APPENDIX A

CALCULATIONS

Calculations

Equation 1a - Dry Molecular Weight:

$$MWd = 0.440(\%CO2) + 0.320(\%O2) + 0.280(\%N2 + \%CO)$$

Equation 1b - Wet Molecular Weight:

$$MWw = MWd(1-Bws) + 18.0(Bws)$$

Equation 2a - Meter Volume at Standard Conditions:

$$Vm(std) = VmY \frac{(Tstd)(Pbar + \Delta H/13.6)}{(Tm)(Pstd)}$$

Equation 2b - Volume of Water Vapor Condensed:

$$Vwc(std) = K1(Wf-Wi)$$

Equation 2c - Moisture Content:

$$Bws = Vwc(std)/(Vwc(std) + Vm(std))$$

Equation 3a - Velocity at a Traverse Point:

$$Vd = KpCp(Ts\Delta P/PsMWw)^{1/2}$$

Equation 3b - Volumetric Flow Rate (Actual Basis):

$$Q = Vd(avg)Ad\ 60$$

Equation 3c - Volumetric Flow Rate (Standard Basis):

$$Qstd = Q \frac{(Tstd)(Ps)}{(Ts)(Pstd)}$$

Equation 3d - Volumetric Flow Rate (Standard Dry Basis):

$$Qstd(dry) = Qstd(1-Bws)$$

Equation 4a - Isokinetic Sampling Nozzle Inside Diameter:

$$D_n = \left[\frac{(0.0358)QmPm}{TmCp(1-Bws)} \left[\frac{(TsMWw)}{(Ps\Delta P)}\right]^{0.5}\right]^{0.5}$$

Equation 4b - Isokinetic Sampling "X" Factor:

$$X = 846.72 \times Dn^4 \times \Delta H@i \times Cp^2 \times (1-Bws)^2 \times \frac{(MWd \times Ps)}{(MWw \times Pm)}$$

Equation 4c - Orifice Pressure Drop at Isokinetic Sampling Rate:

$$\Delta H = X \times \Delta P \times \frac{(Tm)}{(Ts)}$$

Equation 4d - Sample Percentage of Isokinetic:

$$\%ISO = \frac{(TsavgVmstdPstd100)}{(TstdVdavg\theta AnPs60(1-Bws))}$$

Equation 4e - Concentration of Mercury Species (µg/dscm):

$$C = \frac{(Ms - Mb)}{(Vmstd \times 0.0283)}$$

Equation 4f - Mercury Species Emission Rate (gram/hr):

$$ER = \frac{(Ms - Mb)}{Vmstd} \times Qstd(dry) \times 60$$

Symbol Identification

An	=	Nozzle area (ft^2)
Ad	=	Area of duct (ft^2)
Bws	=	Water vapor in gas stream, proportional by volume
C	=	Mercury species concentration (µg /dscm)
Cp	=	Pitot tube calibration factor (unitless)
Dn	=	Inside diameter of sample nozzle (inches)
ER	=	Mercury species emission rate (gram/hr)
K1	=	Constant (0.04715 ft^3/g)
Kp	=	Constant (85.49)
Mb	=	Mass of mercury species in blank (µg - as defined in Section 15.1 of the Ontario-Hydro Method)
Ms	=	Mass of mercury species in sample (µg)
MWd	=	Duct gas dry molecular weight (lb/lb-mole)
MWw	=	Duct gas wet molecular weight (lb/lb-mole)
Pbar	=	Barometric pressure ("Hg)
Pm	=	Meter pressure (assumed to be 30"Hg)
Ps	=	Absolute stack pressure ("Hg)
Pstd	=	Standard pressure (29.92"Hg)
Q	=	Duct volumetric flow rate (actual cfm)
Qm	=	Assumed sampling rate (cfm)

Symbol Identification (continued)

Qstd	=	Duct volumetric flow rate (scfm)
Qstd(dry)	=	Duct volumetric flow rate (dscfm)
Tm	=	Absolute temperature at meter (°R)
Ts	=	Absolute temperature of duct gas (°R)
Tstd	=	Standard temperature (528°R)
Vd	=	Duct velocity at a traverse point (ft/s)
Vm	=	Dry test meter volume (cf)
Vm(std)	=	Dry test meter volume at standard conditions (scf)
Vwc(std)	=	Volume of water vapor condensed at standard conditions (scf)
Wf	=	Final weight of impinger/absorber train (g)
Wi	=	Initial weight of impinger/absorber train (g)
X	=	Isokinetic orifice pressure drop sampling coefficient
Y	=	Dry test meter calibration factor (unitless)
%CO2	=	Duct gas carbon dioxide content (%volume)
%CO	=	Duct gas carbon monoxide content (%volume)
%ISO	=	Sample percentage of isokinetic (must be 100±10%)
%N2	=	Duct gas nitrogen content (%volume)
%O2	=	Duct gas oxygen content (%volume)
θ	=	Total sample time (minutes)
ΔH	=	Pressure drop across orifice ("H2O)
ΔH@i	=	Orifice calibration coefficient ("H2O)
ΔP	=	Pressure drop across pitot tube ("H2O)

APPENDIX B

RAW FIELD DATA and CALIBRATION DATA SHEETS

BRAUN INTERTEC

Field Data Sheet
EPA Methods 1-4
Project Number: Cnox-99-0263

Facility: Heskett
Sample Location: inlet
Run #: initial
Date: 2/19/99
Ambient T (°F): 75°
Pbar ("Hg): 27.82

Pstatic ("H2O): -18.5
Ps ("H2O):
Meter Box #: 81231
ΔH@i: 1.829
Gamma: 1.003
Pitot #: 18-2
Cp: 0.84

POINT	DUCT DATA		METER DATA			DRY TEST METER VOL
	Temp	ΔP	Tempi	Tempo	ΔH	
A 4	305°	0.37				
3	307	0.43				
2	308	0.30				
1	306	0.33				
B 4	308	0.29				
3	310	0.34				
2	310	0.22				
1	307	0.25				
C 4	308	0.22				
3	311	0.24				
2	313	0.30				
1	304	0.10				
D 4	307	0.22				
3	312	0.21				
2	314	0.25				
1	302	0.06				
E 4	310	0.15				
3	313	0.15				
2	316	0.14				
1	301	0.05				

Impinger#	Tare Weight	Final Weight	Net Weight
1			
2			
3			
4			
Total Net weight:			

Orsat Analysis

	CO2	O2	N2
RUN 1			
RUN 2			
RUN 3			
AVERAG			
AIR			

SN, KH

BRAUN INTERTEC

Field Data Sheet
EPA Methods 1-4
Project Number: Cmox-99-0262

Facility:	Hescott	Pstatic ("H2O):	-1.5
Sample Location:	inlet	Ps ("H2O):	
Run #:	initial	Meter Box #:	8/231
Date:	7/19/99	ΔH@i:	1.429
Ambient T (°F):	75°	Gamma:	1.008
Pbar ("Hg):	22.82	Pitot #:	1.82
		Cp:	0.84

POINT	DUCT DATA		METER DATA			DRY TEST METER VOL
	Temp	ΔP	Tempi	Tempo	ΔH	
F4	307°	0.20				
3	314	0.19				
2	316	0.18				
1	302	0.10				
F4	307	0.22				
3	314	0.22				
2	316	0.18				
1	313	0.26				

Impinger#	Tare Weight	Final Weight	Net Weight
1			
2			
3			
4			
Total Net weight:			

Orsat Analysis

	CO2	O2	N2
RUN 1			
RUN 2			
RUN 3			
AVERAG			
AIR			

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Heskett
Sample Location: Inlet
Run #: Blank
Date: 7/19/99
Ambient Temp.(oF): 70°
Pbar ("Hg): 27.82
Pstatic ("H2O):

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg):
Probe Material: Teflon
Probe Heater Setting: 250°
Filter Heater Setting: ~~250°~~ -
Nozzle #:

Meter Box #: 81231
ΔH@i: 1.829
Y: 1.003
Pitot #: 18-2
Cp: 0.84
Nozzle Material: Teflon/SS
Nozzle Diameter: 0.238

Pre-test Leak Rate: 0.006@10
Post-test Leak Rate:
X-Factor:

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA		Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Sample Line (oF)		

Comments:

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Haskett Date: 3/19/99

Sample Location: Inlet Run #: Blank

Run Time: —

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl		736.5	
Mod. G.S. 2	100 ml 1N KCl		728.2	
G.S. 3	100 ml 1N KCl		735.3	
Mod. G.S. 4	100 ml 5%HNO_3/15%H_2O_2		728.6	
Mod. G.S. 5	100 ml 4%$KMnO_4$/10%H_2SO_4		765.1	
Mod. G.S. 6	100 ml 4%$KMnO_4$/10%H_2SO_4		744.0	
G.S. 7	100 ml 4%$KMnO_4$/10%H_2SO_4		745.9	
Mod. G.S. 8	Silica Gel		672.0	
			TOTAL	

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1			
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: MDU Heskett
Sample Location: Inlet
Run #: ~~Blank~~ 1
Date: 7/19/99
Ambient Temp.(oF): 86
Pbar ("Hg): 22.82
Pstatic ("H2O): -18.5"

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 26.46
Probe Material: Teflon
Probe Heater Setting: 250°
Filter Heater Setting: na
Nozzle #:

Meter Box #: 81231
ΔH@i: 1.829
Y: 1.003
Pitot #: 18-2
Cp: 0.84
Nozzle Material: Teflon/SS
Nozzle Diameter: 0.238

Pre-test Leak Rate: 0.002@10
Post-test Leak Rate: 0.004@12
X-Factor: 2.426

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA		Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Sample Line (oF)		
A 4	1330	325	0.44	96	96	0.76	5	242	238	62	~~125.224~~
3	1335	327	0.44	98	95	0.76	5	245	229	60	125.311
2	1340	328	0.29	99	96	0.50	4	244	241	59	|
1	1345	319	0.42	99	96	0.73	5	237	234	58	134.700
B 4	1354	326	0.41	98	96	0.71	5	232	241	61	|
3	1359	328	0.43	100	96	0.74	5	248	237	58	|
2	1404	328	0.23	101	96	0.48	4	245	241	57	|
1	1409	320	0.41	100	96	0.71	5	240	244	58	143.709
C 4	1425	331	0.26	98	96	0.45	4	226	237	63	|
3	1430	331	0.27	100	97	0.48	5	240	245	60	|
2	1435	329	0.32	101	97	0.55	5	243	241	59	|
1	1440	313	0.11	102	97	0.19	4	246	246	60	152.705
D 4	1449	321	0.22	99	98	0.38	4	230	240	64	|
3	1454	330	0.23	~~98~~ 102	~~98~~	0.40	4	246	243	61	|
2	1459	322	0.27	102	98	0.47	5	250	243	61	|
1	1504	314	0.08	102	98	0.14	4	245	245	60	159.369
E 4	1515	321	0.14	98	96	0.24	4	239	243	61	|
3	1520	330	0.15	99	96	0.26	4	242	247	60	163.355
2	1525	328	0.13	98	95	0.22	4	241	241	59	165.753
1	1530	320	0.19	93	92	0.33	6	230	245	62	166.521
F 4	1627	335	0.18	92	92	0.36	8	242	241	60	|
3	1636	336	0.21	90	90	0.35	12	240	245	59	|
2	1641	335	0.20	89	89	0.34	9	240	241	57	|
1	1646	335	0.21	88	88	0.35	5	237	245	57	173.478
G 4	1653	335	0.23	87	86	0.38	5	243	240	60	|
3	1658	335	0.29	87	86	0.48	7	240	233	58	|
2	1703	334	0.22	86	86	0.37	9	243	240	57	|
1	1708	334	0.31	86	85	0.52	8	244	240	56	180.206

Comments: SN, KH

9 cfm

144.766 .6 166

39 .0 .1

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0261

Plant: Hackett Date: 7/15/99

Sample Location: Inlet Run #: 1

Run Time: 140 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	862.1	742.4	119.7
Mod. G.S. 2	100 ml 1N KCl	763.4	740.7	22.7
G.S. 3	100 ml 1N KCl	761.8	759.6	2.2
Mod. G.S. 4	100 ml 5%HNO3/15%H2O2	742.4	739.4	3.0
Mod. G.S. 5	100 ml 4%KMnO4/10%H2SO4	742.1	741.8	0.3
Mod. G.S. 6	100 ml 4%KMnO4/10%H2SO4	755.1	753.5	1.6
G.S. 7	100 ml 4%KMnO4/10%H2SO4	745.9	745.8	0.1
Mod. G.S. 8	Silica Gel	849.2	837.5	11.7
			TOTAL	161.3

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	8.6	11.8	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 063

Plant: Heskett
Sample Location: INLET
Run #: 2
Date: 7/20/99
Ambient Temp.(oF): 70°
Pbar ("Hg): 27.08
Pstatic ("H2O): -19.0

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 26.48
Probe Material: Teflon
Probe Heater Setting: 200°
Filter Heater Setting: -
Nozzle #:

Meter Box #: 81231
ΔH@i: 1.829
Y: 1.003
Pitot #: 18-2
Cp: 0.84
Nozzle Material: Teflon/SS
Nozzle Diameter: 0.238

Pre-test Leak Rate: 0.002 @ 10
Post-test Leak Rate: 0.002 @ 12
X-Factor: 2.426

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA		Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Sample Line (oF)		
A4	800	310	0.31	70	70	0.52	5	249	239	60	182.482
3	0805	312	0.33	72	71	0.55	6	248	244	52	
2	0810	313	0.39	73	71	0.65	9	248	245	52	
1	0816	297	0.40	74	71	0.69	11	244	240	51	190.856
B4	0825	311	0.31	72	71	0.52	10	245	238	55	
3	0830	320	0.37	75	72	0.62	12	245	232	53	
2	0835	319	0.24	76	72	0.46	9	245	246	53	196.488
1	0909	308	0.33	76	75	0.56	5	245	240	65	196.589
C4	0919	311	0.31	77	77	0.52	5	246	229	59	198.717
3	0924	324	0.33	80	77	0.55	5	245	232	54	
2	0929	314	0.31	81	77	0.52	5	245	244	54	
1	0934	305	0.13	82	78	0.22	4	245	241	54	206.179
D4	0942	327	0.20	80	78	0.33	4	246	239	63	
3	0947	325	0.27	84	86	0.45	5	245	235	57	
2	0952	316	0.26	84	80	0.44	5	245	243	57	
1	0957	296	0.10	84	80	0.18	4	245	245	57	212.863
E4	1005	326	0.19	81	80	0.32	4	246	237	62	
3	1010	327	0.15	85	81	0.25	4	245	243	59	
2	1015	317	0.16	85	82	0.27	4	245	246	60	
1	1020	298	0.06	86	82	0.11	4	246	247	60	218.334
F4	1028	322	0.16	84	83	0.27	4	246	235	68	
3	1033	328	0.15	87	84	0.25	4	246	243	63	
2	1038	323	0.20	87	84	0.34	5	246	245	61	
1	1043	294	0.07	88	85	0.12	4	246	246	59	223.814
G4	1052	320	0.11	86	85	0.19	4	246	230	68	
3	1057	328	0.20	88	86	0.34	5	246	242	60	
2	1102	318	0.21	89	86	0.36	5	246	244	58	
1	1107	297	0.29	89	86	0.51	5	247	246	58	230.304

Comments:

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 023

Plant: Hoeft Date: 3/20/99

Sample Location: Inlet Run #: 2

Run Time: 140 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	850.8	746.4	104.4
Mod. G.S. 2	100 ml 1N KCl	277.9	246.3	31.6
G.S. 3	100 ml 1N KCl	268.5	258.7	9.8
Mod. G.S. 4	100 ml 5%HNO3/15%H2O2	743.2	740.2	3.0
Mod. G.S. 5	100 ml 4%KMnO4/10%H2SO4	742.1	741.4	0.7
Mod. G.S. 6	100 ml 4%KMnO4/10%H2SO4	745.2	744.1	1.1
G.S. 7	100 ml 4%KMnO4/10%H2SO4	739.3	739.2	0.1
Mod. G.S. 8	Silica Gel	858.6	849.1	9.5
			TOTAL	160.2

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	8.6	11.8	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Heskett
Sample Location: Inlet
Run #: 3
Date: 7-20-99
Ambient Temp.(oF): 80
Pbar ("Hg): 27.08
Pstatic ("H2O): -19.0

Bws (assumed): 0.04
MWwet (assumed): 28.71
Ps ("Hg): 26.48
Probe Material: Teflon
Probe Heater Setting: 250
Filter Heater Setting: -
Nozzle #:

Meter Box #: 51231
ΔH@i: 1.829
Y: 1.003
Pitot #: 18-2
Cp: 0.84
Nozzle Material: Teflon 151
Nozzle Diameter: 0.238

Pre-test Leak Rate: 0.002 @ 10
Post-test Leak Rate: 0.002 @ 9
X-Factor: 2.426

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA		Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Sample Line (oF)		
A4	1157	327	0.32	86	88	0.54	4	228	230	61	~~2.426~~
3	1202	329	0.31	88	88	0.52	4	234	247	58	231.015
2	1207	328	0.27	89	89	0.46	4	244	246	56	
1	1212	313	0.39	90	89	0.67	5	245	236	54	239.234
B4	1219	328	0.18	89	89	0.30	4	246	236	61	
3	1224	330	0.25	90	90	0.42	4	246	239	59	
2	1229	329	0.24	91	89	0.41	4	246	247	56	
1	1234	321	0.31	92	89	0.53	5	246	237	55	246.493
C4	1241	330	0.34	90	89	0.57	5	246	231	62	
3	1246	334	0.35	93	90	0.59	5	245	233	58	
2	1251	331	0.34	93	90	0.58	5	246	249	56	
1	1256	315	0.09	93	90	0.16	4	245	237	56	253.886
D4	1304	333	0.28	90	89	0.47	5	246	245	65	
3	1309	335	0.29	93	90	0.49	5	246	249	60	
2	1314	334	0.27	93	90	0.46	5	246	247	58	
1	1319	318	0.09	94	96	0.16	5	247	247	57	260.793
E4	1338	330	0.18	91	92	0.31	4	246	232	64	261.149
3	1343	337	0.14	93	92	0.24	4	246	242	60	
2	1348	334	0.13	93	92	0.22	4	246	246	59	
1	1353	338	0.12	94	92	0.20	4	247	248	57	267.077
F4	1401	334	0.14	92	92	0.24	4	246	226	63	
3	1406	338	0.11	95	92	0.19	4	246	249	59	
2	1411	334	0.11	96	93	0.19	4	246	243	57	
1	1416	333	0.08	96	93	0.14	4	245	244	57	272.394
G4	1424	337	0.16	94	94	0.27	4	246	237	63	
3	1429	336	0.16	97	94	0.27	4	245	245	59	
2	1434	337	0.15	98	95	0.26	4	246	248	58	
1	1439	337	0.15	98	95	0.26	4	246	246	59	278.670

Comments:

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Hoskcft Date: 7/20/99

Sample Location: Inlet Run #: 3

Run Time: 120 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	869.4	733.6	135.8
Mod. G.S. 2	100 ml 1N KCl	743.8	731.0	12.8
G.S. 3	100 ml 1N KCl	733.9	731.4	2.5
Mod. G.S. 4	100 ml 5%HNO_3/15%H_2O_2	733.2	731.2	2.0
Mod. G.S. 5	100 ml 4%$KMnO_4$/10%H_2SO_4	761.0	760.0	1.0
Mod. G.S. 6	100 ml 4%$KMnO_4$/10%H_2SO_4	747.1	746.4	0.7
G.S. 7	100 ml 4%$KMnO_4$/10%H_2SO_4	745.8	745.5	0.3
Mod. G.S. 8	Silica Gel	676.6	672.0	4.6
			TOTAL	159.7

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	8.2	12.3	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0463

Plant: MDU Heskett
Sample Location: Stack
Run #: Stack Blank
Date: 7/19/99
Ambient Temp.(oF): 90°
Pbar ("Hg): 27.82
Pstatic ("H2O): -.45

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 27.79
Probe Material: Glass
Probe Heater Setting: 250°
Filter Heater Setting: 250°
Nozzle #:

Meter Box #: 38758
ΔH@i: 1.811
Y: 1.007
Pitot #: 3-2
Cp: 0.813
Nozzle Material: Glass
Nozzle Diameter: 0.302

Pre-test Leak Rate: 0.005 @ 12
Post-test Leak Rate:
X-Factor:

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA			Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Filter (oF)	Sample Line (oF)		

Comments:

BRAUN INTERTEC ENVIRONMENTAL, INC.
PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Haskell Date: 7/28/99

Sample Location: Stack Run #: Blank

Run Time: –

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl		733.8	
Mod. G.S. 2	100 ml 1N KCl		738.1	
G.S. 3	100 ml 1N KCl		737.6	
Mod. G.S. 4	100 ml 5%HNO_3/15%H_2O_2		741.0	
Mod. G.S. 5	100 ml 4%$KMnO_4$/10%H_2SO_4		756.2	
Mod. G.S. 6	100 ml 4%$KMnO_4$/10%H_2SO_4		753.7	
G.S. 7	100 ml 4%$KMnO_4$/10%H_2SO_4		727.5	
Mod. G.S. 8	Silica Gel		887.3	
			TOTAL	

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1			
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: MMU Heskett
Sample Location: Stack
Run #: ~~Blank~~ Run 1
Date: 7/19/99
Ambient Temp.(oF): 80°
Pbar ("Hg): 27.82
Pstatic ("H2O): -.45

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 27.79
Probe Material: Glass
Probe Heater Setting: 250°
Filter Heater Setting: 250°
Nozzle #:

Meter Box #: 38758
ΔH@i: 1.811
Y: 1.005
Pitot #: 32
Cp: 0.813
Nozzle Material: Glass
Nozzle Diameter: 0.302

Pre-test Leak Rate: 0.006@ 9
Post-test Leak Rate: 0.008@ 14
X-Factor: 6.808

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA			Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Filter (oF)	Sample Line (oF)		
A3	13:30	317	0.44	80	80	2.08	6	246	247		67	153.731
2	13:40	318	0.44	81	80	2.08	6	253	254		60	
1	13:50	318	0.41	84	81	1.95	6	246	249		61	
	14:00											176.750
B3	14:08	319	0.46	81	81	2.17	6	250	247		68	
2	14:17	319	0.42	82	80	1.98	7	249	245		58	
1	14:27	319	0.39	83	81	1.85	7	250	252		59	199.649
	14:37	~~317~~	~~0.47~~					~~248~~	~~256~~			
C3	14:48	317	0.47	81	81	2.22	7	248	256		64	
2	14:58	321	0.48	81	80	2.26	7	251	256		65	
1	15:08	321	0.49	82	80	2.31	7	249	255		67	
												224.263
D3	16:43	319	0.48	80	79	2.26	8	248	251		69	
2	16:53	322	0.51	79	78	2.39	8	250	253		68	
1	17:03	321	0.47	80	78	2.21	8	245	243		69	
												249.080

Comments:

BRAUN INTERTEC ENVIRONMENTAL, INC.
PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Helcft Date: 7/19/99

Sample Location: Stack Run #: 1

Run Time: 120 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	978.6	748.2	230.4
Mod. G.S. 2	100 ml 1N KCl	781.6	732.1	49.5
G.S. 3	100 ml 1N KCl	737.8	732.6	5.2
Mod. G.S. 4	100 ml 5%HNO3/15%H2O2	742.5	736.3	6.2
Mod. G.S. 5	100 ml 4%KMnO4/10%H2SO4	771.9	762.4	9.5
Mod. G.S. 6	100 ml 4%KMnO4/10%H2SO4	732.7	731.8	0.9
G.S. 7	100 ml 4%KMnO4/10%H2SO4	758.9	758.0	0.9
Mod. G.S. 8	Silica Gel	878.9	856.8	22.1
			TOTAL	319.2

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	7.9	12.3	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: MDU Heskett
Sample Location: Stack
Run #: 2
Date: 7/20/99
Ambient Temp.(oF): 70°
Pbar ("Hg): 27.88
Pstatic ("H2O): -.45

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 27.85
Probe Material: Glass
Probe Heater Setting: 250°
Filter Heater Setting: 250°
Nozzle #:

Meter Box #: 38758
ΔH@i: 1.811
Y: 1.005
Pitot #: 3-2
Cp: 0.813
Nozzle Material: Glass
Nozzle Diameter: 0.302

Pre-test Leak Rate: 0.006 @ 17
Post-test Leak Rate: 0.002 @ 10
X-Factor: 6.808

	POINT	TIME	DUCT DATA		METER DATA				HEATER DATA			Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
			Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Filter (oF)	Sample Line (oF)		
D	3	08:00	293	0.42	82	83	2.05	6	254	254		51	249.886
	2	08:10	297	0.47	81	81	2.28	7	248	257		47	
	1	08:20	299	0.40	84	81	1.95	6	252	250		51	
		08:30											273.349
C	3	08:40	306	0.48	80	80	2.30	7	253	255		60	
	2	08:50	308	0.45	84	81	2.17	7	251	248		52	
	1	09:00	308	0.40	87	81	1.93	7	263	244		54	
		09:10											297.134
B	3	09:22	311	0.42	83	83	2.01	7	265	254		66	
	2	09:32	311	0.39	87	83	1.88	7	257	248		52	
	1	09:42	311	0.38	90	84	1.84	7	253	250		55	
													319.551
A	3	10:40	314	0.38	85	85	1.82	7	260	248		63	
	2	10:50	316	0.37	87	85	1.77	7	261	244		50	
	1	11:00	308	0.32	92	86	1.56	7	259	247		51	
													340.757

Comments:

BRAUN INTERTEC ENVIRONMENTAL, INC.
PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 026

Plant: MDU Hewitt
Date: 7/20/99
Sample Location: Stack
Run #: 2
Run Time: 120 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	995.8	743.7	252.1
Mod. G.S. 2	100 ml 1N KCl	750.7	728.7	22.0
G.S. 3	100 ml 1N KCl	736.3	731.8	4.5
Mod. G.S. 4	100 ml 5%HNO3/15%H2O2	744.1	737.2	6.9
Mod. G.S. 5	100 ml 4%KMnO4/10%H2SO4	771.5	769.5	2.0
Mod. G.S. 6	100 ml 4%KMnO4/10%H2SO4	724.3	723.5	0.8
G.S. 7	100 ml 4%KMnO4/10%H2SO4	750.2	749.2	1.0
Mod. G.S. 8	Silica Gel	890.2	878.7	11.5
			TOTAL	300.9

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	8.0	12.2	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Haskett
Sample Location: Outlet
Run #: 3
Date: 7/20/99
Ambient Temp.(oF): 80°
Pbar ("Hg): 27.88
Pstatic ("H2O): -.94

Bws (assumed): 0.14
MWwet (assumed): 28.71
Ps ("Hg): 27.87
Probe Material: Glass
Probe Heater Setting: 250°
Filter Heater Setting: 250°
Nozzle #:

Meter Box #: 38758
ΔH@i: 1.811
Y: 1.007
Pitot #: 3-2
Cp: 0.813
Nozzle Material: Glass
Nozzle Diameter: 0.302

Pre-test Leak Rate: 0.006 @ 10
Post-test Leak Rate: 0.002 @ 10
X-Factor: 6.808

POINT	TIME	DUCT DATA		METER DATA				HEATER DATA			Impinger Outlet (oF)	Dry Test Meter Vol. (CF)
		Temp (oF)	ΔP ("H20)	Temp i (oF)	Temp o (oF)	ΔH ("H2O)	Vac ("Hg)	Probe (oF)	Filter (oF)	Sample Line (oF)		
A3	11:57	315	0.40	87	87	1.92	5	241	255		66	341.019
2	12:07	321	0.39	90	87	1.86	5	246	259		56	
1	12:17	316	0.33	94	88	1.60	4	250	249		57	
												362.904
B3	12:35	321	0.43	90	89	2.06	5	247	244		65	
2	12:45	320	0.38	96	90	1.84	5	244	248		55	
1	12:55	321	0.34	99	91	1.65	5	245	250		55	
												385.158
C3	13:15	323	0.45	93	92	2.16	5	250	243		65	
2	13:25	322	0.42	99	93	2.04	5	247	245		62	
1	13:35	322	0.39	101	94	1.90	5	248	244		59	
												409.425
D3	14:11	325	0.40	93	93	1.91	5	250	256		68	
2	14:21	325	0.43	96	93	2.07	6	253	248		55	
1	14:31	325	0.39	101	93	1.89	6	256	251		56	
												433.656

Comments:

BRAUN INTERTEC ENVIRONMENTAL, INC.
PARTICULATE FIELD DATA
PROJECT NUMBER: CMXX - 99 - 0263

Plant: Haskett Date: 7/20/99

Sample Location: Stack Run #: 3

Run Time: 120 min

Absorber Type	Contents	Final Weight (grams)	Tare Weight (grams)	Net Water (grams)
Mod. G.S. 1	100 ml 1N KCl	969.4	740.1	229.3
Mod. G.S. 2	100 ml 1N KCl	~~789.8~~ 789.9	735.6	54.3
G.S. 3	100 ml 1N KCl	744.4	739.3	5.1
Mod. G.S. 4	100 ml 5%HNO3/15%H2O2	743.3	737.0	6.3
Mod. G.S. 5	100 ml 4%KMnO4/10%H2SO4	750.2	749.3	0.9
Mod. G.S. 6	100 ml 4%KMnO4/10%H2SO4	754.3	753.3	1.0
G.S. 7	100 ml 4%KMnO4/10%H2SO4	724.8	724.4	0.4
Mod. G.S. 8	Silica Gel	890.8	886.6	4.2
			TOTAL	301.5

ORSAT ANALYSIS

	O_2	CO_2	N_2
Run 1	8.2	12.2	
Run 2			
Run 3			
Average			
Air Audit			

Comments :

DRY GAS METER CALIBRATIONS

DATE: 6/16/99

Meter box: 81231

Barometric press: 30.39

Calibrated by KH

Orifice setting (dH) in. H2O		Gas volume Wet test meter (Vw) L	Wet test meter (Vw) ft^3		Dry gas meter (Vd) ft^3	Temperatures Wet test meter average (tw) C	Wet test meter average (tw) F	Dry gas meter average (td) F	Time min.	Yi	dH@i in. H2O
0.5	initial	345.63	5.106	initial	314.490	22.2	71	74	13.0	1.003	1.785
	final	490.23		final	319.601						
1	initial	171.63	5.507	initial	308.367	22.2	71	74	10.0	1.006	1.816
	final	327.60		final	313.860						
2	initial	988.90	6.159	initial	301.962	22.2	71	72	8.0	1.002	1.865
	final	1163.33		final	308.089						
3	initial	848.07	4.737	initial	297.017	22.2	71	72	5.0	1.000	1.848
	final	982.21		final	301.727						

Average:	1.003	1.829
Deviation:	0.003	0.043

Meter Yi must be +-.01 of Yavg and .98< Yavg <1.02 for each run.
The Yavg of this meter is acceptable.

Meter dH@ should be +- 0.15 of dH@avg for each run.
Recommended range of dH@avg is 1.69< dH@avg <2.09 (not required).
The d@Havg of this meter is acceptable.

DRY GAS METER CALIBRATIONS

DATE: 7/6/99 Meter box: 38758

Barometric press: 30.16 Calibrated by KH

Orifice setting (dH) in. H2O		Gas volume Wet test meter (Vw) L	Gas volume Wet test meter (Vw) ft^3		Dry gas meter (Vd) ft^3	Temperatures Wet test meter average (tw) C	Temperatures Wet test meter average (tw) F	Temperatures Dry gas meter average (td) F	Time min.	Yi	dH@i in. H2O
0.5	initial	138.78	5.315	initial	645.916	24.4	76	77	13.0	1.002	1.682
	final	289.31		final	651.226						
1	initial	976.26	5.619	initial	640.219	24.4	76	77	10.0	1.007	1.781
	final	1135.38		final	645.798						
2	initial	793.70	6.120	initial	633.827	24.4	76	77	8.0	1.006	1.922
	final	967.02		final	639.890						
3	initial	651.06	4.772	initial	628.866	24.4	76	75	5.0	1.007	1.859
	final	786.21		final	633.563						

Average:	1.005	1.811
Deviation:	0.004	0.129

Meter Yi must be +-.01 of Yavg and .98< Yavg <1.02 for each run.
The Yavg of this meter is acceptable.

Meter dH@ should be +- 0.15 of dH@avg for each run.
Recommended range of dH@avg is 1.69< dH@avg <2.09 (not required).
The d@Havg of this meter is acceptable.

PITOT TUBE CALIBRATION

UNIT: 3-2 CALIBRATED BY: SN
DATE: 6/17/99

A SIDE CALIBRATION

RUN No.	dPstd "H20	dP(s) "H20	CP(s)	DEVIATION Cp(s)-Cp(A)
1	0.60	0.89	0.813	0.003
2	0.59	0.88	0.811	0.005
3	0.61	0.88	0.824	0.008
		Cp(A)	0.816	

B SIDE CALIBRATION

RUN No.	dPstd "H20	dP(s) "H20	CP(s)	DEVIATION Cp(s)-Cp(B)
1	0.61	0.90	0.815	0.004
2	0.60	0.90	0.808	0.002
3	0.60	0.90	0.808	0.002
		Cp(B)	0.811	

Cp(A)-Cp(B)| must be less than or equal to 0.01. This pitot is acceptable
Avg Deviation (A) must be less than or equal to 0.01 This pitot acceptable
Avg Deviation (B) must be less than or equal to 0.01 This pitot acceptable

AVG DEVIATION (A)	0.01	Cp(A)-Cp(B)	0.01
AVG DEVIATION (B)	0.00	**Cp**	**0.813**

PITOT TUBE CALIBRATION

UNIT: 18-2 CALIBRATED BY: SN
DATE: 6/17/99

A SIDE CALIBRATION

RUN No.	dPstd "H20	dP(s) "H20	CP(s)	DEVIATION Cp(s)-Cp(A)
1	0.60	0.83	0.842	0.002
2	0.59	0.82	0.840	0.004
3	0.61	0.83	0.849	0.005
		Cp(A)	0.843	

B SIDE CALIBRATION

RUN No.	dPstd "H20	dP(s) "H20	CP(s)	DEVIATION Cp(s)-Cp(B)
1	0.61	0.84	0.844	0.001
2	0.60	0.83	0.842	0.001
3	0.60	0.83	0.842	0.001
		Cp(B)	0.842	

|Cp(A)-Cp(B)| must be less than or equal to 0.01. This pitot is acceptable
Avg Deviation (A) must be less than or equal to 0.01 This pitot is acceptable
Avg Deviation (B) must be less than or equal to 0.01 This pitot is acceptable

AVG DEVIATION (A)	0.00	|Cp(A)-Cp(B) |	0.00
AVG DEVIATION (B)	0.00	**Cp**	**0.843**

BRAUN SM
INTERTEC

Heskett Station Meter Y_c Check

Pbar - 27.82

Inlet -

Meter - 81231
Y - 1.003
ΔHg - 1.829

V_i - 117.190
Vf - 125.014
Tm - 69° → 529°R

$$Y_c = \frac{10}{7.824}\left(\frac{0.0319 \times 529}{27.82}\right)^{1/2} = 0.995 \quad \text{ok}$$

$0.97y < Y_c < 1.03y$
$0.9729 < Y_c < 1.0331$

Outlet -

Meter - 38758
Y - 1.005
ΔHg - 1.811

V_i - 145.931
Vf - 153.651
Tm - 72° → 532°R

$$Y_c = \frac{10}{7.720}\left(\frac{0.0319 \times 532}{27.82}\right)^{1/2} = 1.012 \quad \text{o.k.}$$

$0.97y < Y_c < 1.03y$
$0.9749 < Y_c < 1.0352$

APPENDIX C

REDUCED FIELD DATA SHEETS

Client: M-DU Heskett Station

Sample Location: Inlet

	Run 1	Run 2	Run 3	Average
DSCFM	112,200	106,000	99,700	105,967
Mercury Results - Concentration (ug/dscm)				
Particle	3.258	2.024	5.284	3.522
Oxidized	3.713	0.664	0.314	1.564
Elemental	2.462	1.801	2.188	2.150
Total	9.433	4.489	7.786	7.236
			Check->	7.236
Mass Flow Rate (gram/hr)				
Particle	0.621	0.364	0.895	0.627
Oxidized	0.707	0.119	0.053	0.293
Elemental	0.469	0.324	0.370	0.388
Total	1.797	0.807	1.318	1.307
			Check->	1.307
Mass Flow Rate (lb/year)				
Particle	12.0	7.0	17.3	12.1
Oxidized	13.7	2.3	1.0	5.7
Elemental	9.1	6.3	7.2	7.5
Total	34.8	15.6	25.5	25.3
			Check->	25.3
Adjusted Mercury Results - (Based on Stack flow rates)				
Mass Flow Rate (gram/hr)				
Particle	1.163	0.689	1.761	1.204
Oxidized	1.324	0.225	0.104	0.551
Elemental	0.878	0.613	0.728	0.740
Total	3.365	1.527	2.593	2.495
			Check->	2.495
Mass Flow Rate (lb/year)				
Particle	22.5	13.2	34.0	23.2
Oxidized	25.7	4.4	2.0	10.7
Elemental	17.0	11.9	14.2	14.4
Total	65.2	29.5	50.2	48.3
			Check->	48.3

Sample Location: Stack

	Run 1	Run 2	Run 3	Average
DSCFM	210,120	200,540	196,120	202,260
Mercury Results - Concentration (ug/dscm)				
Particle	0.077	0.051	0.038	0.055
Oxidized	1.050	0.294	0.132	0.492
Elemental	3.331	3.834	3.374	3.513
Total	4.458	4.179	3.544	4.060
			Check->	4.060
Mass Flow Rate (gram/hr)				
Particle	0.027	0.017	0.013	0.019
Oxidized	0.374	0.100	0.044	0.173
Elemental	1.188	1.306	1.123	1.206
Total	1.589	1.423	1.180	1.397
			Check->	1.397
Mass Flow Rate (lb/year)				
Particle	0.5	0.3	0.2	0.3
Oxidized	7.2	1.9	0.8	3.3
Elemental	22.9	25.2	21.7	23.3
Total	30.6	27.4	22.7	26.9
			Check->	26.9
Hg Input from Coal -				
Coal Feed (Ton/hr)	61.325	60.592	61.682	61.200
Hg Content (ug/g)	0.098	0.088	0.073	0.086
Hg Input (g/hr)	5.452	4.837	4.085	4.791
Hg % Removal Efficiency - (Based upon Adjusted Inlet Results)				
Total	**52.78**	**6.81**	**54.49**	**43.99**
Hg % Removal Efficiency - (Based upon Coal Hg Input)				
Total	**70.85**	**70.58**	**71.11**	**70.84**

Reduced Isokinetic Field Data (page 1 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	81231
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:	1.829
Run #:	1	MWd(assumed):	30.45	Gamma:	1.003
Date:	07/19/99	Pstatic ("H2O):	-18.50	Pitot #:	18-2
Pbar ("Hg):	27.82	Probe Mat:	Teflon	Cp:	0.84
Ps ("Hg):	26.46	Nozzle Mat:	Teflon/SS	X-Factor:	2.426
Sample time/pt:	5.0	Dn (in.):	0.238	# of Ports:	7

PORT:	A		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	13	30	325	0.44	96	96	5.0	242	238	62	125.311	0.76
3	13	35	327	0.44	98	95	5.0	245	229	60		0.76
2	13	40	328	0.29	99	96	4.0	244	241	59		0.50
1	13	45	319	0.42	99	96	5.0	237	234	58		0.73
	13	50									134.700	
Run Time:		20	325	0.40	98	96	4.8	242	236	60	9.389	0.69

PORT:	B		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	13	54	326	0.41	98	96	5.0	232	241	61	134.700	0.71
3	13	59	328	0.43	100	96	5.0	248	237	58		0.74
2	14	4	328	0.23	101	96	4.0	245	241	57		0.40
1	14	9	320	0.41	100	96	5.0	240	244	58		0.71
	14	14									143.709	
Run Time:		20	326	0.37	100	96	4.8	241	241	59	9.009	0.64

PORT:	C		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	14	25	331	0.26	98	96	4.0	226	237	63	143.709	0.44
3	14	30	331	0.27	100	97	5.0	240	245	60		0.46
2	14	35	329	0.32	101	97	5.0	243	241	59		0.55
1	14	40	313	0.11	102	97	4.0	246	246	60		0.19
	14	45									152.705	
Run Time:		20	326	0.24	100	97	4.5	239	242	61	8.996	0.41

PORT:	D		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	14	49	321	0.22	99	98	4.0	230	240	64	152.705	0.38
3	14	54	330	0.23	102	98	4.0	246	243	61		0.40
2	14	59	322	0.27	102	98	5.0	250	243	61		0.47
1	15	4	314	0.08	102	98	4.0	245	245	60		0.14
	15	9									159.369	
Run Time:		20	322	0.20	101	98	4.3	243	243	62	6.664	0.35

Reduced Isokinetic Field Data (page 2 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:
Run #:	1	MWd(assumed):	30.45	Gamma:
Date:	07/19/99	Pstatic ("H2O):	-18.5	Pitot #:
Pbar ("Hg):	27.8	Probe Mat:	Teflon	Cp:
Ps ("Hg):	26.5	Nozzle Mat:	Teflon/SS	X-Factor:
Sample time/pt:	5	Dn (in.):	0.238	# of Ports:

PORT:	E		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	15	15	321	0.14	98	96	4.0	239	243	61	159.369	0.24
3	15	20	330	0.15	99	96	4.0	242	247	60		0.26
2	15	25	328	0.13	98	95	4.0	241	241	59	163.355	0.22
1	15	30	320	0.19	93	92	6.0	230	245	62	165.753	0.33
	15	35									166.521	
Run Time:		20	325	0.15	97	95	4.5	238	244	61	4.754	0.26

PORT:	F		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	16	27	335	0.18	92	92	8.0	242	241	60	166.521	0.30
3	16	32	336	0.21	90	90	12.0	240	245	59		0.35
2	16	37	335	0.20	89	89	9.0	240	241	57		0.34
1	16	42	335	0.21	88	88	5.0	237	245	57		0.35
	16	47									173.478	
Run Time:		20	335	0.20	90	90	8.5	240	243	58	6.957	0.34

PORT:	G		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	16	53	335	0.23	87	86	5.0	243	240	60	173.478	0.38
3	16	58	335	0.29	87	86	7.0	240	233	58		0.48
2	17	3	334	0.22	86	86	9.0	243	240	57		0.37
1	17	8	334	0.31	86	85	8.0	244	240	56		0.52
	17	13									180.206	
Run Time:		20	335	0.26	87	86	7.3	243	238	58	6.728	0.44

Post Test Leak Rate: 0.004 CFM @ 12 "Hg

Summary	140	328		96	94	6	241	241	60	52.497	0.45

Velocity Traverse and Volume Flow Rate Data

Plant: Heskett Station
Sample Location: ESP Inlet
Test Date: 07/19/99

Run #: 1

DUCT DIMENSIONS
Width: 120 inches
Depth: 120 inches
Area: 100.000 sq. feet

Pbar: 27.82 "Hg
Ps: 26.46 "Hg
Bws: 0.14
MWw: 28.52 g/g-mole
Tstd: 68 "deg F
Pstd: 29.92 "Hg
Cp: 0.84

	Traverse Data			
Traverse Point #	In. From Edge	Td (deg. F)	dP ("H2O)	Vd (ft/sec)
A4	105	325	0.44	48.6
A3	75	327	0.44	48.7
A2	45	328	0.29	39.5
A1	15	319	0.42	47.3
B4	105	326	0.41	46.9
B3	75	328	0.43	48.1
B2	45	328	0.23	35.2
B1	15	320	0.41	46.8
C4	105	331	0.26	37.5
C3	75	331	0.27	38.2
C2	45	329	0.32	41.5
C1	15	313	0.11	24.1
D4	105	321	0.22	34.3
D3	75	330	0.23	35.2
D2	45	322	0.27	38.0
D1	15	314	0.08	20.6
E4	105	321	0.14	27.3
E3	75	330	0.15	28.5
E2	45	328	0.13	26.5
E1	15	320	0.19	31.8
F4	105	335	0.18	31.3
F3	75	336	0.21	33.8
F2	45	335	0.20	33.0
F1	15	335	0.21	33.8
G4	105	335	0.23	35.4
G3	75	335	0.29	39.7
G2	45	334	0.22	34.6
G1	15	334	0.31	41.0
Average		328	0.26	36.7

Results:
Average Velocity: 36.68 fps @ 328 deg. F 26.46 "Hg

Q:	220.08	x 1000	ACFM	13,204.8	KACFH
Q (std):	130.49	x 1000	SCFM	7,829.4	KSCFH
Q (std dry):	112.19	x 1000	DSCFM	6,731.4	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.52	
Sample Loc:	ESP Inlet	Pstd:	29.92	An:	0.0003	sq. ft.
Date:	07/19/99	Vmstd:	46.636	%ISO:	96.1	
Run #:	1					

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Mod. Greenberg Smith	100 ml 0.1N KCl	862.1	742.4	119.7
Mod. Greenberg Smith	100 ml 0.1N KCl	763.4	740.7	22.7
Greenberg Smith	100 ml 0.1N KCl	761.8	759.6	2.2
Mod. Greenberg Smith	100ml 5%HNO3/10%H2O2	742.4	739.4	3.0
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	742.1	741.8	0.3
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	755.1	753.5	1.6
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	745.9	745.8	0.1
Mod. Greenberg Smith	Silica Gel	849.2	837.5	11.7
			TOTAL	161.3

Fixed Gas Analysis	
%CO2:	11.8
%O2:	8.6
%C0:	0.0
%N2	79.6
Fo	1.042
Bws:	0.140
DSCFM	112,200

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**	
Sample Front-Half:	4.3 ug	Sample KCl:	4.9 ug	Sample HNO3/H2O2:	< 0.25 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:	ND ug
Net Front-Half:	4.300 ug	Net KCl:	4.900 ug	Net HNO3/H2O2:	< 0.250 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:	0.010 ug
				Sample KMnO4:	3.0 ug
				Blank KMnO4:	ND ug
				Net KMnO4:	3.000 ug
				Detection Limit:	0.030 ug
Total Mercury:	12.45 ug			Total Elemental:	3.250 ug

	Concentration (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	3.258	0.621	12.0
Oxidized Hg	3.713	0.707	13.7
Elemental Hg	2.462	0.469	9.1
HNO3	0.189	0.036	
H2SO4	2.273	0.433	
Total Hg	9.433	1.797	34.8

Measured Flow: 112.2 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

Reduced Isokinetic Field Data (page 1 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	81231
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:	1.829
Run #:	2	MWd(assumed):	30.45	Gamma:	1.003
Date:	07/20/99	Pstatic ("H2O):	-19.00	Pitot #:	18-2
Pbar ("Hg):	27.88	Probe Mat:	Teflon	Cp:	0.84
Ps ("Hg):	26.48	Nozzle Mat:	Teflon/SS	X-Factor:	2.426
Sample time/pt:	5.0	Dn (in.):	0.238	# of Ports:	7

PORT:	A		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	8	0	310	0.31	70	70	5.0	249	239	60	182.482	0.52
3	8	5	312	0.33	72	71	6.0	248	244	52		0.55
2	8	10	313	0.39	73	71	9.0	248	245	52		0.65
1	8	15	299	0.40	74	71	11.0	244	240	51		0.68
	8	20									190.856	
Run Time:		20	309	0.36	72	71	7.8	247	242	54	8.374	0.60

PORT:	B		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	8	25	311	0.31	72	71	10.0	245	238	55	190.856	0.52
3	8	30	320	0.37	75	72	12.0	245	232	53		0.62
2	8	35	319	0.24	76	72	9.0	245	246	53	196.488	0.40
1	9	9	308	0.33	76	75	5.0	245	240	65		0.56
	9	14									198.717	
Run Time:		20	315	0.31	75	73	9.0	245	239	57	7.760	0.52

PORT:	C		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	9	19	311	0.31	77	77	5.0	246	229	59	198.717	0.52
3	9	24	324	0.33	80	77	5.0	245	232	54		0.55
2	9	29	316	0.31	81	77	5.0	245	244	54		0.52
1	9	34	305	0.13	82	78	4.0	245	241	54		0.22
	9	39									206.179	
Run Time:		20	314	0.27	80	77	4.8	245	237	55	7.462	0.46

PORT:	D		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	9	42	327	0.20	80	78	4.0	246	239	63	206.179	0.33
3	9	47	325	0.27	84	80	5.0	245	235	57		0.45
2	9	52	316	0.26	84	80	5.0	245	243	57		0.44
1	9	57	296	0.10	84	80	4.0	245	245	57		0.17
	10	2									212.863	
Run Time:		20	316	0.21	83	80	4.5	245	241	59	6.684	0.35

Reduced Isokinetic Field Data (page 2 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:	
Run #:	2	MWd(assumed):	30.45	Gamma:	
Date:	07/20/99	Pstatic ("H2O):	-19	Pitot #:	
Pbar ("Hg):	27.9	Probe Mat:	Teflon	Cp:	
Ps ("Hg):	26.5	Nozzle Mat:	Teflon/SS	X-Factor:	
Sample time/pt:	5	Dn (in.):	0.238	# of Ports:	

PORT:	E		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	10	5	326	0.19	81	80	4.0	246	237	62	212.863	0.32
3	10	10	327	0.15	85	81	4.0	245	243	59		0.25
2	10	15	317	0.16	85	82	4.0	245	246	60		0.27
1	10	20	298	0.06	86	82	4.0	246	247	60		0.10
	10	25									218.334	
Run Time:		20	317	0.14	84	81	4.0	246	243	60	5.471	0.24

PORT:	F		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	10	28	322	0.16	84	83	4.0	246	235	68	218.334	0.27
3	10	33	328	0.15	87	84	4.0	246	243	63		0.25
2	10	38	323	0.20	87	84	5.0	246	245	61		0.34
1	10	43	294	0.07	88	85	4.0	246	246	59		0.12
	10	48									223.814	
Run Time:		20	317	0.15	87	84	4.3	246	242	63	5.480	0.25

PORT:	G		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	10	52	320	0.11	86	85	4.0	246	230	68	223.814	0.19
3	10	57	328	0.20	88	86	5.0	246	242	60		0.34
2	11	2	318	0.21	89	86	5.0	246	244	58		0.36
1	11	7	297	0.29	89	86	5.0	247	246	58		0.51
	11	12									230.304	
Run Time:		20	316	0.20	88	86	4.8	246	241	61	6.490	0.35

Post Test Leak Rate: 0.002 CFM @ 12 "Hg

Summary	140	315		81	79	6	246	241	58	47.721	0.39

Velocity Traverse and Volume Flow Rate Data

Plant: Heskett Station
Sample Location: ESP Inlet
Test Date: 07/20/99

Run #: 2

DUCT DIMENSIONS
Width: 120 inches
Depth: 120 inches
Area: 100.000 sq. feet

Pbar: 27.88 "Hg
Ps: 26.48 "Hg
Bws: 0.147
MWw: 28.43 g/g-mole
Tstd: 68 "deg F
Pstd: 29.92 "Hg
Cp: 0.84

	Traverse Data			
Traverse Point #	In. From Edge	Td (deg. F)	dP ("H2O)	Vd (ft/sec)
A4	105	310	0.31	40.4
A3	75	312	0.33	41.8
A2	45	313	0.39	45.4
A1	15	299	0.40	45.6
B4	105	311	0.31	40.5
B3	75	320	0.37	44.5
B2	45	319	0.24	35.8
B1	15	308	0.33	41.7
C4	105	311	0.31	40.5
C3	75	324	0.33	42.1
C2	45	316	0.31	40.6
C1	15	305	0.13	26.1
D4	105	327	0.20	32.8
D3	75	325	0.27	38.1
D2	45	316	0.26	37.2
D1	15	296	0.10	22.8
E4	105	326	0.19	32.0
E3	75	327	0.15	28.4
E2	45	317	0.16	29.2
E1	15	298	0.06	17.7
F4	105	322	0.16	29.3
F3	75	328	0.15	28.5
F2	45	323	0.20	32.8
F1	15	294	0.07	19.0
G4	105	320	0.11	24.2
G3	75	328	0.20	32.9
G2	45	318	0.21	33.5
G1	15	297	0.29	38.8
Average		315	0.23	34.4

Results:
Average Velocity: 34.35 fps @ 315 deg. F 26.48 "Hg

Q:	206.10	x 1000	ACFM	12,366.0	KACFH
Q (std):	124.34	x 1000	SCFM	7,460.4	KSCFH
Q (std dry):	106.00	x 1000	DSCFM	6,360.0	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.43	
Sample Loc:	ESP Inlet	Pstd:	29.92	An:	0.0003	sq. ft.
Date:	07/20/99	Vmstd:	43.656	%ISO:	95.2	
Run #:	2					

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Mod. Greenberg Smith	100 ml 0.1N KCl	850.8	746.4	104.4
Mod. Greenberg Smith	100 ml 0.1N KCl	777.9	746.3	31.6
Greenberg Smith	100 ml 0.1N KCl	768.5	758.7	9.8
Mod. Greenberg Smith	100ml 5%HNO3/10%H2O2	743.2	740.2	3.0
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	742.1	741.4	0.7
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	745.2	744.1	1.1
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	739.3	739.2	0.1
Mod. Greenberg Smith	Silica Gel	858.6	849.1	9.5
			TOTAL	160.2

Fixed Gas Analysis	
%CO2:	11.8
%O2:	8.6
%C0:	0.0
%N2	79.6
Fo	1.042
Bws:	0.147
DSCFM	106,000

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**		
Sample Front-Half:	2.50 ug	Sample KCl:	0.82 ug	Sample HNO3/H2O2:	<	0.025 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:		ND ug
Net Front-Half:	2.500 ug	Net KCl:	0.820 ug	Net HNO3/H2O2:	<	0.025 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:		0.010 ug
				Sample KMnO4:		2.2 ug
				Blank KMnO4:		ND ug
				Net KMnO4:		2.200 ug
				Detection Limit:		0.030 ug
Total Mercury:	5.545 ug			Total Elemental:		2.225 ug

	Concentration (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	2.024	0.364	7.0
Oxidized Hg	0.664	0.119	2.3
Elemental Hg	1.801	0.324	6.3
HNO3	0.020	0.004	
H2SO4	1.781	0.321	
Total Hg	4.489	0.807	15.6

Measured Flow: 106.0 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

Reduced Isokinetic Field Data (page 1 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	81231
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:	1.829
Run #:	3	MWd(assumed):	30.45	Gamma:	1.003
Date:	07/20/99	Pstatic ("H2O):	-19.00	Pitot #:	18-2
Pbar ("Hg):	27.88	Probe Mat:	Teflon	Cp:	0.84
Ps ("Hg):	26.48	Nozzle Mat:	Teflon/SS	X-Factor:	2.426
Sample time/pt:	5.0	Dn (in.):	0.238	# of Ports:	7

PORT:	A		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	11	57	327	0.32	86	88	4.0	228	230	61	231.015	0.54
3	12	2	329	0.31	88	88	4.0	234	247	58		0.52
2	12	7	328	0.27	89	89	4.0	244	246	56		0.46
1	12	12	313	0.39	90	89	5.0	245	236	54		0.67
	12	17									239.234	
Run Time:		20	324	0.32	88	89	4.3	238	240	57	8.219	0.55

PORT:	B		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	12	19	328	0.18	89	89	4.0	246	236	61	239.234	0.30
3	12	24	330	0.25	90	90	4.0	246	239	59		0.42
2	12	29	329	0.24	91	89	4.0	246	247	56		0.41
1	9	9	321	0.31	92	89	5.0	246	237	55		0.53
	9	14									246.493	
Run Time:		20	327	0.25	91	89	4.3	246	240	58	7.760	0.42

PORT:	C		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	12	41	330	0.34	90	89	5.0	246	231	62	246.493	0.57
3	12	46	334	0.35	93	90	5.0	245	233	58		0.59
2	12	51	331	0.34	93	90	5.0	246	249	56		0.58
1	12	56	315	0.09	93	90	4.0	245	237	56		0.16
	13	1									253.886	
Run Time:		20	328	0.28	92	90	4.8	246	238	58	7.393	0.47

PORT:	D		Duct Data		Meter Data			Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	13	4	333	0.28	90	89	5.0	246	245	65	253.886	0.47
3	13	9	335	0.29	93	90	5.0	246	249	60		0.49
2	13	14	334	0.27	93	90	5.0	246	247	58		0.46
1	13	19	318	0.09	94	90	5.0	247	247	57		0.16
	13	24									260.793	
Run Time:		20	330	0.23	93	90	5.0	246	247	60	6.907	0.39

Reduced Isokinetic Field Data (page 2 of 2)

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	
Sample Loc:	ESP Inlet	MWs(assumed):	28.71	dH@i:	
Run #:	3	MWd(assumed):	30.45	Gamma:	
Date:	07/20/99	Pstatic ("H2O):	-19	Pitot #:	
Pbar ("Hg):	27.9	Probe Mat:	Teflon	Cp:	
Ps ("Hg):	26.5	Nozzle Mat:	Teflon/SS	X-Factor:	
Sample time/pt:	5	Dn (in.):	0.238	# of Ports:	

PORT:	E		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	13	38	330	0.18	91	92	4.0	246	232	64	261.149	0.30
3	13	43	337	0.14	93	92	4.0	246	242	60		0.24
2	13	48	334	0.13	93	92	4.0	246	246	59		0.22
1	13	53	338	0.12	94	92	4.0	247	248	57		0.20
	13	58									267.077	
Run Time:		20	335	0.14	93	92	4.0	246	242	60	5.928	0.24

PORT:	F		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	14	1	334	0.14	92	92	4.0	246	226	63	267.077	0.24
3	14	6	338	0.11	95	92	4.0	246	249	59		0.19
2	14	11	334	0.11	96	93	4.0	246	243	57		0.19
1	14	16	333	0.08	96	93	4.0	245	244	57		0.14
	14	21									272.394	
Run Time:		20	335	0.11	95	93	4.0	246	241	59	5.317	0.19

PORT:	G		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
4	14	.24	337	0.16	94	94	4.0	246	237	63	272.394	0.27
3	14	29	336	0.16	97	94	4.0	245	245	59		0.27
2	14	34	337	0.15	98	95	4.0	246	248	58		0.25
1	14	39	337	0.15	98	95	4.0	247	246	59		0.25
	14	44									278.670	
Run Time:		20	337	0.16	97	95	4.0	246	244	60	6.276	0.26

Post Test Leak Rate: 0.002 CFM @ 9 "Hg

Summary	140	331		93	91	4	245	242	59	47.800	0.36

Velocity Traverse and Volume Flow Rate Data

Plant: Heskett Station
Sample Location: ESP Inlet
Test Date: 07/20/99

Run #: 3

DUCT DIMENSIONS
Width: 120 inches
Depth: 120 inches
Area: 100.000 sq. feet

Pbar: 27.88 "Hg
Ps: 26.48 "Hg
Bws: 0.15
MWw: 28.46 g/g-mole
Tstd: 68 "deg F
Pstd: 29.92 "Hg
Cp: 0.84

	Traverse Data			
Traverse Point #	In. From Edge	Td (deg. F)	dP ("H2O)	Vd (ft/sec)
A4	105	327	0.32	41.5
A3	75	329	0.31	40.9
A2	45	328	0.27	38.2
A1	15	313	0.39	45.4
B4	105	328	0.18	31.2
B3	75	330	0.25	36.8
B2	45	329	0.24	36.0
B1	15	321	0.31	40.7
C4	105	330	0.34	42.9
C3	75	334	0.35	43.6
C2	45	331	0.34	42.9
C1	15	315	0.09	21.9
D4	105	333	0.28	39.0
D3	75	335	0.29	39.7
D2	45	334	0.27	38.3
D1	15	318	0.09	21.9
E4	105	330	0.18	31.2
E3	75	337	0.14	27.6
E2	45	334	0.13	26.6
E1	15	338	0.12	25.6
F4	105	334	0.14	27.6
F3	75	338	0.11	24.5
F2	45	334	0.11	24.5
F1	15	333	0.08	20.8
G4	105	337	0.16	29.5
G3	75	336	0.16	29.5
G2	45	337	0.15	28.6
G1	15	337	0.15	28.6
Average		331	0.21	33.1

Results:
Average Velocity: 33.05 fps @ 331 deg. F 26.48 "Hg

Q:	198.30	x 1000	ACFM	11,898.0	KACFH
Q (std):	117.20	x 1000	SCFM	7,032.0	KSCFH
Q (std dry):	99.66	x 1000	DSCFM	5,979.6	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.46	
Sample Loc:	ESP Inlet	Pstd:	29.92	An:	0.0003	sq. ft.
Date:	07/20/99	Vmstd:	42.795	%ISO:	99.3	
Run #:	3					

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Mod. Greenberg Smith	100 ml 0.1N KCl	869.4	733.6	135.8
Mod. Greenberg Smith	100 ml 0.1N KCl	743.8	731.0	12.8
Greenberg Smith	100 ml 0.1N KCl	733.9	731.4	2.5
Mod. Greenberg Smith	100ml 5%HNO3/10%H2O2	733.2	731.2	2.0
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	761.0	760.0	1.0
Mod. Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	747.1	746.4	0.7
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	745.8	745.5	0.3
Mod. Greenberg Smith	Silica Gel	676.6	672.0	4.6
			TOTAL	159.7

Fixed Gas Analysis	
%CO2:	12.3
%O2:	8.2
%C0:	0.0
%N2	79.5
Fo	1.033
Bws:	0.150
DSCFM	99,700

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**	
Sample Front-Half:	6.40 ug	Sample KCl:	0.38 ug	Sample HNO3/H2O2:	< 0.25 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:	ND ug
Net Front-Half:	6.400 ug	Net KCl:	0.380 ug	Net HNO3/H2O2:	< 0.250 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:	0.010 ug
				Sample KMnO4:	2.4 ug
				Blank KMnO4:	ND ug
				Net KMnO4:	2.400 ug
				Detection Limit:	0.030 ug
Total Mercury:	9.43 ug			Total Elemental:	2.650 ug

	Concentration (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	5.284	0.895	17.3
Oxidized Hg	0.314	0.053	1.0
Elemental Hg	2.188	0.370	7.2
HNO3	0.206	0.035	
H2SO4	1.982	0.335	
Total Hg	7.786	1.318	25.5

Measured Flow: 99.7 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

Reduced Isokinetic Field Data

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	38758
Sample Loc:	Main Stack	MWs(assumed):	28.71	dH@i:	1.811
Run #:	1	MWd(assumed):	30	Gamma:	1.005
Date:	07/19/99	Pstatic ("H2O):	-0.45	Pitot #:	3-2
Pbar ("Hg):	27.82	Probe Mat:	Glass	Cp:	0.813
Ps ("Hg):	27.79	Nozzle Mat:	Glass	X-Factor:	6.808
Sample time/pt:	10.0	Dn (in.):	0.302	# of Ports:	4

PORT:	A		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	13	20	317	0.44	80	80	6.0	246	247	67	153.731	2.08
2	13	30	318	0.44	81	80	6.0	253	254	60		2.08
1	13	40	318	0.41	84	81	6.0	246	249	61		1.95
	13	50									176.750	
Run Time:		30	318	0.43	82	80	6.0	248	250	63	23.019	2.04

PORT:	B		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	14	7	319	0.46	81	81	6.0	250	247	58	176.750	2.17
2	14	17	319	0.42	82	80	7.0	249	245	58		1.99
1	14	27	319	0.39	83	81	7.0	250	252	59		1.85
	14	37									199.649	
Run Time:		30	319	0.42	82	81	6.7	250	248	58	22.899	2.01

PORT:	C		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	16	43	317	0.47	81	81	7.0	248	256	64	199.649	2.23
2	16	53	321	0.48	81	80	7.0	251	256	65		2.26
1	17	3	321	0.49	82	80	7.0	249	255	67		2.32
	17	13									224.263	
Run Time:		30	320	0.48	81	80	7.0	249	256	65	24.614	2.27

PORT:	D		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	16	43	319	0.48	80	79	8.0	248	251	69	224.263	2.27
2	16	53	322	0.51	79	78	8.0	250	253	68		2.39
1	17	3	321	0.47	80	78	8.0	245	243	69		2.21
	17	13									249.080	
Run Time:		30	321	0.49	80	78	8.0	248	249	69	24.817	2.29
Post Test Leak Rate:				0.008	CFM @	14	"Hg					
Summary		120	319	0.46	81	80	7	249	251	64	95.349	2.15

Velocity Traverse and Volume Flow Rate Data

Plant:	Heskett Station		
Sample Location:	Main Stack		
Date:	07/19/99	Run #:	1

Duct Diameter (in.):	160.4	Ps ("Hg):	27.79
Rectangular Duct:	0.0	Bws:	0.147
Area (sq.ft.):	140.3	MWw:	28.48
		Tstd (F):	68
		Pstd ("Hg):	29.92
		Cp:	0.813

		Port: A			Port: B			Port: C			Port: D		
Point #	In. From Edge	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)
3	47.5	0.44	317	45.7	0.46	319	46.8	0.47	317	47.2	0.48	319	47.8
2	23.4	0.44	318	45.7	0.42	319	44.7	0.48	321	47.8	0.51	322	49.3
1	7.1	0.41	318	44.1	0.39	319	43.1	0.49	321	48.3	0.47	321	47.3

RESULTS:

Average Duct Velocity = 46.5 at 319 deg. F and 27.79 "Hg

Q	=	391.43 x1000	ACFM	23,485.8	KACFH
Qstd	=	246.31 x1000	SCFM	14,778.6	KSCFH
Qstd(dry)	=	210.12 x1000	DSCFM	12,607.2	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.48
Sample Loc:	Main Stack	Pstd:	29.92	An:	0.0005 sq. ft.
Date:	07/19/99	Vmstd:	87.527	%ISO:	97.9
Run #:	1				

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Modified Greenberg Smith	100 ml 0.1N KCl	978.6	748.2	230.4
Modified Greenberg Smith	100 ml 0.1N KCl	781.6	732.1	49.5
Greenberg Smith	100 ml 0.1N KCl	737.8	732.6	5.2
Modified Greenberg Smith	100ml 5%HNO3/10%H2O2	742.5	736.3	6.2
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	771.9	767.4	4.5
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	732.7	731.8	0.9
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	758.9	758	0.9
Modified Greenberg Smith	Silica Gel	878.9	856.8	22.1
			TOTAL	319.7

Fixed Gas Analysis	
%CO2:	12.3
%O2:	7.9
%C0:	0.0
%N2	79.8
Fo	1.057
Bws:	0.147
DSCFM	210100

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**		
Sample Front-Half:	0.19 ug	Sample KC	2.6 ug	Sample HNO3/H2O2:	<	0.25 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:		ND ug
Net Front-Half:	0.190 ug	Net KCl:	2.600 ug	Net HNO3/H2O2:	<	0.250 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:		0.010 ug
				Sample KMnO4:		8.0 ug
				Blank KMnO4:		ND ug
				Net KMnO4:		8.000 ug
				Detection Limit:		0.030 ug
Total Mercury:	11.04 ug			Total Elemental:		8.250 ug

	Concentrati (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	0.077	0.027	0.5
Oxidized Hg	1.050	0.374	7.2
Elemental Hg	3.331	1.188	22.9
HNO3	0.101	0.036	
H2SO4	3.230	1.152	
Total Hg	4.458	1.589	30.6

Measured Flow: 210.12 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

Reduced Isokinetic Field Data

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	38758
Sample Loc:	Main Stack	MWs(assumed):	28.71	dH@i:	1.811
Run #:	2	MWd(assumed):	30	Gamma:	1.005
Date:	07/20/99	Pstatic ("H2O):	-0.45	Pitot #:	3-2
Pbar ("Hg):	27.88	Probe Mat:	Glass	Cp:	0.813
Ps ("Hg):	27.85	Nozzle Mat:	Glass	X-Factor:	6.808
Sample time/pt:	10.0	Dn (in.):	0.302	# of Ports:	4

PORT:	A		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	8	0	293	0.42	82	83	6.0	254	254	51	249.886	2.06
2	8	10	297	0.47	81	81	7.0	248	257	47		2.29
1	8	20	299	0.40	84	81	6.0	252	250	51		1.95
	8	30									273.349	
Run Time:		30	296	0.43	82	82	6.3	251	254	50	23.463	2.10

PORT:	B		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	8	40	306	0.48	80	80	7.0	253	255	60	273.349	2.30
2	8	50	308	0.45	84	81	7.0	251	248	52		2.17
1	9	0	308	0.40	87	81	7.0	263	244	54		1.94
	9	10									297.134	
Run Time:		30	307	0.44	84	81	7.0	256	249	55	23.785	2.14

PORT:	C		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	9	22	311	0.42	83	83	7.0	265	254	66	297.134	2.01
2	9	32	311	0.39	87	83	7.0	257	248	52		1.88
1	9	42	311	0.38	90	84	7.0	253	250	55		1.85
	9	52									319.551	
Run Time:		30	311	0.40	87	83	7.0	258	251	58	22.417	1.91

PORT:	D		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	10	40	314	0.38	85	85	7.0	260	248	63	319.551	1.82
2	10	50	316	0.37	87	85	7.0	261	244	50		1.78
1	11	0	308	0.32	92	86	7.0	254	247	51		1.57
	11	10									340.757	
Run Time:		30	313	0.36	88	85	7.0	258	246	55	21.206	1.72
Post Test Leak Rate:				0.002	CFM @	10	"Hg					
Summary		120	307	0.41	85	83	7	256	250	54	90.871	1.97

Velocity Traverse and Volume Flow Rate Data

Plant:	Heskett Station		
Sample Location:	Main Stack		
Date:	07/20/99	Run #:	2

Duct Diameter (in.):	160.4	Ps ("Hg):	27.85
Rectangular Duct:	0.0	Bws:	0.146
Area (sq.ft.):	140.3	MWw:	28.48
		Tstd (F):	68
		Pstd ("Hg):	29.92
		Cp:	0.813

		Port: A			Port: B			Port: C			Port: D		
Point #	In. From Edge	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)
3	47.5	0.42	293	43.9	0.48	306	47.3	0.42	311	44.4	0.38	314	42.3
2	23.4	0.47	297	46.6	0.45	308	45.9	0.39	311	42.8	0.37	316	41.8
1	7.1	0.40	299	43.0	0.40	308	43.3	0.38	311	42.2	0.32	308	38.7

RESULTS:

Average Duct Velocity = 43.5 at 307 deg. F and 27.85 "Hg

Q	=	366.38 x1000	ACFM	21,982.8	KACFH
Qstd	=	234.79 x1000	SCFM	14,087.4	KSCFH
Qstd(dry)	=	200.54 x1000	DSCFM	12,032.4	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.48
Sample Loc:	Main Stack	Pstd:	29.92	An:	0.0005 sq. ft.
Date:	07/20/99	Vmstd:	83.031	%ISO:	97.3
Run #:	2				

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Modified Greenberg Smith	100 ml 0.1N KCl	995.8	743.7	252.1
Modified Greenberg Smith	100 ml 0.1N KCl	750.7	728.7	22.0
Greenberg Smith	100 ml 0.1N KCl	736.3	731.8	4.5
Modified Greenberg Smith	100ml 5%HNO3/10%H2O2	744.1	737.2	6.9
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	771.5	769.5	2.0
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	724.3	723.5	0.8
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	750.2	749.2	1.0
Modified Greenberg Smith	Silica Gel	890.2	878.7	11.5
			TOTAL	300.8

Fixed Gas Analysis	
%CO2:	12.2
%O2:	8.0
%C0:	0.0
%N2	79.8
Fo	1.057
Bws:	0.146
DSCFM	200500

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**	
Sample Front-Half:	0.12 ug	Sample KCl:	0.69 ug	Sample HNO3/H2O2:	0.31 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:	ND ug
Net Front-Half:	0.120 ug	Net KCl:	0.690 ug	Net HNO3/H2O2:	0.310 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:	0.010 ug
				Sample KMnO4:	8.7 ug
				Blank KMnO4:	ND ug
				Net KMnO4:	8.700 ug
				Detection Limit:	0.030 ug
Total Mercury:	9.82 ug			Total Elemental:	9.010 ug

	Concentrati (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	0.051	0.017	0.3
Oxidized Hg	0.294	0.100	1.9
Elemental Hg	3.834	1.306	25.2
HNO3	0.132	0.045	
H2SO4	3.702	1.261	
Total Hg	4.179	1.423	27.4

Measured Flow: 200.54 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

Reduced Isokinetic Field Data

Plant:	Heskett Station	Bws(assumed):	0.14	Meter Box #:	38758
Sample Loc:	Main Stack	MWs(assumed):	28.71	dH@i:	1.811
Run #:	3	MWd(assumed):	30	Gamma:	1.005
Date:	07/20/99	Pstatic ("H2O):	-0.45	Pitot #:	3-2
Pbar ("Hg):	27.88	Probe Mat:	Glass	Cp:	0.813
Ps ("Hg):	27.85	Nozzle Mat:	Glass	X-Factor:	6.808
Sample time/pt:	10.0	Dn (in.):	0.302	# of Ports:	4

PORT:	A		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	11	57	315	0.40	87	87	5.0	241	255	66	341.019	1.92
2	12	7	321	0.39	90	87	5.0	246	259	56		1.87
1	12	17	316	0.33	94	88	4.0	250	249	57		1.60
	12	27									362.904	
Run Time:		30	317	0.37	90	87	4.7	246	254	60	21.885	1.80

PORT:	B		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	12	35	321	0.43	90	89	5.0	247	244	65	362.904	2.06
2	12	45	320	0.38	96	90	5.0	244	248	55		1.84
1	12	55	321	0.34	99	91	5.0	245	250	55		1.66
	13	5									385.158	
Run Time:		30	321	0.38	95	90	5.0	245	247	58	22.254	1.85

PORT:	C		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	13	15	323	0.45	93	92	5.0	250	243	65	385.158	2.16
2	13	25	322	0.42	99	93	5.0	247	245	62		2.04
1	13	35	322	0.39	101	94	5.0	248	244	59		1.90
	13	45									409.425	
Run Time:		30	322	0.42	98	93	5.0	248	244	62	24.267	2.04

PORT:	D		Duct Data			Meter Data		Heater Data		Impinge	Meter	Theo.
Point	Time		Td	dP	Tmi	Tmo	Vac.	Probe	Filter	Outlet	Volume	dH
#	hr	mi	(F)	("H2O)	(F)	(F)	("Hg)	(F)	(F)	(F)	(CF)	("H2O)
3	14	11	325	0.40	93	93	5.0	250	256	68	409.425	1.92
2	14	21	325	0.43	96	93	6.0	253	248	55		2.07
1	14	31	325	0.39	101	93	6.0	256	251	56		1.90
	14	41									433.656	
Run Time:		30	325	0.41	97	93	5.7	253	252	60	24.231	1.96
Post Test Leak Rate:				0.002	CFM @	10	"Hg					
Summary		120	321	0.40	95	91	5	248	249	60	92.637	1.91

Velocity Traverse and Volume Flow Rate Data

Plant:	Heskett Station		
Sample Location:	Main Stack		
Date:	07/20/99	Run #:	3

Duct Diameter (in.):	160.4	Ps ("Hg):	27.85
Rectangular Duct:	0.0	Bws:	0.146
Area (sq.ft.):	140.3	MWw:	28.49
		Tstd (F):	68
		Pstd ("Hg):	29.92
		Cp:	0.813

		Port: A			Port: B			Port: C			Port: D		
Point #	In. From Edge	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)	dP ("H2O)	Ts (F)	Vd (ft/s)
3	47.5	0.40	315	43.4	0.43	321	45.2	0.45	323	46.3	0.40	325	43.7
2	23.4	0.39	321	43.1	0.38	320	42.5	0.42	322	44.7	0.43	325	45.3
1	7.1	0.33	316	39.5	0.34	321	40.2	0.39	322	43.1	0.39	325	43.2

RESULTS:

Average Duct Velocity = 43.4 at 321 deg. F and 27.85 "Hg

Q	=	365.05 x1000	ACFM	21,903.0	KACFH
Qstd	=	229.60 x1000	SCFM	13,776.0	KSCFH
Qstd(dry)	=	196.12 x1000	DSCFM	11,767.2	KDSCFH

Analytical Results

Plant:	Heskett Station	Tstd:	68	MWw:	28.49
Sample Loc:	Main Stack	Pstd:	29.92	An:	0.0005 sq. ft.
Date:	07/20/99	Vmstd:	83.267	%ISO:	99.8
Run #:	3				

IMPINGER ANALYSIS

TYPE	CONTENTS	W (g)	Wi (g)	Net (g)
Modified Greenberg Smith	100 ml 0.1N KCl	969.4	740.1	229.3
Modified Greenberg Smith	100 ml 0.1N KCl	789.9	735.6	54.3
Greenberg Smith	100 ml 0.1N KCl	744.4	739.3	5.1
Modified Greenberg Smith	100ml 5%HNO3/10%H2O2	743.3	737.0	6.3
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	750.2	749.3	0.9
Modified Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	754.3	753.3	1.0
Greenberg Smith	100 ml 4% KMnO4/10% H2SO4	724.8	724.4	0.4
Modified Greenberg Smith	Silica Gel	890.8	886.6	4.2
			TOTAL	301.5

Fixed Gas Analysis	
%CO2:	12.2
%O2:	8.2
%C0:	0.0
%N2	79.6
Fo	1.041
Bws:	0.146
DSCFM	196100

Concentration and Emission Rate Data

Particle-Bound Mercury		**Oxidized Mercury**		**Elemental Hg**		
Sample Front-Half:	0.089 ug	Sample KCl:	0.31 ug	Sample HNO3/H2O2:	<	0.25 ug
Blank Front-Half:	ND ug	Blank KCl:	ND ug	Blank HNO3/H2O2:		ND ug
Net Front-Half:	0.089 ug	Net KCl:	0.310 ug	Net HNO3/H2O2:	<	0.250 ug
Detection Limit:	0.010 ug	D.L:	0.030 ug	Detection Limit:		0.010 ug
				Sample KMnO4:		7.7 ug
				Blank KMnO4:		ND ug
				Net KMnO4:		7.700 ug
				Detection Limit:		0.030 ug
Total Mercury:	8.349 ug			Total Elemental:		7.950 ug

	Concentrati (ug/dscm)	Mass Flow Rate (gram/hr)	Mass Flow Rate* (lb/year)
Particle-Bound Hg	0.038	0.013	0.2
Oxidized Hg	0.132	0.044	0.8
Elemental Hg	3.374	1.123	21.7
HNO3	0.106	0.035	
H2SO4	3.268	1.088	
Total Hg	3.544	1.180	22.7

Measured Flow: 196.12 X1000 dscfm

* Assumes operation 24 hr/day, 365 day/year

APPENDIX D

SAMPLING LOG and CHAIN of CUSTODY RECORDS

NOTICE OF SAMPLE RECEIPT-PHILIP ANALYTICAL SERVICES

Attention: [redacted]
Client: Braun Intertec
Re Client Project: CMXX-99-0263
FAX #: 612-946-6001
Phone #: 612-833-4653

Jim,
receipt of Hg samples by lab

Samples for: 'DA' Hg
were received in good condition unless indicated below.

SAMPLE LISTING

Philip ID #	Sample ID	Date Sampled	Date Received
043189	Reagent Blank C7/C12	99/07/19	99/08/10
043190	1B-C01/C02	99/07/19	99/08/10
043191	1R1-C01/C02	99/07/19	99/08/10
043192	1R2-C01/C02	99/07/20	99/08/10
043193	1R3-C01/C02	99/07/20	99/08/10
043194	SR1-C01/C02	99/07/19	99/08/10
043195	SR2-C01/C02	99/07/20	99/08/10
043196	SR3-C01/C02	99/07/20	99/08/10
043225	SB-C01/C02	99/07/19	99/08/10
043224	Reagent Blank C11	99/07/20	99/08/10
043197	Reagent Blank C08	99/07/20	99/08/10
043198	1B-C03	99/07/19	99/08/10
043199	1R1-C03A/B	99/07/19	99/08/10
043200	1R2-C03A/B	99/07/20	99/08/10
043201	1R3-C03A/B	99/07/20	99/08/10
043202	SB-C03	99/07/19	99/08/10
043203	SR1-C03A/B	99/07/19	99/08/10
043204	SR2-C03A/B	99/07/20	99/08/10
043205	SR3-C03A/B	99/07/20	99/08/10
043215	Reagent Blank C10	99/07/20	99/08/10
043216	1B-C05	99/07/19	99/08/10
043217	1R1-C05	99/07/19	99/08/10
043218	1R2-C05	99/07/20	99/08/10
043219	1R3-C05	99/07/20	99/08/10
043220	SB-C05	99/07/19	99/08/10
043221	SR1-C05	99/07/19	99/08/10
043222	SR2-C05	99/07/20	99/08/10
043223	SR3-C05	99/07/20	99/08/10
043206	Reagent Blank C09	99/07/20	99/08/10
043207	1B-C04	99/07/19	99/08/10
043208	1R1-C04	99/07/19	99/08/10
043209	1R2-C04	99/07/20	99/08/10
043210	1R3-C04	99/07/20	99/08/10
043211	SB-C04	99/07/19	99/08/10
043212	SR1-C04	99/07/19	99/08/10

Comments:

Date 99/08/12

NOTICE OF SAMPLE RECEIPT-PHILIP ANALYTICAL SERVICES

Attention: Bruce Randall
Client: Braun Intertec
Re Client Project: CMXX-99-0263
FAX #: 612-946-6001
Phone #: 612-833-4653

Samples for:_____
were received in good condition unless
indicated below.

SAMPLE LISTING

Philip ID #	Sample ID	Date Sampled	Date Received
043213	SR2-C04	99/07/20	99/08/10
043214	SR3-C04	99/07/20	99/08/10

Comments:_____

_____

_____

Date 99/08/12

BRAUN INTERTEC[SM]
Braun Intertec Corporation
6875 Washington Ave. S.
Edina, MN 55439-0108

Bottle orders and sampling inquires:
labservices@brauncorp.com
Phone: 612-942-4930 Fax: 612-942-4844

REQUEST FOR LABORATORY ANALYTICAL SERVICES

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

For Braun Intertec Use Only
Braun Intertec Project No.

REPORT RESULTS TO
Contact Name Jones
Company Dre
Mailing Address
City, State, Zip 55435
Telephone # (612)
Fax # (612) 946-6001

Project ID/Project Name CWVY-99-0263
P.O. #

SEND INVOICE TO
Contact Name J. Trybo
Company
Address
City, State, Zip
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

Circle metals that require low detection limits
Ag | As | Be | Cd | Cr | Pb | Ni | Sb | Se | Tl | V | Other

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	Hg-Cu Intro Hydro										FOR LAB USE ONLY
1	IR1-CD1	7-19		filter				X										
2	IR2-CD1	7-20						X										
3	IR3-CD1	7-20						X										
4	IB-CD1 (blank)	7-19						X										
5	IR1-~~CD4~~ CD2	7-19		Liquid				X										
6	IR2-CD2	7-20						X										
7	IR3-CD2	"						X										
8	IB-CD2 (blank)	7-19						X										
9	IR1-CD3A > combine	7-19						X										
10	IR1-CD3B	"						X										
11	IR2-CD3A > combine	7-20						X										
12	IR2-CD3B	"						X										
13	IR3-CD3A > combine	7-20						X										
14	IR3-CD3B	"						X										
15	IB-CD3 (blank)	7-21						X										

CHAIN OF CUSTODY
Collected by: *(Print)*
Relinquished by: Date/Time 7-3-99
Relinquished by: Date/Time

Collector's Signature:
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time

Evidence Tape Intact ☐ Yes ☐ No ☐ N/A
Sample Condition Upon Receipt: ☐ Acceptable ☐ Other _____
Temperature _____ °C ☐ Received on Ice
Matrix Spike Samples Received: ☐ Yes ☐ No ☐ N/A

Comments:

BRAUN INTERTECSM
Braun Intertec Corporation
6875 Washington Ave. S.
Edina, MN 55439-0108

Bottle orders and sampling inquires:
labservices@brauncorp.com
Phone: 612-942-4930 Fax: 612-942-4844

REQUEST FOR LABORATORY ANALYTICAL SERVICES

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

For Braun Intertec Use Only
Braun Intertec Project No.

REPORT RESULTS TO
Contact Name: James Tryba
Company: Braun Intertec Corp.
Mailing Address: P.O. Box 35108
City, State, Zip: Minneapolis, MN 55439
Telephone #: (612) 833-4654 Fax #: (612) 946-6001

Project ID/Project Name: CMXX-99-0263
P.O. #

SEND INVOICE TO
Contact Name: Jo Tryba
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

Circle metals that require low detection limits

Ag	As	Be	Cd	Cr	Pb	Ni	Sb	Se	Tl	V	Other			

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	Hg-Cu-Fe-Mn-Ni-Zn										FOR LAB USE ONLY
1	IR1-CD4	7-19		Liquid				X										
2	IR2-CD4	7-20						X										
3	IR3-CD4	7-20						X										
4	IB-CD4 (blank)	7-19						X										
5	IR1-CD5	7-19						X										
6	IR2-CD5	7-20						X										
7	IR3-CD5	7-20						X										
8	IB-CD5 (blank)	7-19						X										
9	CD7 (reagent blank)	7-20						X										
10	CD8 (reagent blank)							X										
11	CD9 "							X										
12	CD10 "							X										
13	Nothing	below		this		line												
14																		
15																		

CHAIN OF CUSTODY
Collected by: *(Print)*
Relinquished by: [signature] Date/Time 7-20-99
Relinquished by: Date/Time

Collector's Signature:
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time

Evidence Tape Intact ☐ Yes ☐ No ☐ N/A
Sample Condition Upon Receipt: ☐ Acceptable ☐ Other _____
Temperature _____ °C ☐ Received on Ice
Matrix Spike Samples Received: ☐ Yes ☐ No ☐ N/A

Comments:

BRAUN INTERTEC℠
Braun Intertec Corporation
6875 Washington Ave. S.
Edina, MN 55439-0108

Bottle orders and sampling inquires:
labservices@brauncorp.com
Phone: 612-942-4930 Fax: 612-942-4844

REQUEST FOR LABORATORY ANALYTICAL SERVICES

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

For Braun Intertec Use Only
Braun Intertec Project No.

REPORT RESULTS TO
Contact Name: James Tryba
Company: Braun Intertec Corp
Mailing Address: 3916B (P.O. Box)
City, State, Zip: Minneapolis, MN 55439
Telephone #: (612) 833-4164 Fax #: (612) 946-6001

Project ID/Project Name: CMXY-99-0763
P.O. #

SEND INVOICE TO
Contact Name: J. Tryba
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

Circle metals that require low detection limits
Ag | As | Be | Cd | Cr | Pb | Ni | Sb | Se | Tl | V | Other

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	Hg-Cadmium Hydride										FOR LAB USE ONLY
1	SP1-CD1	7-19		filter				X										
2	SP2-CD1	7-20		↓				X										
3	SP3-CD1	7-20		↓				X										
4	SB-CD1 (Blank)	7-19		↓				X										
5	SP1-CD2	7-19		Liquid				X										
6	SP2-CD2	7-20		↓				X										
7	SP3-CD2	7-20		↓				X										
8	SB-CD2 (blank)	7-19		↓				X										
9	SP1-CD3A > combine	7-19		↓				X										
10	SP1-CD3B	"		↓				X										
11	SP2-CD3A > combine	7-20		↓				X										
12	SP2-CD3B	"		↓				X										
13	SP3-CD3A > combine	"		↓				X										
14	SP3-CD3B	"		↓				X										
15	SB-CD3 (blank)	7-19		↓				X										

CHAIN OF CUSTODY
Collected by: *(Print)*
Relinquished by: [signature] Date/Time 7-20
Relinquished by: Date/Time

Collector's Signature:
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time

Evidence Tape Intact ☐ Yes ☐ No ☐ N/A
Sample Condition Upon Receipt: ☐ Acceptable ☐ Other _____
Temperature _____ °C ☐ Received on Ice
Matrix Spike Samples Received: ☐ Yes ☐ No ☐ N/A

Comments:

BRAUN INTERTEC℠

Braun Intertec Corporation
6875 Washington Ave. S.
Edina, MN 55439-0108

Bottle orders and sampling inquires:
labservices@brauncorp.com
Phone: 612-942-4930 Fax: 612-942-4944

REQUEST FOR LABORATORY ANALYTICAL SERVICES

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

For Braun Intertec Use Only
Braun Intertec Project No.

REPORT RESULTS TO
Contact Name: Jones Tryba
Company: Braun Intertec Corp.
Mailing Address: P.O. Box 3[illegible]
City, State, Zip: Minneapolis, MN 55439
Telephone #: (612) 833-4[illegible] Fax #: (612) 946-6001

Project ID/Project Name: CMXX-99-0763
P.O. #

SEND INVOICE TO
Contact Name: J. Tryba
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting limits)

Circle metals that require low detection limits

Ag	As	Be	Cd	Cr	Pb	Ni	Sb	Se	Tl	V	Other			

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	Hg Cr Cd Ni Pb										FOR LAB USE ONLY
1	SP1 - Cd4	7-19		Liquid				X										
2	SP2 - Cd4	7-20						X										
3	SP3 - Cd4	7-20						X										
4	SB - Cd4 (blank)	7-19						X										
5	SP1 - Cd5	7-19						X										
6	SP2 - Cd5	7-20						X										
7	SP3 - Cd5	7-20						X										
8	SB - Cd5 (blank)	7-19						X										
9	Cd11 - Reagent blank	7-20						X										
10	Cd12A - Inlet filter reagent blank	7-20		filter				X										
11	Cd12B - Outlet filter reagent blank	7-20		"				X										
12	Nothing below this line																	
13																		
14																		
15																		

CHAIN OF CUSTODY
Collected by: *(Print)*
Relinquished by: [signature] Date/Time 7-20
Relinquished by: Date/Time

Collector's Signature:
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time

Evidence Tape Intact ☐ Yes ☐ No ☐ N/A
Sample Condition Upon Receipt: ☐ Acceptable ☐ Other _____
Temperature _____ °C ☐ Received on Ice
Matrix Spike Samples Received: ☐ Yes ☐ No ☐ N/A

Comments:

MDU Heskett Stack

BRAUN™ INTERTEC

Sample Log

ID	Date Collected	Date Stored
SR1 - CØ1	7/19/99	7/20/99
SR1 - CØ2		
SR1 - CØ3 A&B		
SR1 - CØ4		
SR1 - CØ5	7/19/99	7/20/99
SR2 - CØ1	7/20/99	7/20/99
SR2 - CØ2		
SR2 - CØ3 A&B		
SR2 - CØ4		
SR2 - CØ5	7/20/99	7/20/99
SR3 - CØ1	7/20/99	7/20/99
SR3 - CØ2		
SR3 - CØ3 A&B		
SR3 - CØ4		
SR3 - CØ5	7/20/99	7/20/99
SB - CØ1	7/19/99	7/20/99
SB - CØ2		
SB - CØ3		
SB - CØ4		
SB - CØ5	7/19/99	7/20/99

BRAUN™ INTERTEC

MDU Heskett Inlet
Sample log

ID	Date Collected	Date Stored
1R1-CØ1	7/19/99	7/20/99
1R1-CØ2		
1R1-CØ3 A&B		
1R1-CØ4		
1R1-CØ5	7/19/99	7/20/99
1R2-CØ1	7/20/99	7/20/99
1R2-CØ2		
1R2-CØ3 A+B		
1R2-CØ4		
1R2-CØ5	7/20/99	7/20/99
1R3-CØ1	7/20/99	7/20/99
1R3-CØ2		
1R3-CØ3 A&B		
1R3-CØ4		
1R3-CØ5	7/20/99	7/20/99
1B-CØ1	7/19/99	7/20/99
1B-CØ2		
1B-CØ3		
1B-CØ4		
1B-CØ5	7/19/99	7/20/99

BRAUN℠
INTERTEC

Stack
dp - .36
temp - 285°
- 0.06

Inlet
dp - .22
temp - 310
Static -

MDU - Heskett

BRAUN™
INTERTEC

7/19/99 -

- Arrived on-site 7:00 a.m.
- Setup on stack and west inlet
- Started Run 1 @ ~~11:40~~ 13:30
- Received written approval from EPA (Per Rick Patterson)
- Filter plugged on inlet test train. Impinger contents intermixed. Aborted run
- Started Run 1 @ 13:30. Completed @ 17:30

7/20

- Started Run 2 @ 8:00 A.m.
- Completed Run @ 11:16 A.m.
- Recovered both trains
- Started Run 3 @ 11:57 A.m.
- Completed Run @ 14:49 a.m.
- Recovered both trains

No problems encountered

07/21/99

MDU Heskett

BRAUN™
INTERTEC

	Inlet	Stack
Console -	81231	38758
dH@ -	1.829	1.811
Y -	1.005	1.005
Pitot -	18-2	3-2
cp -	0.84	0.813
bar μ -	27.82	27.82
x factor -	~~6.475~~ 2.426	6.808
Nozzle dia -	0.304	0.310
Static -	-18.5	-0.65
MWs -	28.71	28.71

APPENDIX E

ANALYTICAL DATA SHEETS

Mercury [illegible]

MVTL LABORATORIES, Inc.

P.O. BOX 1873, 1411 S. 12th STREET
BISMARCK, ND 58502
PHONE (701) 258-9720 WATS (800) 279-6885 FAX (701) 258-9724

MEMBER ACIL

WE ARE AN EQUAL OPPORTUNITY EMPLOYER

Sample Number: 99-01660

Report Date: 8/12/99

Sue Tracy
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Work Order #: 99-504
P.O. #: M2672-200 OA
Date Collected: 7/23/99

Sample Description: Test #1
Sample Site: Heskett

*** PROXIMATE ***

ANALYTE	AS RECEIVED		DRY BASIS	
Total Moisture	34.77	wt. %		
Ash	7.73	wt. %	11.85	wt. %
BTU/lb	7063	BTU/lb	10828	BTU/lb
Total Sulfur	1.06	wt. %	1.63	wt. %

*** ULTIMATE ***

ANALYTE	AS RECEIVED		DRY BASIS	
Total Moisture	34.77	wt. %		
Ash	7.73	wt. %	11.85	wt. %
Total Sulfur	1.06	wt. %	1.63	wt. %
Chlorine	< 0.01	wt. %	< 0.02	wt. %

*** SULFUR FORMS ***

ANALYTE	AS RECEIVED		DRY BASIS	
Total Sulfur	1.06	wt. %	1.63	wt. %

*** ASH FUSION ***

ANALYTE	REDUCING	OXIDIZING

*** MINERAL ANALYSIS OF ASH ***

ANALYTE	DRY BASIS

*** MISCELLANEOUS ***

ANALYTE	AS RECEIVED		DRY BASIS	
Mercury, Trace ug/g	0.064	ug/g	0.098	ug/g

D. Zook

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

MVTL LABORATORIES, Inc.
P.O. BOX 1873, 1411 S. 12th STREET
BISMARCK, ND 58502
PHONE (701) 258-9720 WATS (800) 279-6885 FAX (701) 258-9724

MEMBER ACIL

WE ARE AN EQUAL OPPORTUNITY EMPLOYER

Sample Number: 99-C1661

Report Date: 8/12/99

Sue Tracy
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Work Order #: 89-504
P.O. #: M2672-200 OA
Date Collected: 7/20/99

Sample Description: Test #2
Sample Site: Heskett

*** PROXIMATE ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Moisture	34.96 wt. %	
Ash	6.66 wt. %	10.24 wt. %
BTU/lb	7081 BTU/lb	10887 BTU/lb
Total Sulfur	0.74 wt. %	1.14 wt. %

*** ULTIMATE ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Moisture	34.96 wt. %	
Ash	6.66 wt. %	10.24 wt. %
Total Sulfur	0.74 wt. %	1.14 wt. %
Chlorine	< 0.01 wt. %	< 0.02 wt. %

*** SULFUR FORMS ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Sulfur	0.74 wt. %	1.14 wt. %

*** ASH FUSION ***

ANALYTE	REDUCING	OXIDIZING

*** MINERAL ANALYSIS OF ASH ***

ANALYTE	DRY BASIS

*** MISCELLANEOUS ***

ANALYTE	AS RECEIVED	DRY BASIS
Mercury, Trace ug/g	0.037 ug/g	0.058 ug/g

D. Zand

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

MVTL LABORATORIES, Inc.
P.O. BOX 1873, 1411 S. 12th STREET
BISMARCK, ND 58502
PHONE (701) 258-9720 WATS (800) 279-6885 FAX (701) 258-9724

MEMBER ACIL

WE ARE AN EQUAL OPPORTUNITY EMPLOYER

Sample Number: 99-01662

Report Date: 8/12/99

Sue Tracy
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Work Order #: 89-504
P.O. #: 42672-200 OA
Date Collected: 7/29/99

Sample Description: Test #3
Sample Site: Heskett

*** PROXIMATE ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Moisture	34.49 wt. %	
Ash	7.88 wt. %	12.03 wt. %
BTU/lb	6988 BTU/lb	10666 BTU/lb
Total Sulfur	0.78 wt. %	1.19 wt. %

*** ULTIMATE ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Moisture	34.49 wt. %	
Ash	7.88 wt. %	12.03 wt. %
Total Sulfur	0.78 wt. %	1.19 wt. %
Chlorine	< 0.01 wt. %	< 0.02 wt. %

*** SULFUR FORMS ***

ANALYTE	AS RECEIVED	DRY BASIS
Total Sulfur	0.78 wt. %	1.19 wt. %

*** ASH FUSION ***

ANALYTE	REDUCING	OXIDIZING

*** MINERAL ANALYSIS OF ASH ***

ANALYTE	DRY BASIS

*** MISCELLANEOUS ***

ANALYTE	AS RECEIVED	DRY BASIS
Mercury, Trace ug/g	0.048 ug/g	0.073 ug/g

Approved By: D. Zorda

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

PHILIP SERVICES

Bruce Randell
Braun Intertec
8585 West 78th Street
Minneapolis, MN
55438

December 7, 1999

Dear Mr. Randell:

Re Correction on Proj# CMXX-99-0263 (PASC Submission # 9H0294):

Regretfully, we must inform you that there were calculation errors on some of the draft ASTM mercury speciation data reported to you in the past. The portions that were impacted are the KCl and KMnO4 impinger data which were reported high by a factor of 9/4th relative to the correct value.

The error occurred where a correction factor for sample vs standard prep of 1.5 was applied to the data in the wrong direction - a multiplication rather than a division. The 1.5 factor compensates for a 1.5-fold dilution of the standards during the preparation of these digested standards.

Enclosed is a revised report that presents the final results to the correct values. In regard to the corresponding data packages; the concentrations on the corresponding run sequence tables are incorrect since the dilution factors were entered as 1.5 (or appropriate dilutions of this value) rather than 0.667. The corresponding final ug of mercury per train portion as reported on the run sequence tables and on the validation tables have been reported high by the factor of 9/4th. I have enclosed copies of example pages from the original data package in which these errors are present. Instead of correcting each erroneous page of the original package, I request that with the data package as submitted to you prior, you include this letter of explanation and the enclosed revised report.

Of course quality data is of great concern to Philip and since this error has past several review stages before it has been identified, our review processes must be re-evaluated. We will also keep you informed as to the appropriated corrective actions that we implement to ensure that such an error will not repeat.

Should you have any questions in this regard please do not hesitate to contact me at extension 236 or the QA/QC scientist, Gerry Bengert, at extension 248.

Yours truly,

Ronald A. McLeod, Ph.D., C.Chem.
Principal Scientist

cc: Gerry Bengert

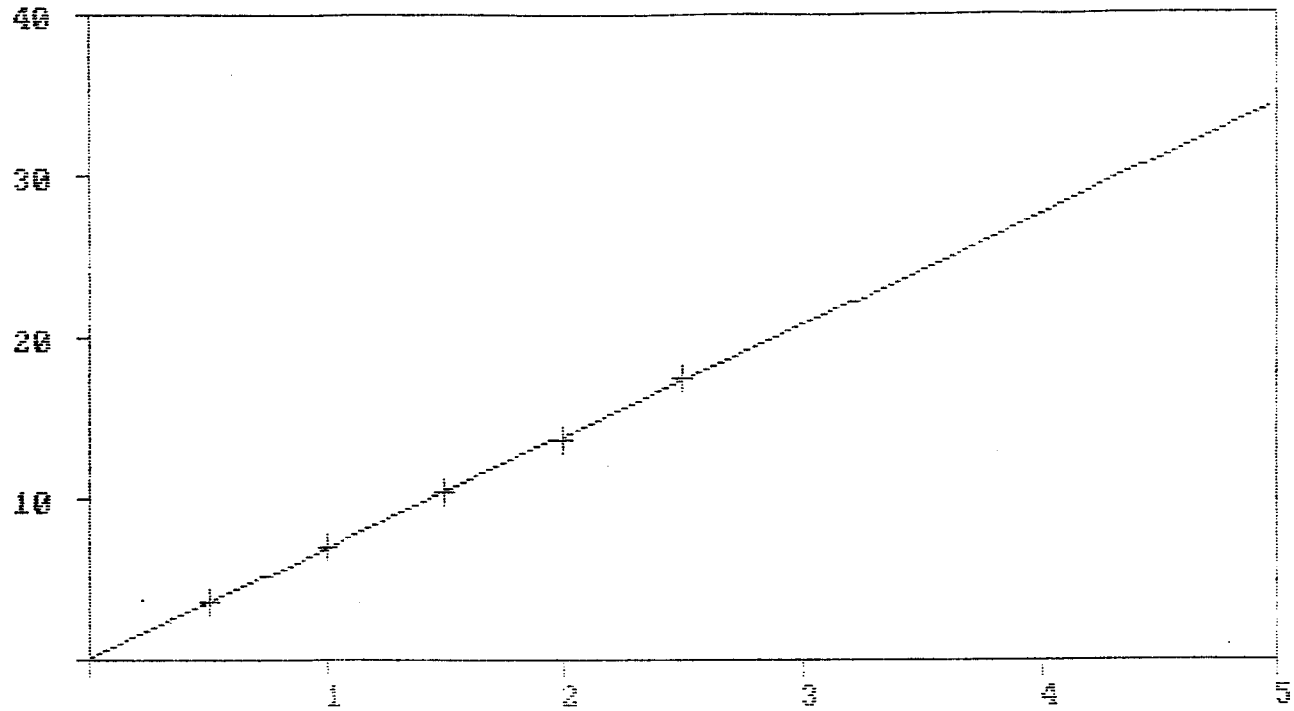
Philip Analytical Services Corporation
5555 North service Road Burlington, Ontario Canada L7L 5H7 Tel:(905) 332-8788 Fax:(905) 332-9169

enon mber	Client	Client ID	Parameter	TS	Result	Dup.	Spike	% Rec.	Dup. Spk	% Rec.	Batch Date	Batch Code	Run Date	Run Code	Day Old	Day In	Analyst's Comments
3216	BRAUN-MN	1B-C05	Mercury -	PV	0.666						99/10/05	3GMN	99/10/05	MG02	78.	56.	
3217	BRAUN-MN	1R1-C05	Mercury -	PV	6.804	6.831	13.863	93.	13.956	95.	99/10/05	3GMN	99/10/05	MG02	78.	56.	*BLKIMP*
3218	BRAUN-MN	1R2-C05	Mercury -	PV	4.869						99/10/05	3GMN	99/10/05	MG02	77.	56.	
3219	BRAUN-MN	1R3-C05	Mercury -	PV	5.495						99/10/05	3GMN	99/10/05	MG02	77.	56.	
3220	BRAUN-MN	SB-C05	Mercury -	PV	0.518						99/10/05	3GMN	99/10/05	MG02	78.	56.	
3221	BRAUN-MN	SR1-C05	Mercury -	PV	18.038						99/10/05	3GMN	99/10/05	MG02	78.	56.	
3222	BRAUN-MN	SR2-C05	Mercury -	PV	19.533						99/10/05	3GMN	99/10/05	MG02	77.	56.	
3223	BRAUN-MN	SR3-C05	Mercury -	PV	17.425						99/10/05	3GMN	99/10/05	MG02	77.	56.	
L1005	INTERNAL		Mercury -	PV	-0.030	-99999.0	0.307	102.	0.290	97.	99/10/05	3GMN	99/10/05	MG02	$$$	$$$	

9 Tests for OHMN4 with an MDL of 0.030 ug Validated By [signature] Control Chart Updated N/A IO Requirements met N/A

00123

CHANNEL NAME: LDC
RUN NAME: 991005W



DATA TYPE: FIA
CALIBRATION ORDER: 1
INTERCEPT = -7.44
SLOPE = 6.862724

CORRELATION: .9999237

CHANNEL NAME: LDC
RUN DATE: 10-06-1999
SAMPLE TABLE NAME: 991005W
METHOD NAME: HGWATER

CUP#	SAMPLE ID	DIL	WGT	HEIGHT/AREA	CONCENTRATION (ppb)	EF
1	PRIMER	1	1	10.1	1.466	s
2	DUMMY	1	1	0.0	-0.004	I
3	S1: 0	1	1	0.1	-0.000	I
4	S2: .5	1	1	3.6	0.509	
5	S3: 1	1	1	6.9	0.996	
6	S4: 1.5	1	1	10.4	1.498	
7	S5: 2	1	1	13.7	1.982	
8	S6: 2.5	1	1	17.3	2.516	
9	ICV	1	1	10.1	1.462	97%
10	B	1	1	0.0	-0.011	b
11	D4	1	1	10.4	1.498	d
12	WS 378	1	1	12.6	1.818	91%
13	ORG REF	1	1	11.9	1.719	86%
14	BL1005-1GMN	1	1	0.0	-0.011	I
15	BL1005-1GMN	1	1	0.0	-0.011	I
16	BL1005S	1	1	6.9	0.996	s
17	BL1005S	1	1	6.9	0.993	
18	BL1005DS	1	1	6.9	1.000	
19	BL1005DS	1	1	6.9	0.989	
20	53747	30	1	7.9	34.369	
21	53747	30	1	7.8	33.621	

TUG

<0.03

REPEATED @ END TO CHECK. NA

00142

25	53747D	30	1	14.0	[illegible]	
26	53747DS	30	1	14.1	61.577	
27	53747DS	30	1	14.0	61.056	
28	53747DS	150	1	2.8	60.289	
29	53747DS	150	1	2.9	61.890	
30	53751	1.5	1	4.6	0.993	
31	53751	1.5	1	4.4	0.939	s
32	53751D	1.5	1	4.4	0.939	
33	53751D	1.5	1	4.7	1.003	
34	CCV	1	1	6.8	0.978 98%	
35	B	1	1	0.0	-0.011	b
36	D4	1	1	10.4	1.498	d
37	53751S	1.5	1	9.6	2.092	
38	53751S	1.5	1	10.5	2.279	
39	53747DS	1.5	1	10.2	2.220	
40	53747DS	1.5	1	10.6	2.300	
41	42277	1.5	1	6.0	1.302	
42	42277	1.5	1	6.0	1.302	
43	42277D	1.5	1	6.1	1.307	
44	42277D	1.5	1	6.1	1.307	
45	42277S	1.5	1	12.3	2.663	
46	42277S	1.5	1	12.5	2.722	s
47	42277DS	1.5	1	12.4	2.701	
48	42277DS	1.5	1	12.5	2.717	
49	42260	1.5	1	0.0	-0.006	I
50	42260	1.5	1	0.0	-0.011	I
51	42261	60	1	7.7	66.389	
52	42261	60	1	7.8	67.456	
53	42262	60	1	7.7	67.029	
54	42262	60	1	7.8	67.243	
55	42263	60	1	7.4	63.827	
56	42263	60	1	7.4	64.467	
57	CCV	1	1	6.9	0.989 99%	
58	B	1	1	0.0	0.011	b
59	D4	1	1	10.4	1.498	d
60	42276	1.5	1	0.0	0.016	I
61	42276	1.5	1	0.0	-0.016	I
62	42278	30	1	11.8	51.342	
63	42278	30	1	11.9	51.769	
64	42279	30	1	11.4	49.420	
65	42279	30	1	11.3	48.993	
66	BL1005-2GMN	1	1	0.0	-0.011	I
67	BL1005-2GMN	1	1	0.0	-0.011	I
68	BL1005S	1	1	6.9	0.993	
69	BL1005S	1	1	6.9	0.993	
70	BL1005DS	1	1	6.9	1.000	
71	BL1005DS	1	1	6.9	0.996	
72	42754	30	1	5.1	21.986	
73	42754	30	1	5.1	21.879	
74	42754D	30	1	5.0	21.665	
75	42754D	30	1	5.0	21.559	
76	42754S	30	1	11.6	50.595	s
77	42754S	30	1	11.5	49.954	
78	42754DS	30	1	11.6	50.275	
79	42754DS	30	1	11.5	49.741	
80	CCV	1	1	6.9	0.993 99%	
81	B	1	1	0.0	-0.011	b
82	D4	1	1	10.4	1.498	d
83	42754DS	150	1	2.2	46.945	
84	42754DS	150	1	2.2	47.479	
85	42280	1.5	1	0.0	-0.016	I
86	42281	1.5	1	0.0	-0.016	I
87	42282	1.5	1	0.0	0.016	I

PHILIP SERVICES

Certificate of Analysis

CLIENT INFORMATION		LABORATORY INFORMATION	
Attention:	Bruce Randall	**Contact:**	Ron McLeod
Client Name:	Braun Intertec	**Project:**	AN991011
Project:	CMXX-99-0263	**Date Received:**	99/08/10
Project Desc:	Stack Emissions	**Date Reported:**	99/10/12
Address:	P.O. Box 39108 Minneapolis, MN 55439	**Submission No.:**	9H0294
		Sample No.:	043188-043225
Fax Number:	612-946-6001		
Phone Number:	612-833-4653		

NOTES: ***"-" = not analysed '<' = less than Method Detection Limit (MDL) 'NA' = no data available***
LOQ can by determined for all analytes by multiplying the appropriate MDL X 3.33
Solids data is based on dry weight except for biota analyses.
Organic analyses are not corrected for extraction recovery standards except for isotope dilution methods, (i.e. CARB 429 PAH, all PCDD/F and DBD/DBF analyses)

Methods used by PASC are based upon those found in 'Standard Methods for the Examination of Water and Wastewater', Nineteenth Edition. Other methods are based on the principles of MISA or EPA methodologies. New York State: ELAP Identification Number 10756.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies, quality assurance and quality control procedures except where otherwise agreed to by the client and testing company in writing. Any and all use of these test results shall be limited to the actual cost of the pertinent analysis done. There is no other warranty expressed or implied. Your samples will be retained at PASC for a period of three weeks from receipt of data or as per contract.

COMMENTS: **Revised Report: 99/12/06**

Certified by: _____

PHILIP ANALYTICAL SERVICES CORPORATION
5555 North Service Road Burlington, Ontario, Canada L7L 5H7 Tel (905) 332-8788 Fax (905) 332-9169

PASC - Certificate of Analysis

	Client ID:		Method Blank	Blank Spike#1	Blank Spike#1	Blank Spike#2	Blank Spike#2	Reagent Blank C7/C12	1B C01/C02	1R1 C01/C02	1R2 C01/C02	1R3 C01/C02
	Lab No.:		043188 99	043188 99	043188 99	043188 99	043188 99	043189 99	043190 99	043191 99	043192 99	043193 99
	Date Sampled:		-	-	-	-	-	99/07/19	99/07/19	99/07/19	99/07/20	99/07/20
Component	**MDL**	**Units**			% Recoveries		% Recoveries					
Mercury - FH (Outlet)	0.010	ug	<	0.098	98	0.097	97	<	-	-	-	-
Mercury - FH (Inlet)	0.010	"	<	0.10	100	0.10	100	<0.080	<0.10	4.3	2.5	6.4

			SR1	SR2	SR3	SB
	Client ID:		C01/C02	C01/C02	C01/C02	C01/C02
	Lab No.:		043194 99	043195 99	043196 99	043225 99
	Date Sampled:		99/07/19	99/07/20	99/07/20	99/07/19
Component	**MDL**	**Units**				
Mercury - FH (Outlet)	0.010	ug	0.19	0.12	0.089	0.016
Mercury - FH (Inlet)	0.010	"	-	-	-	-

	Client ID:		Reagent Blank C11
	Lab No.:		043224 99
	Date Sampled:		99/07/20
Component	**MDL**	**Units**	
Impinger volume - hydroxylamine		ml	84
Mercury - hydroxyalamine	0.010	ug	<

PASC - Certificate of Analysis

			Method	Blank	Blank	Blank	Blank	Reagent		1R1	1R2	1R3
	Client ID:		Blank	Spike#1	Spike#1	Spike#2	Spike#2	Blank C08	1B-C03	C03A/B	C03A/B	C03A/B
	Lab No.:		043188 99	043188 99	043188 99	043188 99	043188 99	043197 99	043198 99	043199 99	043200 99	043201 99
	Date Sampled:		-	-	-	-	-	99/07/20	99/07/19	99/07/19	99/07/20	99/07/20
Component	**MDL**	**Units**			% Recoveries		% Recoveries					
Mercury - KCl	0.030	ug	<	0.28	93	0.29	95	<	0.57	4.9	0.82	0.38

PASC - Certificate of Analysis

	Client ID:		SB-C03	SB-C03	SB-C03	SB-C03	SB-C03	SB-C03	SR1 C03A/B	SR2 C03A/B	SR3 C03A/B
	Lab No.:		043202 99	043202 99	043202 99	043202 99	043202 99	043202 99	043203 99	043204 99	043205 99
	Date Sampled:		99/07/19	99/07/19	99/07/19	99/07/19	99/07/19	99/07/19	99/07/19	99/07/20	99/07/20
Component	**MDL**	**Units**		Duplicate	M. Spike	MS % Rec.	MS Dup	MSD % Rec.			
Mercury - KCl	0.030	ug	0.66	0.66	1.30	96	1.30	93	2.6	0.69	0.31

PASC - Certificate of Analysis

	Client ID:		Method Blank	Blank Spike#1	Blank Spike#1	Blank Spike#2	Blank Spike#2	Reagent Blank C10	1B-C05	1R1-C05	1R1-C05
	Lab No.:		043188 99	043188 99	043188 99	043188 99	043188 99	043215 99	043216 99	043217 99	043217 99
	Date Sampled:		-	-	-	-	-	99/07/20	99/07/19	99/07/19	99/07/19
Component	**MDL**	**Units**			% Recoveries		% Recoveries				Duplicate
Mercury - KMnO4	0.030	ug	<	0.30	99	0.30	99	<	0.30	3.0	3.0

	Client ID:		1R1-C05	1R1-C05	1R1-C05	1R1-C05	1R2-C05	1R3-C05	SB-C05	SR1-C05	SR2-C05	SR3-CO5
	Lab No.:		043217 99	043217 99	043217 99	043217 99	043218 99	043219 99	043220 99	043221 99	043222 99	043223 99
	Date Sampled:		99/07/19	99/07/19	99/07/19	99/07/19	99/07/20	99/07/20	99/07/19	99/07/19	99/07/20	99/07/20
Component	**MDL**	**Units**	M. Spike	MS % Rec.	MS Dup	MSD % Rec.						
Mercury - KMnO4	0.030	ug	6.2	93	6.2	95	2.2	2.4	0.23	8.0	8.7	7.7

PASC - Certificate of Analysis

			Method	Blank	Blank	Blank	Blank	Reagent						
Client ID:			Blank	Spike#1	Spike#1	Spike#2	Spike#2	Blank C09	1B-C04	1B-C04	1B-C04	1B-C04	1B-C04	1B-C04
Lab No.:			043188 99	043188 99	043188 99	043188 99	043188 99	043206 99	043207 99	043207 99	043207 99	043207 99	043207 99	043207 99
Date Sampled:			-	-	-	-	-	99/07/20	99/07/19	99/07/19	99/07/19	99/07/19	99/07/19	99/07/19
Component	**MDL**	**Units**			% Recoveries		% Recoveries			Duplicate	M. Spike	MS % Rec.	MS Dup	MSD % Rec.
Mercury - H202	0.010	ug	<	0.051	100	0.050	100	<0.25	<0.25	<0.25	2.7	100	2.6	100

Client ID:			1R1-C04	1R2-C04	1R3-C04	SB-C04	SR1-C04	SR2-C04	SR3-C04
Lab No.:			043208 99	043209 99	043210 99	043211 99	043212 99	043213 99	043214 99
Date Sampled:			99/07/19	99/07/20	99/07/20	99/07/19	99/07/19	99/07/20	99/07/20
Component	**MDL**	**Units**							
Mercury - H202	0.010	ug	<0.25	<0.025	<0.25	<0.25	<0.25	0.31	<0.25

Batch Code:	**10094GFL**	
Mercury - FH (Outlet)	043188 99	
	043189 99	
	043194 99	
	043195 99	
	043196 99	
	043225 99	
Run Date:	99/10/09	
Date of Sample Prep:	99/10/09	
Batch Code:	**10112GFB**	
Mercury - FH (Inlet)	043188 99	
	043189 99	
	043190 99	
	043191 99	
	043192 99	
	043193 99	
Run Date:	99/10/11	
Date of Sample Prep:	99/10/11	
Batch Code:	**1001MGHY**	
Mercury - hydroxalamine	043224 99	
Run Date:	99/10/01	
Date of Sample Prep:	99/10/01	
Batch Code:	**10034BKC**	**10045GKC**
Mercury - KCl	043188 99	043202 99
	043197 99	043203 99
	043198 99	043204 99
	043199 99	043205 99
	043200 99	
	043201 99	
Run Date:	99/10/03	99/10/04
Date of Sample Prep:	99/10/03	99/10/04
Batch Code:	**10052GMN**	**10053GMN**
Mercury - KMnO4	043188 99	043216 99
	043215 99	043217 99
		043218 99
		043219 99
		043220 99
		043221 99
		043222 99
		043223 99
Run Date:	99/10/05	99/10/05
Date of Sample Prep:	99/10/05	99/10/05
Batch Code:	**1001MN2B**	
Mercury - H202	043188 99	

	043206 99
	043207 99
	043208 99
	043209 99
	043210 99
	043211 99
	043212 99
	043213 99
	043214 99
Run Date:	99/10/02
Date of Sample Prep:	99/10/01

APPENDIX F

OPERATING DATA SHEETS

EPA Mercury Stack Test
Test Run 1
7/19/99

Date-7/19/1999								
TR Set Voltage	Time							
PPTR 2		1:30	2:15	2:50	3:20	3:50	4:20	5:05
Set 1	20	26	26	26	26	26.5	26	26
	19	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Set 2	18	30	30	30	30	30	29.5	30
	17	31	31	30.5	31	31	30.5	30.5
Set 3	19	30.5	31	30.5	31	31	30.5	30.5
	20	30	30	30	30	30	30	30
Set 4	17	34	34	34	34	34	34	34
	18	28.5	28.5	28.5	28.5	28.5	28	28.5
Set 5	24	32	32.5	32	32.5	32.5	32	32.5
	23	32.5	32.5	32.5	32.5	32.5	32.5	32.5
Set 6	22	33.5	33.5	33	33.5	33.5	33.5	33.5
	21	39	39	39	39	39	39	38
Set 7	23	38	37.5	37.5	38	37.5	38	38
	24	31	31.5	31	31.5	32	31.5	31.5
Set 8	21	38.5	39	38.5	39	38.5	38	38
	22	35	35	35	35	35	35	35
Set 9	16	41.5	43	43	43.5	44	43	44
	15	43	42.5	42.5	43	42.5	42.5	43.5
Set 10	14	40	39	39	40	40.5	39	40
	13	37.5	38.5	36.5	36.5	38	37	38
Heat In to Stack		863.1	867.8	867.8	866.5	866.5	870.7	879.8
(mmbtu/hr)								
Heat Value		7063	7063	7063	7063	7063	7063	7063
(btu/lb)								
Fuel Qua.		61.10	61.43	61.43	61.34	61.34	61.64	62.28
tons/hr								
Load		78.2	78.4	78.4	78.5	78.5	78.2	78.9

Date-7/20/99								
TR Set Voltage	Time	8:05	8:40	9:18	9:50	10:25		
PPTR 2								
Set 1	20	27	26.5	26	26	26		
	19	31	31.5	31	31	31		
Set 2	18	30.5	30	30	30	30		
	17	31	31	31	31	31		
Set 3	19	31	31	30.5	31	31		
	20	30.5	30.5	30	30	30		
Set 4	17	33.5	33.5	33	33	33		
	18	30	29	29	29	29		
Set 5	24	33	33	32.5	32.5	32		
	23	33	33	33	33	32.5		
Set 6	22	35	34	34	34	33.5		
	21	38.5	38.5	38.5	38.5	38		
Set 7	23	39	39	38.5	38.5	38		
	24	31.5	31	31	31	31		
Set 8	21	40.5	39	39.5	39	39		
	22	37.5	36	36	36	36		
Set 9	16	42	40	41	41	41		
	15	44	44	43.5	43.5	43		
Set 10	14	42.5	42	40.5	40	40.5		
	13	40	39	38	37.5	38		
Heat In to Stack		871.7	871.7	847.1	847.1	853.1		
(mmbtu/hr)								
Heat Value		7081	7081	7081	7081	7081		
(btu/lb)								
Fuel Qua.		61.55	61.55	59.81	59.81	60.24		
tons/hr								
Load		78	78	78.1	78.1	77.9		

Date-7/20/99							
TR Set Voltage		Time					
PPTR 2		11:59	12:28	12:57	1:34	2:07	2:31
Set 1	20	26	26.5	26	26	26.5	26.5
	19	31	31	31	31	31	31
Set 2	18	30	30	30	30	30	30
	17	31	31	31	31	30.5	30.5
Set 3	19	30.5	31	31	30.5	30.5	30.5
	20	30.5	30	30	30.5	30.5	30.5
Set 4	17	33.5	33.5	33.5	33.5	33.5	33.5
	18	29	29	28.5	28.5	28.5	28.5
Set 5	24	32.5	33	32.5	33	33	32.5
	23	32.5	32.5	32.5	32.5	32.5	32.5
Set 6	22	33.5	34	33.5	33.5	33.5	33.5
	21	38.5	38.5	38.5	38.5	38.5	38.5
Set 7	23	38.5	39	38	38	38	38
	24	31	31	31.5	32	32	32
Set 8	21	39	39	39	38.5	38.5	39
	22	36	36	35	35	35	35
Set 9	16	43	43	42.5	43.5	43.5	44
	15	43.5	43	43	43.5	42.5	43
Set 10	14	40.5	40.5	40	40.5	40.5	40.5
	13	38	38	38	38	38	38
Heat In to Stack		866	858.7	858.7	861.1	864	864
Heat Value		6988	6988	6988	6988	6988	6988
Fuel Qua.		61.96	61.44	61.44	61.61	61.82	61.82
Load		78.6	78.1	78.1	78.2	78.1	78.1

APPENDIX G

LIST OF PARTICIPANTS

List of Participants

Name	Organization	Project Role
Alan Welte	M-DU Heskett	Plant Manger
Richard Patzman	M-DU	Air Quality Program Coordinator
Art Carlson	M-DU Heskett	Plant Contact/Process Monitor
Bruce Randall	Braun Intertec	Project Director
James Tryba	Braun Intertec	Test Team Leader
David Hillesheim	Braun Intertec	Main Stack Sample Team Leader
George Jansen	Braun Intertec	Main Stack Sample Technician
Kevin Hoffman	Braun Intertec	Inlet Sample Team Leader
Shawn Nelezen	Braun Intertec	Inlet Sample Technician
Ron McCloud	Phillips Analytical	Speciated Mercury Sample Analysis