2	20 cc/min
N_2	27.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.1	2.62	5275	0	165	0	1.00	1.00	1.02	3.5	8.4E-10	8.15
100	10.9	2.18	5136	0	161	0	1.00	1.00	1.25	2.8	8.0E-10	8.27
200	9	1.8	4831	0	151	0	1.00	1.00	1.57	2.1	7.2E-10	8.66
300	6.8	1.36	233	0	7	0	1.00	1.00	1.93	0.1	3.6E-11	7.92

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5068	0	96	0	1.00	1.00	1.02	2.3	4.9E-10	8.15	CO=120ppm,O_3=110ppm,NOx=50ppm
100	3752	0	71	0	1.00	1.00	1.25	1.7	3.5E-10	8.27	CO=110ppm,O_3=ND,NOx=ND
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.66	CO=110ppm,O_3=ND,NOx=5ppm
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	7.92	CO=90ppm,O_3=ND,NOx=15ppm

Date : 10/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	47.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.3	2.66	4813	0	151	0	1.00	1.00	1.02	3.2	7.5E-10	8.28
100	11.2	2.24	4662	0	146	0	1.00	1.00	1.25	2.6	7.1E-10	8.50
200	9.8	1.96	3926	0	123	0	1.00	1.00	1.57	1.7	5.4E-10	9.43
300	7.8	1.56	935	0	29	0	1.00	1.00	1.93	0.3	1.3E-10	9.09

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3076	0	59	0	1.00	1.00	1.02	1.4	2.9E-10	8.28	CO=125ppm,O_3=350ppm,NOx=300ppm
100	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	8.50	CO=100ppm,O_3=80ppm,NOx=25ppm
200	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.43	CO=100ppm,O_3=ND,NOx=ND
300	0	0	0	0	1.00	0.00	0.00	0.0	0.0E+00	9.09	CO=110ppm,O_3=ND,NOx=15ppm

Date : 11/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(10500ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.2	2.64	5296	0	166.0	0.0	1.00	1.00	1.02	3.5	8.3E-10	8.21
100	11.1	2.22	5237	0	164.0	0.0	1.00	1.00	1.25	2.9	8.0E-10	8.42
200	9.7	1.94	4499	0	141.0	0.0	1.00	1.00	1.57	1.9	6.2E-10	9.33
300	7.8	1.56	1030	0	32.0	0.0	1.00	1.00	1.93	0.4	1.5E-10	9.09

	Peak Area($CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5002	0	95.0	0.0	1.00	1.00	1.02	2.3	4.8E-10	8.21	CO=115ppm,O_3=300ppm,NOx=220ppm
100	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.42	CO=110ppm,O_3=75ppm,NOx=20ppm
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	9.33	CO=100ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	9.09	CO=90ppm,O_3=ND,NOx=20ppm

Date : 24/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(21800ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	30 cc/min
CO_2	10 cc/min
N_2	27.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T ($^{\circ}$C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.1	2.62	5238	0	164.0	0.0	1.00	1.00	1.02	3.5	8.3E-10	8.15
100	10.7	2.14	5060	0	158.0	0.0	1.00	1.00	1.25	2.8	8.0E-10	8.12
200	8.9	1.78	4152	0	130.0	0.0	1.00	1.00	1.57	1.8	6.3E-10	8.56
300	6.9	1.38	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.04

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T ($^{\circ}$C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6333	0	119.0	0.0	1.00	1.00	1.02	2.8	3.0E-09	8.15	CO=100ppm,O_3=240ppm,NOx=150ppm
100	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.12	CO=70ppm,O_3=ND,NOx=ND
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.56	CO=100ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.04	CO=75ppm,O_3=ND,NOx=20ppm

Date : 10/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(5250ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	10 cc/min
CO_2	20 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.8	2.76	5107	0	160.0	0.0	1.00	1.00	1.02	3.4	7.7E-10	8.59
100	11.5	2.3	4923	0	154.0	0.0	1.00	1.00	1.25	2.7	7.3E-10	8.72
200	10	2	4177	0	131.0	0.0	1.00	1.00	1.57	1.8	5.6E-10	9.62
300	8	1.6	1176	0	37.0	0.0	1.00	1.00	1.93	0.4	1.6E-10	9.32

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3653	0	70.0	0.0	1.00	1.00	1.02	1.7	#DIV/0!	0.00	CO=165ppm,O_3=320ppm,NOx=250ppm
100	3327	0	63.0	0.0	1.00	1.00	1.25	1.5	#DIV/0!	0.00	CO=110ppm,O_3=80ppm,NOx=30ppm
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	#DIV/0!	0.00	CO=115ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	#DIV/0!	0.00	CO=120ppm,O_3=ND,NOx=20ppm

Date : 15/12/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(10500ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	37.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.4	2.68	5528	0	173.0	0.0	1.00	1.00	1.02	3.7	8.6E-10	8.34
100	11.2	2.24	5323	0	167.0	0.0	1.00	1.00	1.25	2.9	8.1E-10	8.50
200	9.8	1.96	4614	0	145.0	0.0	1.00	1.00	1.57	2.0	6.4E-10	9.43
300	7.9	1.58	853	0	27.0	0.0	1.00	1.00	1.93	0.3	1.2E-10	9.21

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	2698	0	52.0	0.0	1.00	1.00	1.02	1.2	2.6E-10	8.34	CO=180ppm,O_3=320ppm,NOx=200ppm
100	3892	0	74.0	0.0	1.00	1.00	1.25	1.8	3.6E-10	8.50	CO=150ppm,O_3=85ppm,NOx=25ppm
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	9.43	CO=150ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	9.21	CO=160ppm,O_3=ND,NOx=15ppm

Date : 25/11/2003

Subject : Removal of CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-H_2O(21800ppm)-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
N_2(bubbling)	20 cc/min
CO_2	20 cc/min
N_2	27.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	13.2	2.64	5179	0	162.0	0.0	1.00	1.00	1.02	3.5	8.1E-10	8.21
100	10.9	2.18	5049	0	158.0	0.0	1.00	1.00	1.25	2.8	7.9E-10	8.27
200	9.2	1.84	4320	0	135.0	0.0	1.00	1.00	1.57	1.9	6.3E-10	8.85
300	7.1	1.42	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.27

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5368	0	101.0	0.0	1.00	1.00	1.02	2.4	5.1E-10	8.21	CO=140ppm,O_3=240ppm,NOx=190ppm
100	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.27	CO=120ppm,O_3=10ppm,NOx=ND
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.85	CO=110ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.27	CO=110ppm,O_3=ND,NOx=20ppm

APPENDIX I

Simultaneous Removal of Ammonia and Trimethyl amine

Date : 16/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-CO_2 (10%)

Gas flow rate : NH_3 (2000ppm) 50 cc/min

$(CH_3)_3N$ (2000ppm) 5 cc/min

CO_2 10 cc/min

N_2 35 cc/min

Total flow rate 100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	10.9	2.18	3830	2737	1319.0	1028.0	-0.33	0.22	0.22	6.2	1.8E-09	6.78
100	8.2	1.64	4034	3690	1378.0	1279.0	-0.65	0.07	0.09	1.7	6.6E-10	6.22
200	5.2	1.04	1134	3223	660.0	1152.0	-0.49	-0.75	-1.17	-6.8	-4.1E-09	5.00
300	5	1	842	1227	598.0	680.0	0.12	-0.14	-0.26	-0.9	-5.8E-10	5.83

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5526	0	104.0	0.0	1.00	1.00	1.02	2.5	6.3E-10	6.78	CO=65ppm,O_3=ND,NOx=ND
100	4988	0	95.0	0.0	1.00	1.00	1.25	2.3	6.3E-10	6.22	CO=90ppm,O_3=ND,NOx=ND
200	4324	0	82.0	0.0	1.00	1.00	1.57	2.0	6.8E-10	5.00	CO=85ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	5.83	CO=65ppm,O_3=ND,NOx=10ppm

Date : 17/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-CO_2 (20%)

Gas flow rate : NH_3 (2000ppm) 50 cc/min

$(CH_3)_3N$ (2000ppm) 5 cc/min

CO_2 20 cc/min

N_2 25 cc/min

Total flow rate 100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	10.8	2.16	3696	3379	1281.0	1194.0	0.15	0.07	0.07	1.9	5.3E-10	6.72
100	9.1	1.82	1733	2525	791.0	976.0	0.30	-0.23	-0.29	-3.2	-1.1E-09	6.90
200	5.8	1.16	2695	3675	1017.0	1275.0	0.09	-0.25	-0.40	-3.6	-1.9E-09	5.58
300	5.3	1.06	4269	984	1448.0	628.0	0.55	0.57	1.09	9.3	5.5E-09	6.18

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3134	0	60.0	0.0	1.00	1.00	1.02	1.4	3.7E-10	6.72	CO=65ppm,O_3=ND,NOx=ND
100	4160	0	79.0	0.0	1.00	1.00	1.25	1.9	4.7E-10	6.90	CO=80ppm,O_3=ND,NOx=ND
200	4530	0	86.0	0.0	1.00	1.00	1.57	2.1	6.4E-10	5.58	CO=95ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.18	CO=105ppm,O_3=ND,NOx=10ppm

Date : 18/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	25 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.9	2.58	1140	0	661.0	0.0	1.00	1.00	1.02	14.1	3.4E-09	8.03
100	10.7	2.14	1508	0	741.0	0.0	1.00	1.00	1.25	13.0	3.8E-09	8.12
200	8.8	1.76	1070	0	646.0	0.0	1.00	1.00	1.57	8.9	3.2E-09	8.46
300	6.7	1.34	873	0	604.0	0.0	1.00	1.00	1.93	6.9	3.2E-09	7.81

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4955	0	94.0	0.0	1.00	1.00	1.02	2.2	4.8E-10	8.03	CO=90ppm,O_3=60ppm,NOx=20ppm
100	4746	0	90.0	0.0	1.00	1.00	1.25	2.2	4.6E-10	8.12	CO=90ppm,O_3=ND,NOx=ND
200	3227	0	62.0	0.0	1.00	1.00	1.57	1.5	3.0E-10	8.46	CO=100ppm,O_3=ND,NOx=5ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	7.81	CO=75ppm,O_3=ND,NOx=10ppm

Date : 19/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
CO_2	20 cc/min
N_2	15 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.8	2.56	907	0	612.0	0.0	1.00	1.00	1.02	13.1	3.2E-09	7.97
100	10.7	2.14	2529	0	977.0	0.0	1.00	1.00	1.25	17.1	5.0E-09	8.12
200	8.9	1.78	754	0	580.0	0.0	1.00	1.00	1.57	8.0	2.8E-09	8.56
300	7	1.4	1327	0	701.0	0.0	1.00	1.00	1.93	8.0	3.5E-09	8.16

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3835	0	73.0	0.0	1.00	1.00	1.02	1.7	3.8E-10	7.97	CO=150ppm,O_3=160ppm,NOx=50ppm
100	4335	0	82.0	0.0	1.00	1.00	1.25	2.0	4.2E-10	8.12	CO=150ppm,O_3=ND,NOx=ND
200	3260	0	62.0	0.0	1.00	1.00	1.57	1.5	3.0E-10	8.56	CO=140ppm,O_3=ND,NOx=5ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.16	CO=120ppm,O_3=ND,NOx=10ppm

Date : 20/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(20%)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	20 cc/min
CO_2	10 cc/min
N_2	15 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.9	2.58	685	0	565.0	0.0	1.00	1.00	1.02	12.1	2.9E-09	8.03
100	10.7	2.14	756	0	580.0	0.0	1.00	1.00	1.25	10.2	3.0E-09	8.12
200	9.3	1.86	867	0	603.0	0.0	1.00	1.00	1.57	8.3	2.8E-09	8.95
300	7	1.4	714	0	572.0	0.0	1.00	1.00	1.93	6.5	2.9E-09	8.16

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4390	0	83.0	0.0	1.00	1.00	1.02	2.0	4.3E-10	8.03	CO=150ppm,O_3=400ppm,NOx=250ppm
100	5477	0	103.0	0.0	1.00	1.00	1.25	2.5	5.2E-10	8.12	CO=90ppm,O_3=100ppm,Nox=40ppm
200	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.95	CO=100ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	8.16	CO=80ppm,O_3=ND,NOx=10ppm

Date : 21/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	25 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	10.1	2.02	1056	2964	643.0	1085.0	-0.52	-0.69	-0.70	-9.4	-2.9E-09	6.29
100	9.1	1.82	1414	2950	720.0	1081.0	-0.51	-0.50	-0.63	-6.3	-2.2E-09	6.90
200	5.5	1.1	1515	3485	742.0	1223.0	-0.71	-0.65	-1.02	-6.6	-3.8E-09	5.29
300	5.3	1.06	3705	759	1283.0	581.0	0.19	0.55	1.06	8.0	4.7E-09	6.18

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5708	0	108.0	0.0	1.00	1.00	1.02	2.6	7.1E-10	6.29	CO=60ppm,O_3=ND,NOx=ND
100	5995	0	113.0	0.0	1.00	1.00	1.25	2.7	6.8E-10	6.90	CO=110ppm,O_3=ND,NOx=ND
200	5420	0	103.0	0.0	1.00	1.00	1.57	2.5	8.0E-10	5.29	CO=90ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.18	CO=85ppm,O_3=ND,NOx=10ppm

Date : 22/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(5250ppm)-CO_2 (20%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	10 cc/min
CO_2	20 cc/min
N_2	15 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.2	2.24	955	3017	622.0	1099.0	-0.53	-0.77	-0.78	-10.2	-2.8E-09	6.97
100	9.4	1.88	1427	2138	723.0	884.0	-0.23	-0.22	-0.28	-2.8	-9.3E-10	7.13
200	6.3	1.26	1387	2734	714.0	1027.0	-0.43	-0.44	-0.69	-4.3	-2.1E-09	6.06
300	5.4	1.08	3864	911	1329.0	613.0	0.14	0.54	1.04	8.2	4.7E-09	6.29

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5446	0	103.0	0.0	1.00	1.00	1.02	2.5	6.1E-10	6.97	CO=85ppm,O_3=ND,NOx=ND
100	6026	0	114.0	0.0	1.00	1.00	1.25	2.7	6.6E-10	7.13	CO=110ppm,O_3=ND,NOx=ND
200	6069	0	115.0	0.0	1.00	1.00	1.57	2.8	7.8E-10	6.06	CO=105ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.29	CO=140ppm,O_3=ND,NOx=10ppm

Date : 23/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-H_2O(10500ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	20 cc/min
CO_2	10 cc/min
N_2	15 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	10.2	2.04	1001	2900	631.0	1069.0	-0.57	-0.69	-0.71	-9.3	-2.9E-09	6.35
100	9	1.8	4570	2635	1543.0	1003.0	-0.47	0.35	0.44	9.5	3.3E-09	6.83
200	6	1.2	1717	3190	787.0	1144.0	-0.67	-0.45	-0.71	-4.9	-2.6E-09	5.77
300	5.2	1.04	3835	1061	1320.0	644.0	0.06	0.51	0.99	7.7	4.6E-09	6.06

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5860	0	111.0	0.0	1.00	1.00	1.02	2.7	7.2E-10	6.35	CO=65ppm,O_3=ND,NOx=ND
100	5785	0	109.0	0.0	1.00	1.00	1.25	2.6	6.6E-10	6.83	CO=75ppm,O_3=ND,NOx=ND
200	6116	0	115.0	0.0	1.00	1.00	1.57	2.8	8.2E-10	5.77	CO=75ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	6.06	CO=70ppm,O_3=ND,NOx=10ppm

Date : 20/12/2003

Subject : Removal of NH_3 1000 ppm $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	15 cc/min
Total flow rate	100 cc/min

Inlet concentration : NH_3 1000 ppm $(CH_3)_3N$ 100 ppm Current : 0.3 mA

			Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	12.5	2.5	947	0	558.0	0.0	1.00	1.00	1.02	11.9	3.0E-09	7.78
100	10.4	2.08	828	0	595.0	0.0	1.00	1.00	1.25	10.4	3.1E-09	7.89
200	8.5	1.7	724	0	574.0	0.0	1.00	1.00	1.57	7.9	2.9E-09	8.18
300	6.8	1.36	712	0	571.0	0.0	1.00	1.00	1.93	6.5	3.0E-09	7.92

	Peak Area$(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4519	0	86.0	0.0	1.00	1.00	1.02	2.1	4.6E-10	7.78	CO=110ppm,O_3=100ppm,NOx=40ppm
100	4934	0	94.0	0.0	1.00	1.00	1.25	2.2	4.9E-10	7.89	CO=100ppm,O_3=ND,NOx=ND
200	2956	0	57.0	0.0	1.00	1.00	1.57	1.4	2.9E-10	8.18	CO=90ppm,O_3=ND,NOx=10ppm
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	7.92	CO=70ppm,O_3=ND,NOx=10ppm

APPENDIX J

Simultaneous Removal of Acetaldehyde, Ammonia and Trimethylamine

Date : 7/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
CO_2	10 cc/min
N_2	27.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm- $(CH_3)_3N$ 150 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.2	2.24	4538	510	142.0	16.0	0.89	0.89	0.90	2.7	7.5E-10	6.97	1571	0	830	0	1.00	1.00	1.02	17.7	4.9E-09	6.97
100	9.6	1.92	4155	394	130.0	12.0	0.92	0.91	1.13	2.1	6.7E-10	7.28	1005	0	645	0	1.00	1.00	1.25	11.3	3.7E-09	7.28
200	7	1.4	3801	2723	119.0	85.0	0.43	0.29	0.45	0.5	2.1E-10	6.73	854	2427	587	1056	-0.10	-0.80	-1.26	-6.5	-2.9E-09	6.73
300	4.6	0.92	3247	1953	102.0	61.0	0.59	0.40	0.78	0.5	3.2E-10	5.36	4424	2871	1461	1157	-0.21	0.21	0.40	3.5	2.3E-09	5.36

	Peak Area ($(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	4030	0	77	0	1.00	1.00	1.02	1.6	4.6E-10	6.97	CO=160ppm,O_3=ND,NOx=ND
100	5141	0	97	0	1.00	1.00	1.25	1.7	5.5E-10	7.28	CO=180ppm,O_3=ND,NOx=ND
200	5518	0	104	0	1.00	1.00	1.57	1.4	6.4E-10	6.73	CO=110ppm,O_3=ND,NOx=ND
300	3378	0	64	0	1.00	1.00	1.93	0.7	4.9E-10	5.36	CO=100ppm,O_3=ND,NOx=10ppm

Date : 6/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2-CO_2 (20%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
CO_2	20 cc/min
N_2	17.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm- $(CH_3)_3N$ 150 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)		
33	11.5	2.3	4277	494	134.0	15.0	0.89	0.89	0.90	2.5	6.9E-10	7.16	861	0	590.0	0.0	1.00	1.00	1.02	12.6	3.4E-09
100	9.3	1.86	3782	339	118.0	11.0	0.92	0.91	1.13	1.9	6.3E-10	7.05	1901	0	923.0	0.0	1.00	1.00	1.25	16.2	5.4E-09
200	7.6	1.52	3792	630	119.0	20.0	0.86	0.83	1.31	1.4	5.6E-10	7.31	864	1533	591.0	819.0	0.19	-0.39	-0.61	-3.1	-1.3E-09
300	5.1	1.02	2822	1721	88.0	54.0	0.62	0.39	0.75	0.4	2.4E-10	5.94	1251	1779	730.0	890.0	0.12	-0.22	-0.42	-1.8	-1.1E-09

	Peak Area $(CH_3)_3N$		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5647	0	107.0	0.0	1.00	1.00	1.02	2.3	6.2E-10	7.16	CO=260ppm,O_3=ND,NOx=ND
100	6239	0	118.0	0.0	1.00	1.00	1.25	2.1	6.9E-10	7.05	CO=265ppm,O_3=ND,NOx=ND
200	6929	0	130.0	0.0	1.00	1.00	1.57	1.8	7.3E-10	7.31	CO=195ppm,O_3=ND,NOx=ND
300	3698	0	71.0	0.0	1.00	1.00	1.93	0.8	4.9E-10	5.94	CO=160ppm,O_3=ND,NOx=10ppm

Date : 5/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2- O_2(10%)-CO_2(10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
O_2	10 cc/min
CO_2	10 cc/min
N_2	17.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm- $(CH_3)_3N$ 150 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)		
33	11.9	2.38	4251	0	133.0	0.0	1.00	1.00	1.02	2.8	7.4E-10	7.41	881	0	598.0	0.0	1.00	1.00	1.02	12.8	3.3E-09
100	10	2	3848	0	121.0	0.0	1.00	1.00	1.25	2.1	6.6E-10	7.59	2857	0	1154.0	0.0	1.00	1.00	1.25	20.2	6.3E-09
200	8.6	1.72	3569	152	112.0	5.0	0.96	0.96	1.50	1.5	5.3E-10	8.27	837	0	580.0	0.0	1.00	1.00	1.57	8.0	2.9E-09
300	6.5	1.3	1284	205	40.0	6.0	0.96	0.85	1.64	0.4	1.9E-10	7.57	695	76	521.0	123.0	0.89	0.76	1.47	4.5	2.2E-09

	Peak Area ($(CH_3)_3N$)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	6193	0	117.0	0.0	1.00	1.00	1.02	2.5	6.5E-10	7.41	CO=165ppm,O_3=160ppm,NOx=80ppm
100	5935	0	112.0	0.0	1.00	1.00	1.25	2.0	6.1E-10	7.59	CO=115ppm,O_3=30ppm,NOx=10ppm
200	4672	0	89.0	0.0	1.00	1.00	1.57	1.2	4.4E-10	8.27	CO=160ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	7.57	CO=150ppm,O_3=ND,NOx=10ppm

Date : 4/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	7.5 cc/min
NH_3 (2000ppm)	50 cc/min
$(CH_3)_3N$ (2000ppm)	5 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	17.5 cc/min
Total flow rate	100 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm- $(CH_3)_3N$ 150 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)			
33	11.4	2.28	4220	438	132.0	14.0	0.90	0.89	0.91	2.5	6.9E-10	7.09	1008	0	646.0	0.0	1.00	1.00	1.02	13.8	3.8E-09	7.09
100	9.4	1.88	4061	338	127.0	11.0	0.92	0.91	1.14	2.0	6.7E-10	7.13	790	0	561.0	0.0	1.00	1.00	1.25	9.8	3.2E-09	7.13
200	7.6	1.52	3890	1015	122.0	32.0	0.76	0.74	1.16	1.2	5.1E-10	7.31	817	2305	572.0	1026.0	-0.54	-0.79	-1.25	-6.3	-2.6E-09	7.31
300	4.5	0.9	2916	1895	91.0	59.0	0.56	0.35	0.68	0.4	2.5E-10	5.24	1886	3135	919.0	1214.0	-0.83	-0.32	-0.62	-3.4	-2.3E-09	5.24

	Peak Area ($(CH_3)_3N$)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	5222	0	99.0	0.0	1.00	1.00	1.02	2.1	5.8E-10	7.09	CO=130ppm,O_3=ND,NOx=ND
100	5415	0	102.0	0.0	1.00	1.00	1.25	1.8	5.9E-10	7.13	CO=135ppm,O_3=ND,NOx=ND
200	5727	0	108.0	0.0	1.00	1.00	1.57	1.5	6.1E-10	7.31	CO=120ppm,O_3=ND,NOx=5ppm
300	3192	0	61.0	0.0	1.00	1.00	1.93	0.7	4.8E-10	5.24	CO=100ppm,O_3=ND,NOx=15ppm

Date : 23/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O(5250ppm)-CO_2 (10%)

Gas flow rate :

CH_3CHO (2000ppm)	10.5 cc/min
NH_3 (2000ppm)	70 cc/min
$(CH_3)_3N$ (2000ppm)	7 cc/min
O_2(10%)	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	22.5 cc/min
Total flow rate	140 cc/min

Inlet concentration : CH_3CHO 150 ppm - NH_3 1000 ppm- $(CH_3)_3N$ 150 ppm Current : 0.3 mA

			Peak Area (CH_3CHO)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Peak Area (NH_3)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}
T (°C)	V (kV)	P (W)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)		
33	11.7	2.34	5467	334	171.0	10.0	0.93	0.94	0.96	3.4	9.1E-10	7.28	1743	0	879.0	0.0	1.00	1.00	1.02	18.8	5.0E-09
100	9.6	1.92	5316	218	167.0	7.0	0.95	0.96	1.20	2.8	9.1E-10	7.28	1235	0	725.0	0.0	1.00	1.00	1.25	12.7	4.1E-09
200	8.6	1.72	5096	486	159.0	15.0	0.89	0.91	1.42	2.0	7.2E-10	8.27	1538	0	820.0	0.0	1.00	1.00	1.57	11.3	4.1E-09
300	6.5	1.3	2871	451	90.0	14.0	0.90	0.84	1.63	0.9	4.1E-10	7.57	354	290	346.0	306.0	0.54	0.12	0.22	0.5	2.2E-10

	Peak Area ($(CH_3)_3N$)		Concentration (ppm)		Removal Efficiency			Ψ_{elec}	Ψ_{ener}	E/N	Byproduct (ppm)
T (°C)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Outlet (mA) (avg.)	Outlet (0.3 mA)	Ψ ,(-)	Ψ' ,(-)	Ψ'' ,(-)				
33	3686	0	70.0	0.0	1.00	1.00	1.02	1.5	4.0E-10	7.28	CO=155ppm,O_3=90ppm,NOx=55p
100	4890	0	93.0	0.0	1.00	1.00	1.25	1.6	5.3E-10	7.28	CO=125ppm,O_3=ND,NOx=ND
200	4231	0	81.0	0.0	1.00	1.00	1.57	1.1	4.0E-10	8.27	CO=150ppm,O_3=ND,NOx=ND
300	0	0	0.0	0.0	1.00	0.00	0.00	0.0	0.0E+00	7.57	CO=150ppm,O_3=ND,NOx=10ppm

APPENDIX K

Simultaneous Removal of Acetaldehyde, Ammonia and Trimethyl amine using two serial reactors

Date : 28/1/2004

Subject : Removal of CH_3CHO 150 ppm - NH_3 1000 ppm - $(CH_3)_3N$ 100 ppm from N_2-O_2(10%)-H_2O (10500ppm)-CO_2(10%) using two reactors in series.

Gas flow rate :

CH_3CHO (2000ppm)	10.5 cc/min
NH_3 (2000ppm)	70 cc/min
$(CH_3)_3N$ (2000ppm)	7 cc/min
O_2(10%)	10 cc/min
N_2(bubbling)	10 cc/min
CO_2	10 cc/min
N_2	22.5 cc/min
Total flow rate	140 cc/min

Inlet concentration : CH3CHO 150 ppm - NH3 1000 ppm- (CH3)3N 150 ppm

1.First reactor

Temperature : 300°C Current : 0.3 mA

I (mA)	V(kV)	C_{out}, CH3CHO (ppm)	C_{out}, NH_3 (ppm)	C_{out}, $(CH_3)_3N$ (ppm)	Byproducts (ppm)
0.3	6.8	12	46	0.0	CO=100ppm,NOx=10ppm

2.Second reactor

Temperature : 100°C

I (mA)	V(kV)	C_{out}, CH3CHO (ppm)	C_{out}, NH_3 (ppm)	C_{out}, $(CH_3)_3N$ (ppm)	Byproducts (ppm)
0.0	0.0	3.5	0.0	0.0	CO=115ppm,O_3=ND,NOx=10ppm
0.1	9.3	0.0	0.0	0.0	CO=120ppm,O_3=ND,NOx=ND
0.2	10	0.0	0.0	0.0	CO=140ppm,O_3=80ppm,NOx=30ppm
0.3	10.4	0.0	0.0	0.0	CO=170ppm,O_3=140ppm,NOx=40ppm
0.4	11.2	0.0	0.0	0.0	CO=180ppm,O_3=160ppm,NOx=60ppm

2.Second reactor

Temperature : 200°C

I (mA)	V(kV)	C_{out}, CH3CHO (ppm)	C_{out}, NH_3 (ppm)	C_{out}, $(CH_3)_3N$ (ppm)	Byproducts (ppm)
0.0	0.0	5	0.0	0.0	CO=90ppm,O_3=ND,NOx=5ppm
0.1	7.6	0.0	0.0	0.0	CO=100ppm,O_3=ND,NOx=ND
0.2	8.2	0.0	0.0	0.0	CO=110ppm,O_3=ND,NOx=ND
0.3	9	0.0	0.0	0.0	CO=115ppm,O_3=ND,NOx=ND
0.4	9.6	0.0	0.0	0.0	CO=155ppm,O_3=ND,NOx=ND

VITA

Mr. Apiluck Iad-uea was born in Trang, Thailand, on February 15, 1979, the first son of Sumon and Rasri Iad-uea. After completing his high-school study at Princess Chulabhorn's College in Trang, in March 1997. He entered Prince of Songkla University, Songkla, in June, 1997. After earning the degree of Bachelor of Engineering in Chemical Engineering in March, 2001, he gained admission to the Graduate School of Chulalongkorn University in June 2001. He received financial support from Thailand Research Fund, which covered research materials and monthly expenses. In April 2004, he was awarded the degree of Master of Engineering in Chemical Engineering.